Nov. 16, 1954 K. GREBE 2,694,484

ENDLESS TROUGH CONVEYER

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Fig. 1

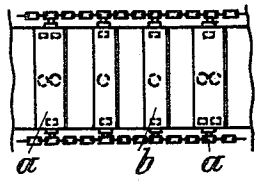

Fig. 2

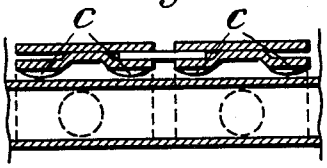

Fig. 3

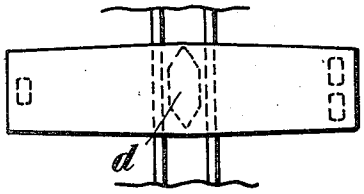

Fig. 4

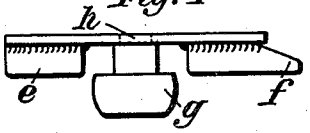

Fig. 5

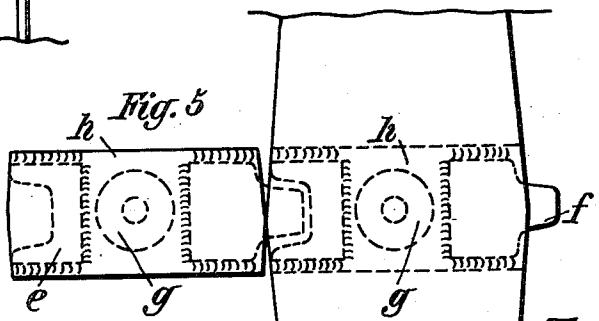

Fig. 6

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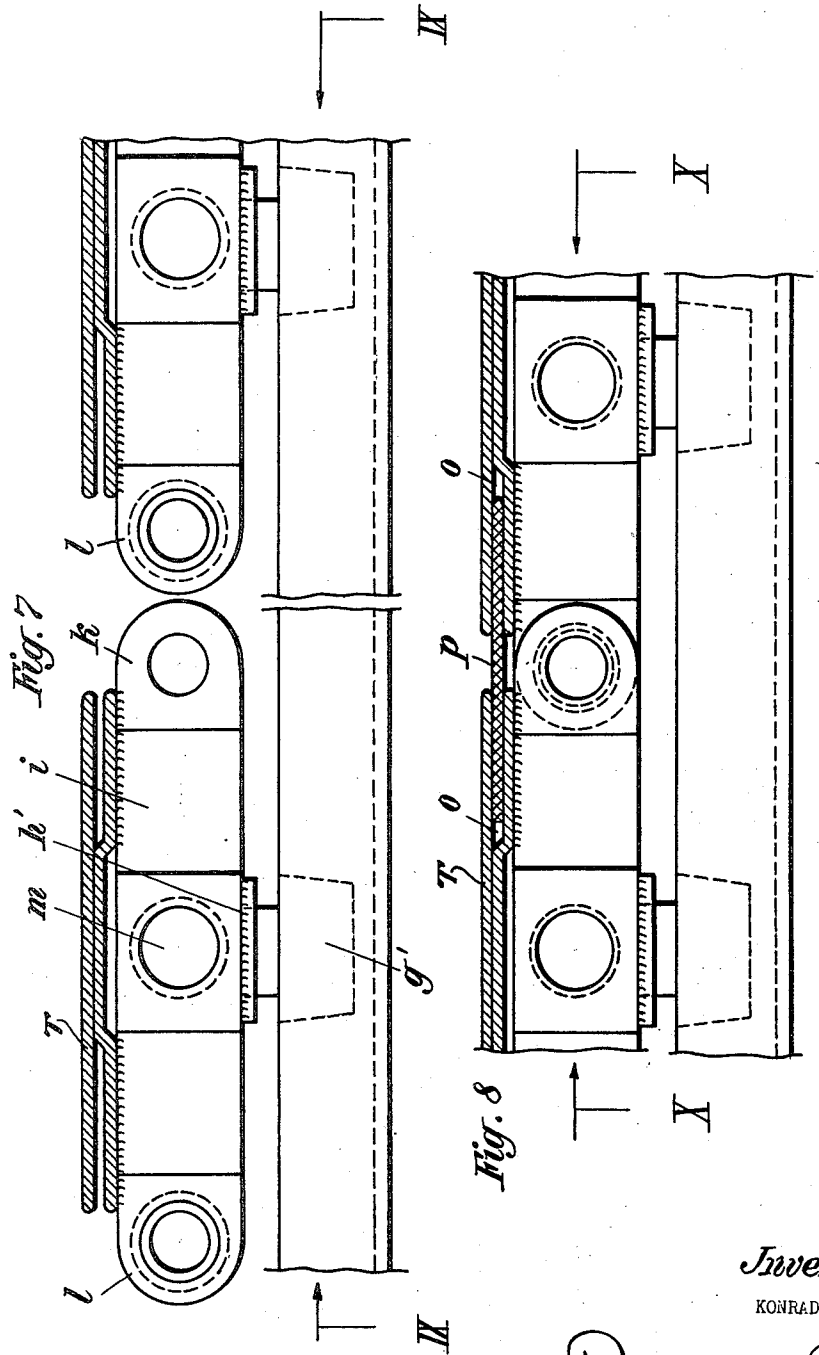

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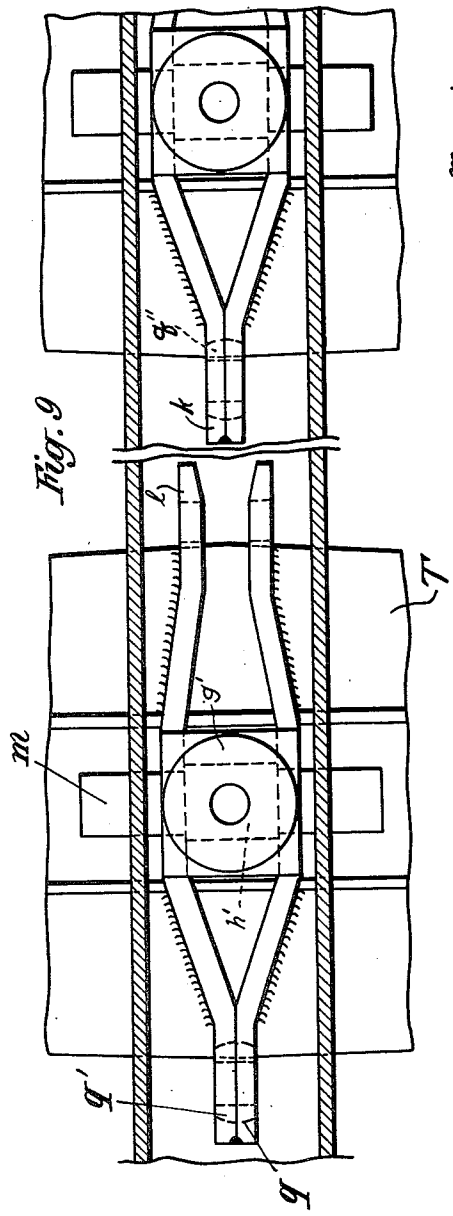

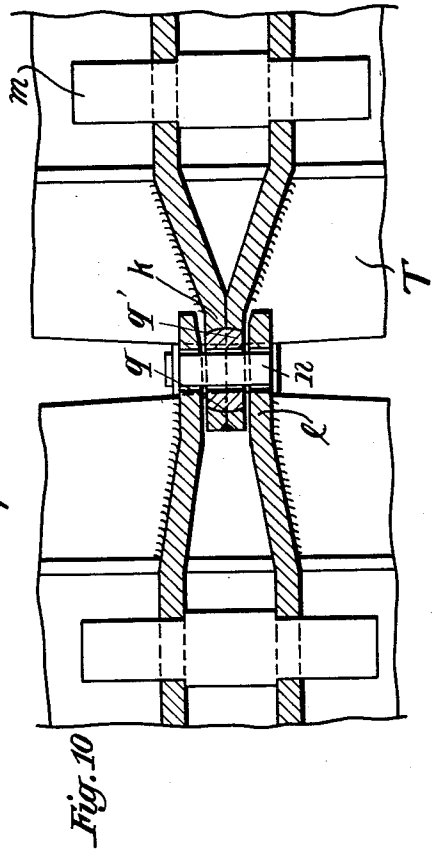

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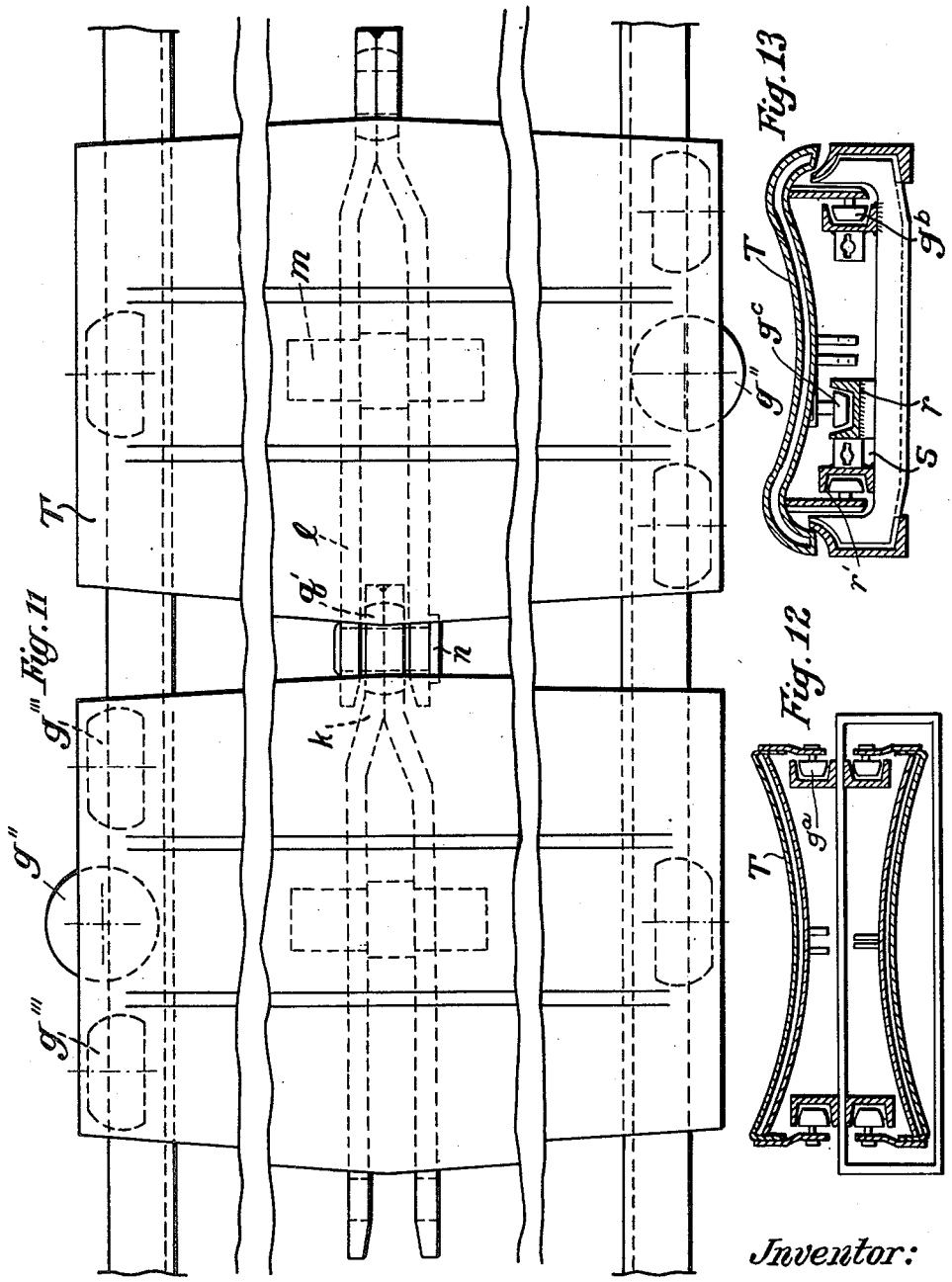

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Fig. 14

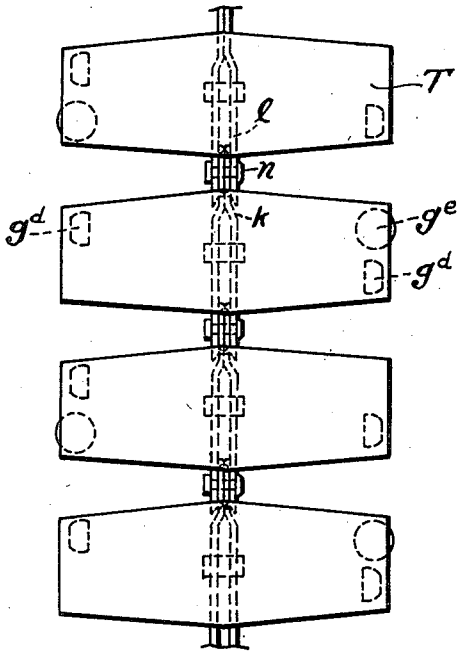
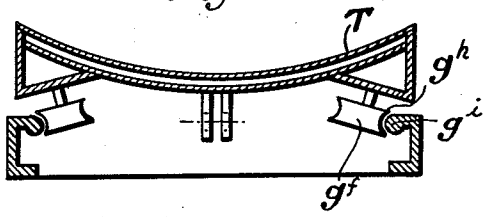


Fig. 15



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ENDLESS TROUGH CONVEYER

Konrad Grebe, Ibbenburen, Westphalia, Germany

Application January 24, 1951, Serial No. 207,548

Claims priority, application Germany January 28, 1950

6 Claims. (Cl. 198—196)

In the specification of my application for Letters Patent Ser. No. 179,045 I have described an endless conveyor, especially for use in mines, the essential feature of which consists in that the conveyor band is fitted on trucks that are secured against lateral and vertical twists by positive guiding means and that are arranged at comparatively short distances from each other, said trucks being flexibly connected with each other and being engaged by the traction means and the conveying surface being formed either by a suspended band or, according to a special form of the conveyor, of separate sections of elastic material which are connected with each other via the covering plates of the trucks which themselves form parts of the endless conveyor surface.

The securing of the trucks against lateral and vertical twist is important because it enables endless conveying means to negotiate any curves relatively both to the horizontal and to the vertical, thereby creating entirely new possibilities for the installation and use of such conveyors, especially in mining. This is effected according to my prior specification aforesaid by conducting the running rollers of the trucks at least on one side in pairs in guides surrounding them above and below with slight play and in addition providing each of the trucks with at least two further guide rollers arranged behind one another and rotating about vertical shafts, the guide rollers in the middle or at the side of the trucks running in or against longitudinal rails by which they are guided.

This solution of the problem of securing the trucks against lateral and vertical twist is in truth technically perfect but entails the use of a relatively large number of running and guide rollers, namely at least five rollers on each of the trucks. This entails a relatively high cost which considerably impairs the economy of the conveyor.

The present invention avoids this drawback by means which make it possible to reduce considerably the number of the guide rollers inasmuch as the securing against twist takes place wholly or partly in a different way.

Considerable success in the sense of a reduction of the number of guide rollers is obtainable by the fact that, instead of each of the trucks being provided with at least three running rollers and two guide rollers, only individual trucks at regular but not too great distances from each other are equipped in this way. Between these trucks run other trucks which have no rollers or only a smaller number of rollers as guide members. The risk of tipping and/or lateral twist is obviated so far as necessary by simpler guide members.

A guiding effect in many cases adequately replacing that of the guide rollers can be obtained by means of the trucks fully secured by the rollers against lateral and vertical twist or by the traction exerted through their connection with the trucks or groups of trucks arranged between them. In particular in the embodiment of the conveyor according to my prior specification aforesaid in which the conveying circle is formed by a continuous rubber belt, the latter, if made sufficiently taut, presents so strong a protection against twist that it is sufficient if, for example, only every third or fourth truck is secured, in the manner described in my prior specification aforesaid, against lateral and vertical twist. The trucks which run between, can be made lighter and narrower than the others, and may be provided on each side with but one running roller and in the centre with one guide roller.

Such an embodiment is shown in Fig. 1 of the accompanying drawings which is a plan view of a portion of a conveyor in which, between two trucks *a* which are each equipped with three running rollers and two guide rollers (in the manner proposed in my prior specification so that the single running roller is mounted alternately on the one and on the other side of the trucks) two narrower trucks *b* are interposed which have only one central guide roller and one running roller on each side.

According to another embodiment of the invention the rollers which serve as a safeguard against twist are replaced in individual trucks or in all the trucks by guiding components sliding in or on the guides. According to Fig. 2, which is a side view, partly in section, of a short portion of a conveyor in accordance with this embodiment, omitting all unnecessary parts, the one running roller of the pair otherwise necessary is replaced by sliding guide members formed by rounded cams *c* which are fitted below the trough plates on both sides at the front and back of the trucks and one of which comes to rest each time on the upper flange of the right or left rail if the truck tends to tip forwards or backwards.

The central guide rollers can, in accordance with the same idea, be wholly or partly replaced by sliding guide members of ship-like outline which, on twist of the truck to right or left, run against the right or left flange of the central guide rail. This constructional form is illustrated in Fig. 3 which shows in plan such a guide member *d* in a truck, all other parts being omitted.

The sliding guides produce a relatively greater friction and therefore increased power consumption so that it is not advisable as a rule to use the guiding means shown in Figs. 2 and 3 together.

In order to reduce the friction where it is greatest, especially at curves and bends and also if necessary at short straight runs directly before and behind them, it may be advisable to allow the ship-like guides to run between rollers at these places. In the long straight runs on the contrary it is possible to a large extent to do away altogether with any special protection against lateral twist; on these sections as a rule the guiding effect of the running rollers suffices.

Figs. 4 to 14 show a number of possibilities based on the same fundamental ideas for protection against twist which, together with an economy of rollers of in each case one of the two guide rollers per truck is provided according to my prior specification aforesaid, result in a specially advantageous guiding of the trucks while relieving the flange of the central guide rails of the considerable pressures to which they are subjected in curves, inasmuch as in the centre of the trough plates fixed guide members are fitted to the latter which form a mutual guide for the truck by which each of them secures the adjoining ones against lateral twist.

In the constructional form according to Figs. 4 and 5, in which Fig. 4 shows the arrangement in side view and Fig. 5 is a plan view of two successive trucks, the trough plates being partly omitted, there is fitted for this purpose in the centre of the trough plates of each of the trucks on one side a nose-like projection and on the other side a corresponding recess, which co-operates with corresponding projections and recesses in the adjoining truck. These projections and recesses are formed by moulded pieces secured by welding, for example, to the truck plate *h* which is fixed at the centre of the trough plate *t* underneath it, between which pieces lies the remaining single vertically-mounted guide roller *g*, also fixed to the plate.

The projections *f* and recesses *e* engage with each other with a certain play so that the angular deviations of the trucks relatively to each other which arise when traversing curves and bends are not impeded. This additional guiding of the trucks in one another effects a direct compensation of the lateral twisting forces from truck to truck and relieves the flange of the guide rails, while the central guide roller *g* prevents lateral deviations of the truck.

Fig. 6 shows a somewhat different constructional form of mutual guiding of the trucks in which the recessed part *e'* is formed by a body projecting ever the edge of the truck, which embraces a vertical cylindrical pin *f'*

arranged at the back of the following or every trough plate. This construction has the advantage that the claws of the part e' grip further round the pin and can be made shallower so that it finds room within the central guide rail and does not require any additional space to accommodate it.

The design of the guide members as described permits, in further development of the inventive idea underlying them, of their simultaneous use as traction means in place of the link chains arranged on both sides of the conveyor according to the arrangement described in my prior specification aforesaid. These guide members are connected with each other either directly or by a chain carried by them in a manner resistant to traction and are so designed that the drive or drives can engage with them or their connection.

The arrangement of a central traction means is known per se and presents advantages in principle as compared with the traction means arranged in pairs on the two sides of the conveyor, these advantages being both economic and technical, particularly the latter when negotiating curves because then, with traction agents engaging on both sides, only the one on the outside of the curve exerts a drive, the other hanging down. In a curve negotiating conveyor of the kind described in my prior specification aforesaid, however, the use of a central traction means has the special advantage that the twisting forces occurring in two-sided traction means behind the curve, where the traction on the truck passes in part at least from the taut traction agent to the slack traction agent, are obviated.

The possibilities which result by designing and using the central guide member as traction means or carrier thereof are illustrated in Figs. 7 to 14.

Fig. 7 shows the resulting designs of the guide members described in principle with reference to Figs. 4 to 6 as a section through two successive trucks in the unconnected condition. Fig. 8 shows them in the connected condition and Fig. 10 is a section on the line X—X of Fig. 8.

In this case the guide or truck members are formed by a double clamp i welded for example one in each case to the bottom of each trough the plate T, which clamp extends over the entire width of the trough plate and ends on one side in an apertured lug-shaped end part k and on the other in a fork-piece l having a corresponding hole.

Through this double clamp there passes the shaft m, the ends of which, as may be seen for example from Fig. 9, project laterally and provide the possibility of engagement for the drive.

Beneath the shaft m there is again fixed the guide roller g' on a welded-on rectangular plate h'.

The lug attachment k and the corresponding fork-piece l of successive clamps are connected with each other by a cylindrical pin n as may be seen for example from Figs. 8 and 10, in which case, as disclosed in my prior specification aforesaid, the trough plates T of the trucks are connected with each other by the plates p of elastic material inserted in the recesses or sockets o.

Fig. 9 shows a horizontal section along line IX—IX of Fig. 7 and shows how, according to a preferred constructional form, the individual clamps of the double clamps extend so far apart from each other in the centre of the truck that they embrace the plate h' on which the guide roller g' is mounted.

It is necessary to arrange the closed end of the double clamp, i. e. the lug, with a certain amount of play in the forked end of the connecting clamp of the next truck in order to permit the necessary angular deviations of the individual trucks relatively to each other when passing along curves, troughs, humps or bends.

In order to reduce as far as possible the wear of the pin n which connects the two double clamps with each other and to ensure that in angular deviations the tensile forces are transmitted to the pin not locally but so far as possible over the entire width of the pin, according to a further feature of the invention the hole of the closed end of the double clamp (the lug k) is made spherical as shown at q (Figs. 9 and 10) and there is fitted in the hole a ring q' of corresponding spherical outer surface which in its turn surrounds the pin and is inserted when welding together the two halves of the double clamp. In this way a sort of ball and socket joint is created so that the double clamp can rotate in every direction round the ball ring secured on the pin, the amount of movement, however, being limited by the form of the fork.

Since in the last described constructional form, with the central guide designed as traction means, the protection against twist is undertaken by the latter, the roller g or g' only has the task of preventing lateral deviation of the trucks. It need not run in a central guide rail but can run as desired against the right or left side running rail or in it, or in a special side guide rail, the central guide rail being dispensed with.

This arrangement is shown in Fig. 11 in which the guide roller g'' is, for successive trucks, placed alternately on the one and on the other side of them between the two running rollers g'''. In order to make this possible it is, for example, merely necessary to cut a window in the respective side cheek of the truck, the cut-out material being preferably bent inwards and serving at the same time as the carrier for the shaft of the guide roller.

If the guiding members are not connected with each other in a traction-proof way, as in the last described arrangements, but in keeping with the further possibility already mentioned are used as carrier for a continuous central traction means, like a link chain, the latter can, in the manner described in my prior specification aforesaid, be fixed by means of cup bows to the guide members designed for example according to Figs. 4 to 6, the central roller g having then to be shifted to another place.

The arrangement of the central traction means results in a specially advantageous form thereof with a view to the use of the new conveyor as a strut conveyor. Figs. 12 and 13 show constructional forms of such a conveyor.

In Fig. 12 is shown a band intended for a two-side mounting by the strut. The arrangement of the rollers g^a is in this case the same as in Fig. 11. Fig. 13 illustrates a band to be mounted at only one side by the strut and at the same time another arrangement of rollers g^b and g^c. In this case the guide roller g^c of each truck is guided in a third U-rail r which, as indicated at s, can be joined to one of the two running rails r^1. The truck is in this case provided on the right side with two running rollers g^b and on the left side with only one running roller. On the next truck the arrangement of the running rollers is reversed.

Possibilities of saving a further roller are illustrated in Figs. 14 and 15. Fig. 14 shows a roller arrangement having running rollers g^d and a guide roller g^e and in which the second running roller is dispensed with in each case. Fig. 15 shows a roller arrangement having only running rollers g^f and in which the guide roller is dispensed with. These possibilities can be realised under the following conditions:

With the design of the traction means according to Figs. 7 to 11, by corresponding shaping of the fork l not only can the possibility of lateral deviation be limited in the simplest way but also that of deviation in the vertical sense. Therefore protection against an inadmissible tipping of the trucks which was originally effected by the arrangement of the running rollers in pairs can be undertaken by the central guide members. Then on each side of the truck there is only one running roller left. In this case it may be desirable to shift the right hand running roller a little towards the front end and the left hand running roller a little towards the back end of the truck (or vice versa); the guide roller is guided either in a guide rail of its own (according to Figs. 7 to 10 or 13) or alternately on the right and left side of the truck, of which Fig. 14 illustrates a constructional example.

According to a further embodiment of the invention the guide rollers can be dispensed with by guiding the running rollers g^f not vertically but obliquely or even horizontally (Fig. 15). In that case they are suitably provided with a wheel flange g^h and run on a rounded rail g^i. They are to be arranged in pairs alternately right and left while on the other side in each case only a roller is necessary. This arrangement can also be used when the traction means engages on both sides.

The drive can, with a central arrangement of the traction means, be effected for example by fork-shaped cams engaging with the shafts m which are passed transversely through the double clamps, namely, on both sides of the double clamp or likewise within the single clamps, spread apart from each other, of the double clamps (Fig. 11). If a central link chain carried by the guide members is arranged the cams of the drive, which are shaped in the

usual way, engage in or behind the cup bows of the link chains.

Although the more important constructional possibilities in accordance with the invention have been described in detail hereinbefore with the aid of the drawings, the invention is by no means confined to the constructional forms described which can be modified in various respects without departing from the fundamental concept of the present invention.

I claim:

1. A conveyor comprising a plurality of closely spaced successively arranged trough members, trucks supporting said trough members respectively, traction chain means loosely connecting said trough members, means providing slots in each of said members, a flexible member extending into slots in adjacent trough members for connecting same and cooperating with said trough members for providing a substantially uninterrupted conveying surface, guide means along which said trucks move, additional guide means for positively restricting both lateral and vertical displacement of said trough members, said last means comprising coacting parts on opposite ends of said trough members loosely interengaging each other and bridging the space between adjacent trucks in the region of each flexible member.

2. A conveyor as claimed in claim 1, comprising a plate on the bottom of each truck for supporting the respective coacting part, and a single roller rotatable about a vertical axis carried by said plate.

3. A conveyor as claimed in claim 1, in which the interengaging parts comprise a lug at one end of each coacting part and a fork at the other end thereof, and means pivotally securing cooperating forks and lugs of the coacting parts, the arms of the fork and the lug overlapping one another a substantial distance with only a small clearance between the overlapping parts so to restrict lateral swinging displacements of the parts relative to each other.

4. A conveyor as claimed in claim 1, in which the interengaging parts comprise a claw on one end of each coacting part and projecting beyond the edge of the respective truck, and a vertical pin at the opposite end of the coacting part arranged beneath the conveyor surface means, whereby the pin of one truck fits into the claw on the adjacent truck.

5. A conveyor as claimed in claim 1, in which said coacting parts comprise members extending centrally of each truck and affording traction means for the conveyor.

6. A conveyor as claimed in claim 1, in which said coacting parts comprise a fork member projecting from one truck, a lug projecting from an adjacent truck with the end portion disposed between the arms of the yoke, a ring having ball-like periphery movably mounted within the end portion of the lug in ball and socket fashion, and a horizontal pin extending through the arms of said yoke and the ring.

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