Nov. 4, 1941. W. H. EMERSON 2,261,149

TRAVELING CONVEYER SYSTEM

Filed March 12, 1940 2 Sheets-Sheet 1

Fig. 1.

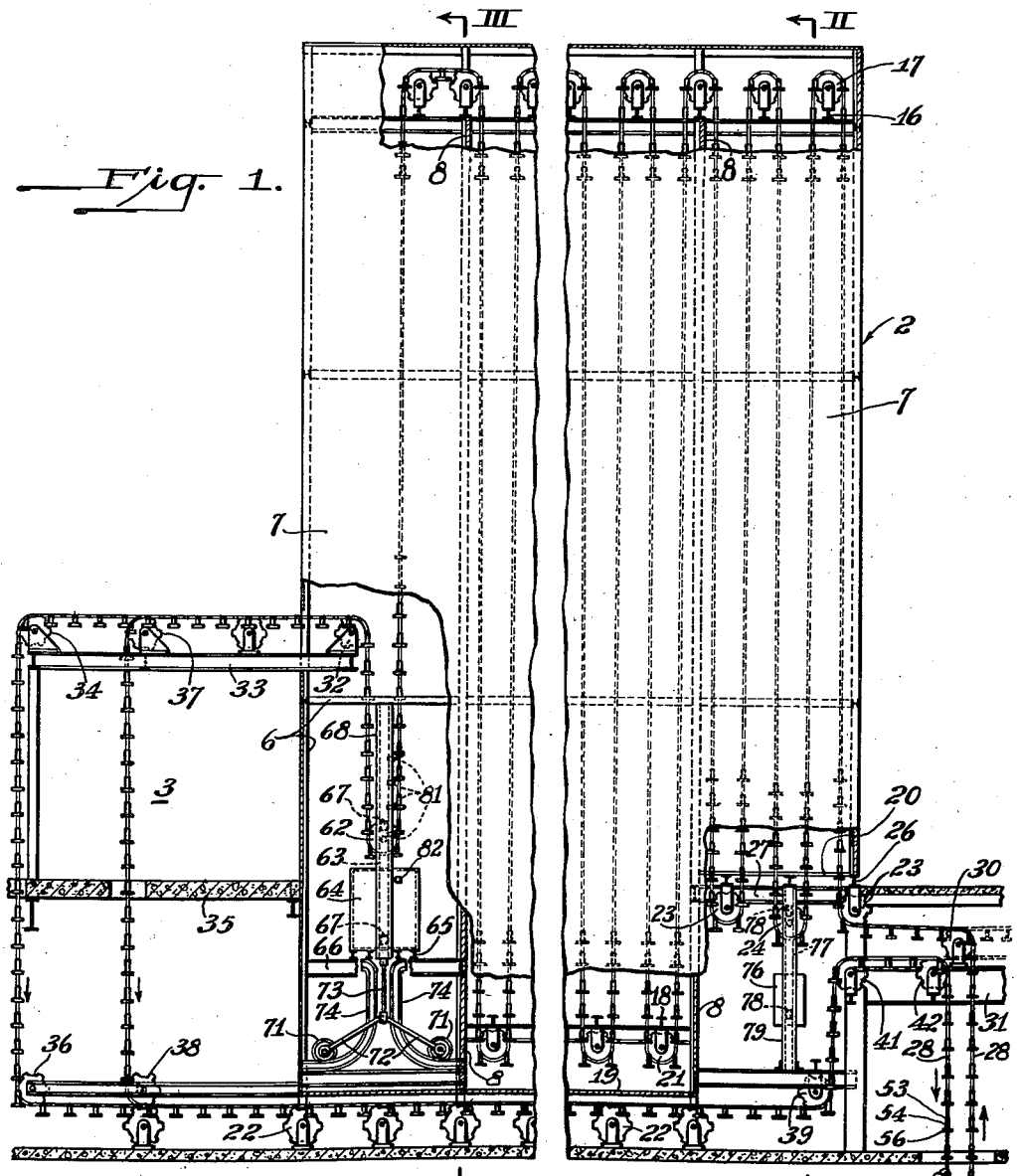
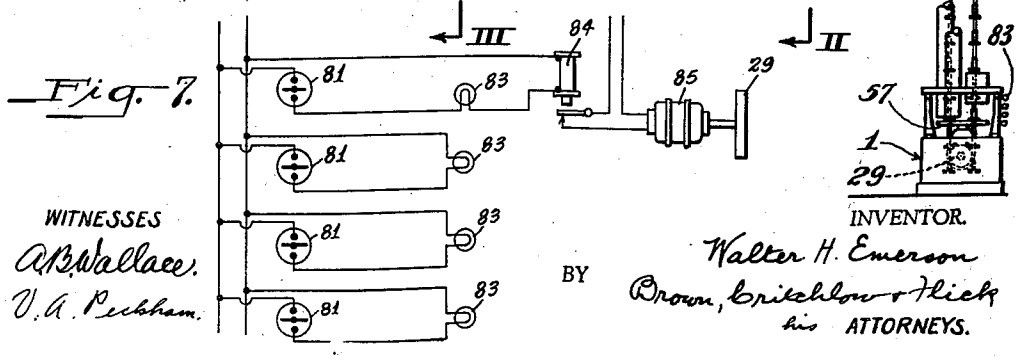


Fig. 7.



WITNESSES

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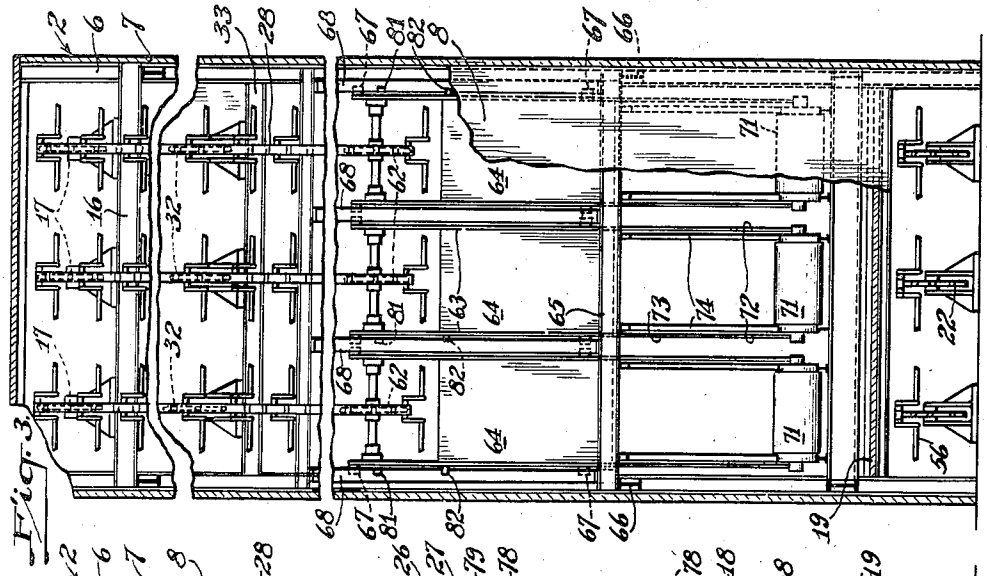


Fig. 3

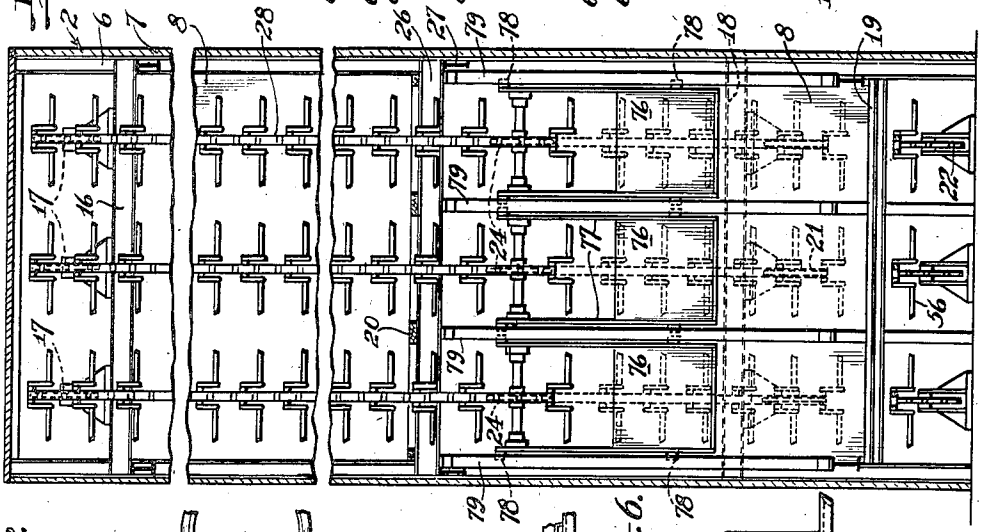


Fig. 2.

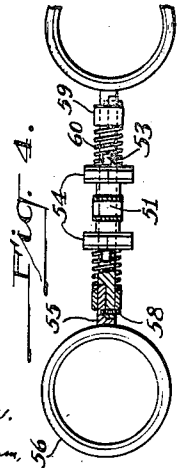


Fig. 4.

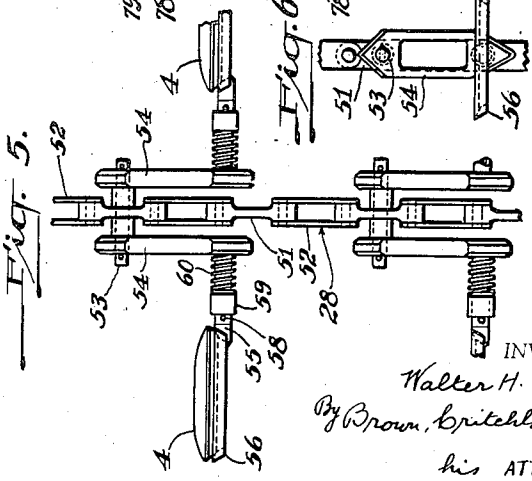


Fig. 5.

Fig. 6.

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UNITED STATES PATENT OFFICE

2,261,149

TRAVELING CONVEYER SYSTEM

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Application March 12, 1940, Serial No. 323,542

16 Claims. (Cl. 198—116)

This invention relates to endless conveyers, and more particularly to those of relatively great length.

With endless conveyers of great length, such, for example, as those used for transporting pottery-ware through a drier, difficulty is experienced in starting the conveyer in motion due to its great weight and extremely high starting friction. If anything happens to increase the running friction of such a conveyer materially, or to stall the conveyer while the driving means is still operating, the conveyer may be broken.

It is among the objects of this invention to provide an endless conveyer system which can easily be started in operation with relatively small power under normal conditions, regardless of the length of the conveyer; which indicates at all times the amount of pull exerted on it; which automatically shuts off its driving means in case of emergency; which automatically picks up and deposits articles at desired points; and which includes readily interchangeable article carriers.

In accordance with this invention an endless conveyer is supported by rotatable members and is driven by suitable means. The conveyer is provided between two of the rotatable members near the tension side of the driving means with a loop, by which is meant any slack in the conveyer, and to which is connected means for normally holding the loop in a predetermined position. This loop-holding means exerts less tension on the loop than is required to overcome the starting resistance of the major portion of the conveyer which is behind the loop; that is, between the loop and the slack side of the driving means. However, means is provided for gradually increasing the tension on the loop as the loop is shortened when the driving means is started in operation until the pull on the conveyer is sufficient to overcome the starting resistance of its major portion. In this way the driving means is permitted to gather speed and momentum while merely exerting enough pull to shorten the loop, wherefor the pull necessary to overcome the starting resistance of the major portion of the conveyer is built up gradually by the driving means.

The shortening loop causes a series of electric switches to be actuated which are connected to means for indicating the amount of pull on the conveyer at any time. In a similar way an electric switch is actuated when the pull on the conveyer approaches the danger point, due to an abnormal increase in the running friction, for shutting off the driving means. Preferably, means is also connected to the conveyer adjacent the slack side of the driving means for taking up slack in the conveyer, which always occurs when the driving means is first started in operation and before the major portion of the conveyer starts to move.

The conveyer preferably comprises an endless chain supported by sprockets and carrying laterally projecting article carriers which are pivoted thereto so that they will always hang horizontally. The article-engaging portion of each carrier may be made readily detachable from the remaining portion so that article-engaging portions of different sizes can be interchanged. At the loading station for the conveyer the article carriers pass upwardly through recesses in article-supporting means whereby the carriers pick up the articles. These articles may be deposited at a desired point by moving loaded carriers downwardly through recesses in receiving means.

The preferred embodiment of the invention is illustrated in the accompanying drawings, in which Fig. 1 is a side view of my conveyer passing through a drier housing the side wall of which is partly broken away; Figs. 2 and 3 are enlarged fragmentary vertical transverse sections taken on the lines II—II and III—III, respectively, of Figs. 1; and Figs. 4, 5, 6 are enlarged plan, side and end views, respectively, of a couple of the article carriers that are attached to the conveyer chain; and Fig. 7 is a wiring diagram of the electric switches and pull-indicating lights.

Referring to Fig. 1 of the drawings, my conveyer is shown in use in a pottery plant for transporting dinner-ware from an automatic ware-forming machine 1, such as shown in my copending application Serial No. 328,638, filed April 9, 1940, through a drier 2 to an unloading station 3, and for conveying the emptied molds 4 back to the machine. Molds 4 are shown only in Fig. 5, but it should be understood that when the conveyer is used in a pottery plant there is such a mold on every conveyer ring 56, and dinnerware is formed on the molds at machine 1 and stripped therefrom at station 3. Of course, the use of this conveyer is not confined to pottery plants.

The drier comprises a structural steel frame 6 enclosed by suitable panel members 7 to form a housing that is divided into sections separated from each other by parallel vertical partition walls 8 (Figs. 2 and 3). The hot air by which the ware is dried is drawn through the housing from end to end by suction apparatus (not shown), connected to one end of it. The purpose of partitions 8 is to form baffles for directing the hot

air vertically through each section of the housing, and therefore alternate partitions have openings at their upper ends and the intermediate partitions have openings at their lower ends.

Mounted on top of horizontal transverse beams 16 adjacent the top of the drier are rows of sprockets 17, three to a beam in this case because three conveyers pass through the drier from three double ware-forming machines, although more or less conveyers may be used depending upon the number of machines I served by the drier. Half of one of these double machines is shown in Fig. 1, it being understood that there are two more double machines mounted at the right of the one shown. Suspended from transverse beams 18 above the floor 19 of the housing is an intermediate series of sprockets 21 staggered longitudinally of the housing relative to the upper sprockets, and mounted on the housing support below its floor is a lower series of sprockets 22. In the section of the housing at its entry or right-hand end, the intermediate sprockets 23 and 24 and a portion 20 of the housing floor are mounted at a higher level than sprockets 21 and floor 19, the end sprocket 23 being suspended from cross beams 26 supported by beams 27, and the central sprockets 24 being movable vertically for a purpose to be described presently.

An endless conveyer chain 28, extending upwardly from a drive sprocket 29 driven from ware-forming machine 1, passes over a sprocket 30 journaled on a framework 31 extending horizontally away from the end of the drier housing. The chain enters the housing through an opening in its end wall, passes under the first sprocket 23, up through floor 20 to the first top sprocket 17, down to sprocket 24, up to the second top sprocket and so on in this manner until it reaches the last section of the housing. The chain there travels over two top sprockets in succession and then downwardly to form a loop before it passes over the top of an intermediate sprocket 32 and horizontally out of the housing. Sprocket 32 is mounted on a framework 33 projecting from the end of the drier housing and supporting at its outer end other sprockets 34 around which the two outer chains travel downwardly past the unloading station 3 and through the building floor 35 to sprockets 36 under which they pass back to lower sprockets 22. The center chain passes downwardly from a sprocket 37 on framework 33 to a sprocket 38. As the three chains pass the unloading station the dried ware is stripped from the molds before they are returned to the ware-forming machine.

The chains are supported by lower sprockets 22 as they travel back beneath housing floor 19 until they reach sprockets 39 in the first section of the housing. They then pass upwardly around these sprockets and out of the housing over sprockets 41, and the near chain travels down around a sprocket 42, supported by framework 31, to drive sprocket 29. The other two chains travel farther out along framework 31 before passing down over sprockets (not shown) to their respective machines.

As shown in Figs. 4 to 6, each conveyer chain is formed from single straight links 51 pivotally mounted at their ends between the ends of double straight links 52 which receive the teeth of the various sprockets. It is a feature of this invention that, extending transversely through the center of every other single link, there is a pin 53 on the opposite ends of which the upper ends of brackets 54 are pivotally mounted. Rigidly connected to the lower end of each bracket is a laterally projecting arm 55 on the outer end of which there is a horizontal ring 56 for lifting loaded molds 4 from recesses in the turntable 57 of the ware-forming machine and carrying them through the drier and back empty to the machine. Brackets 54 are adapted to cooperate with guide members (not shown) adjacent the machine and the unloading station to prevent the mold carriers from swinging at those points.

Each mold carrier may be a unitary device or it may be made in such a way that carrier rings of different sizes are interchangeable with the bracket. In the latter case the arm 55 is divided into two parts, as shown in Fig. 4, one attached to the bracket and the other to the ring. The adjoining ends of the arms have longitudinally overlapping portions provided with transversely aligned openings only one of which extends entirely through its portion of the arm. A pin 58 is removably disposed in the openings to prevent the two parts of the arm from separating axially of the arm, and a sleeve 59 encircles the arm's overlapping portions to prevent them from separating in any other direction. The sleeve, which is slidably mounted on the arm, is pressed tightly against the projecting end of pin 58 by a coil spring 60 encircling the arm between the sleeve and bracket.

It will be realized that the resistance of such a large conveyer to starting is very great. This is due to the starting friction of the sprockets and to the great weight of the long conveyer to which must be added the weight of the molds and the ware carried by them. A motor powerful enough to overcome this starting resistance in the usual way would have very much more power than is required to drive the conveyer after it has been set in motion, and the tremendous pull or tension suddenly exerted upon the chain by such a motor might be more than the chain and drier housing could stand unless they were made exceedingly strong, which would greatly increase their cost.

In accordance with this invention these difficulties are avoided by providing means for allowing the driving means and a relatively short section of the conveyer to get in motion and to gradually gather speed and momentum before the main portion of the conveyer is moved. Accordingly, as shown in Figs. 1 and 3, supported by each chain loop suspended in the last section of the housing is a sprocket 62 pivoted in the upper ends of a pair of vertical side bars 63 that support between them a weight 64 which is just heavy enough when the conveyer is running and operating normally to hold the loop extended sufficiently for the weight to rest on cross beams 65 supported at their ends by beams 66. Projecting from the outer face of each side bar near its top and bottom are guide brackets 67 that are slidably mounted in vertical guide members 68.

As the starting resistance of the portions of the conveyer between the driving sprocket 29 and the loop in the last section of the drier housing is considerably less than the starting resistance of the much longer portion of the conveyer in the housing behind the loop, only enough power need be applied to start the former portion of the conveyer because the loop permits that portion to get under motion without moving the rest of the conveyer. That is, the great resistance of the major portion of the conveyer to starting

causes the last upper sprocket 17 in the drier housing to serve temporarily as a stationary point or anchor for the rear end of the loop, so that as soon as the forward portion of the conveyer starts moving it raises or shortens the loop, weight 64 rising with it, instead of immediately setting the rest of the conveyer in motion. However, while the weight is rising, during the time that the driving motor for sprocket 29 is getting up to speed, the weight exerts a gradually increasing downward pull on the loop, preferably because of a pair of parallel weighted rollers 71. These are suspended from the main weight by a pair of links 72 pivotally connected to the opposite ends of each roller, the other ends of the links being pivoted to the lower ends of a pair of vertical links 73 whose upper ends are pivoted to the bottom of the main weight.

The rollers are supported by and roll upon upwardly curved concave tracks 74 so that as they are pulled toward each other by the rising weight they simultaneously move upwardly on the tracks whose inclination gradually increases until it is vertical, at which point practically the entire weight of the rollers would be carried by main weight 64. Consequently, it will be seen that as these rollers are drawn upwardly they gradually increase the weight on the loop until the pull on the chain reaches and exceeds the starting resistance of the major portion of the conveyer. At that moment the entire conveyer starts moving and the main and auxiliary weights pull the loop downwardly again to its original position because the amount of chain pull required to keep the conveyer running is a great deal less than that required to start it.

To take up any slack that may occur in the chain, and which always does tend to occur on the slack side of the driving sprocket 29 between it and sprocket 30 when the former is first started in operation and the portion of the chain directly ahead of it in the drier housing has not yet started to move, a weight 76 (Fig. 2) is suspended from the vertically movable sprocket 24 in the first section of the housing. Like weight 64 at the opposite end of the housing, weight 76 is supported by vertical side bars 77 in the upper ends of which sprocket 24 is pivotally mounted. Projecting from the outer face of each side bar near its top and bottom are guide brackets 78 that are slidably mounted in vertical guide members 79 extending downwardly from a cross beam 26. Weight 76 pulls sprocket 24 downwardly when driving sprocket 29 first starts to rotate, but it is raised by sprocket 24 as soon as the entire conveyer begins to move and to take up the slack.

Another feature of this invention is that the conveyer automatically indicates the amount of pull on the chain at all times, and stops itself whenever that pull tends to become excessive by reaching a predetermined amount. This is accomplished by means including a series of vertically spaced electric switches 81 that may be attached to the side of a guide member 68 of the chain pull mechanism. Projecting laterally from the side of weight 64 is an actuating member 82 which closes each switch in succession as the weight is raised by the shortening loop. The switches are connected in circuit with indicating means located in a convenient position, such as a series of lights 83 mounted on the ware-forming machine 1. Opposite each light there is a number indicating the number of pounds pull on the chain that is required to lift the weight 64 high enough to cause actuating member 82 to close the switch connected to the light in question.

These lights are of no particular value when the conveyer is first started in operation because it is expected that the weight will rise to a considerable height at that time. However, after the entire conveyer has been set in motion the weight is supposed to drop back to its original position on beams 65. Thereafter, if one or more of the indicating lights 83 is illuminated it is a sign that the weight is rising again, which means that the running friction of the conveyer has been increased above normal and has correspondingly increased the pull on the chain. In such a case the lights are a signal to the attendant that something is wrong with the conveyer, such as a sticking sprocket, fouled chain or the like, and should be investigated.

If the difficulty is so serious as to stop the chain, weight 64 is raised far enough to close the top switch 81 which is connected to a relay 84 or the like (Fig. 7) that opens the electric circuit to the motor 85 that drives driving sprocket 29. This top switch is located low enough on guide member 68 to permit the weight to be drawn upwardly a little further by the coasting chain after the driving means has been shut off, whereby the chain drive and chain are stopped before the pull on the chain becomes great enough to break the chain.

According to the provisions of the patent statutes, I have explained the principle and mode of operation of my invention and have illustrated and described what I now consider to represent its best embodiments. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. A traveling conveyer system comprising an endless conveyer, means for driving the conveyer, spaced members supporting the conveyer with a loop between two of said members adjacent the tension side of said driving means, and means connected to the loop for normally holding it in a predetermined position but normally exerting materially less tension on the loop than required to overcome the starting resistance of the portion of the conveyer behind the loop whereby the loop starts to shorten when said driving means starts operating, said loop-holding means being adapted to increase its load on the loop as the loop becomes shorter until the increasing tension is sufficient to overcome said starting resistance.

2. A traveling conveyer system comprising an endless conveyer, means for driving the conveyer. rotatable means supporting the conveyer with a loop between two of said means adjacent the tension side of said driving means, a rotatable member supported by said loop, and pull means connected to said member for normally holding said loop in a predetermined position but normally exerting materially less pull on the loop than required to overcome the starting resistance of the portion of the conveyor behind the loop whereby the loop starts to shorten when said driving means starts operating, the pull means being adapted to increase its pull on said loop as the loop becomes shorter until the increasing pull is sufficient to overcome said starting resistance.

3. A traveling conveyer system comprising an endless conveyer, means for driving the conveyer,

a portion of the conveyer having material resistance to starting in motion, a pair of rotatable members supporting the conveyer between said portion and the tension side of said driving means, the conveyer forming a loop between said members, a rotatable member supported by said loop, pull means connected to the last-mentioned member for normally holding said loop in a predetermined position, and tension means connected to the conveyer between said conveyer portion and the slack side of said driving means for taking up slack in the conveyer, said pull means normally exerting less pull on the loop than required to overcome said starting resistance and being adapted to exert an increasing pull on said loop as the loop shortens when said driving means is started in operation, whereby the driving means gathers momentum while shortening the loop until the increasing pull on the loop is sufficient to overcome said starting resistance.

4. A traveling conveyer system comprising an endless conveyer, means for driving the conveyer, rotatable means supporting the conveyer with a loop between two of said means adjacent the tension side of said driving means, a rotatable member supported by said loop, a weight connected to said member for normally holding said loop in a predetermined position but normally exerting less pull on the loop than required to overcome the starting resistance of the portion of the conveyer behind the loop whereby the loop starts to shorten when said driving means starts operating, and means for increasing the pull of said weight on the loop as weight is raised by the shortening loop until the increasing pull on the loop is sufficient to overcome said starting resistance.

5. A traveling conveyer system comprising an endless conveyer, means for driving the conveyer, rotatable means supporting the conveyer with a loop between two of said means adjacent the tension side of said driving means, a rotatable member supported by said loop, a weight connected to the pulley for normally holding said loop in a predetermined position but normally exerting less pull on the loop than required to overcome the starting resistance of the portion of the conveyer behind the loop whereby the loop starts to shorten when said driving means starts operating, means connected to the conveyer adjacent the slack side of said driving means for taking up slack in the conveyer, and means for increasing the pull of said weight on the loop as weight is raised by the shortening loop until the increasing pull on the loop is sufficient to overcome said starting resistance.

6. A traveling conveyer system comprising an endless conveyer, means for driving the conveyer, rotatable means supporting the conveyer with a loop between two of said means adjacent the tension side of said driving means, a rotatable member supported by said loop, a main weight connected to said member for normally holding said loop in a predetermined position but normally exerting less pull on the loop than required to overcome the starting resistance of the portion of the conveyer behind the loop whereby the loop starts to shorten when said driving means starts operating, an auxiliary weight disposed below said main weight and connected thereto, and an upwardly curved concave track supporting said auxiliary weight whereby the downward pull of the auxiliary weight on said main weight increases as the auxiliary weight is pulled up the increasingly steep track by the shortening loop until the increasing pull on the loop is sufficient to overcome said starting resistance.

7. A traveling conveyer system comprising an endless conveyer, means for driving the conveyer, rotatable means supporting the conveyer with a loop between two of said means adjacent the tension side of said driving means, a rotatable member supported by said loop, a weight connected to said member for normally holding said loop in a predetermined position but normally exerting less pull on the loop than required to overcome the starting resistance of the portion of the conveyer behind the loop whereby the loop starts to shorten when said driving means starts operating, a cylindrical weighted roller disposed below said weight, means rotatably connecting said roller to the weight, and an upwardly curved concave track supporting the roller whereby the downward pull of the roller on said weight increases as the roller is pulled up the increasingly steep track by the shortening loop until the increasing pull on the loop is sufficient to overcome said starting resistance.

8. A traveling conveyer system comprising an upper and a lower row of spaced rotatable members, an endless conveyer having its upper portion supported by the upper rotatable members and extending downwardly between them around the lower rotatable members to form generally vertical strands, the lower portion of the conveyer extending laterally below said lower row of rotatable members, means operatively connected to the conveyer for driving it, one of said lower rotatable members adjacent the slack side of the driving means being vertically movable, a weight supported by said vertically movable member for taking up slack in the conveyer, one of said rotatable members adjacent the tension side of the driving means being vertically movable, a weight supported by said last-mentioned member, a cylindrical weighted roller disposed below said weight, means rotatably connecting said roller to the weight, and an upwardly curved concave track supporting the roller whereby the downward pull of the roller on said weight increases as the roller is pulled up the increasingly steep track by the shortening loop until the increasing pull on the loop is sufficient to overcome the starting resistance of the upper portion of the conveyer between said vertically movable rotatable member.

9. A traveling conveyer system comprising an endless conveyer, means for driving the conveyer, rotatable means supporting the conveyer with a loop between two of said means adjacent the tension side of said driving means, a rotatable member supported by said loop, pull means connected to said member for normally holding said loop in a predetermined position but normally exerting materially less pull on the loop than required to overcome the starting resistance of the portion of the conveyer behind the loop whereby the loop starts to shorten when said driving means starts operating, the pull means being adapted to increase its pull on said loop as the loop becomes shorter until the increasing pull is sufficient to overcome said starting resistance, and emergency means actuated when said loop is shortened a predetermined amount for stopping said driving means.

10. A traveling conveyer system comprising an endless conveyer, means for driving the conveyer, rotatable means supporting the conveyer with a loop between two of said means adjacent the

tension side of said driving means, a rotatable member supported by said loop, pull means connected to said member for normally holding said loop in a predetermined position but normally exerting materially less pull on the loop than required to overcome the starting resistance of the portion of the conveyer behind the loop whereby the loop starts to shorten when said driving means starts operating, the pull means being adapted to increase its pull on said loop as the loop becomes shorter until the increasing pull is sufficient to overcome said starting resistance, and means actuated as the loop shortens for indicating the amount of pull on the conveyer.

11. A traveling conveyer system comprising an endless conveyer, means for driving the conveyer, rotatable means supporting the conveyer with a loop between two of said means adjacent the tension side of said driving means, a rotatable member supported by said loop, a weight connected to said member for normally holding said loop in a predetermined position but normally exerting less pull on the loop than required to overcome the starting resistance of the portion of the conveyer behind the loop whereby the loop starts to shorten when said driving means starts operating, means for increasing the pull of said weight on the loop as weight is raised by the shortening loop until the increasing pull on the loop is sufficient to overcome said starting resistance, and an electric switch actuated by said weight when it rises a predetermined amount for stopping said driving means.

12. A traveling conveyer system comprising an endless conveyer, means for driving the conveyer, rotatable means supporting the conveyer with a loop between two of said means adjacent the tension side of said driving means, a rotatable member supported by said loop, a weight connected to said member for normally holding said loop in a predetermined position but normally exerting less pull on the loop than required to overcome the starting resistance of the portion of the conveyer behind the loop whereby the loop starts to shorten when said driving means starts operating, means for increasing the pull of said weight on the loop as weight is raised by the shortening loop until the increasing pull on the loop is sufficient to overcome said starting resistance, a plurality of vertically spaced electric switches actuated in succession by said rising weight, and means controlled by said switches for indicating the amount of pull on the conveyer.

13. A traveling conveyer system comprising an endless chain, a plurality of sprockets supporting the chain, means for driving the chain, said chain being provided with a loop between two of the spockets adjacent the tension side of the driving means, a rotatable member supported by said loop, a plurality of article carriers pivotally connected to the side of the chain, and pull means connected to said rotatable member for normally holding said loop in a predetermined position but normally exerting materially less pull on the loop than required to overcome the starting resistance of the portion of the conveyer behind the loop whereby the loop starts to shorten when said driving means starts operating, and the pull means being adapted to increase its pull on said loop as the loop becomes shorter until the increasing pull is sufficient to overcome said starting resistance.

14. A traveling conveyer system comprising an endless chain, a plurality of sprockets supporting the chain, means for driving the chain, said chain being provided with a loop between two of the sprockets adjacent the tension side of the driving means, a sprocket supported by said loop, a plurality of brackets pivotally connected at their upper ends to the side of the chain, an arm connected to the lower end of each bracket and projecting laterally therefrom, means connected to the outer end of each arm for supporting an article, and pull means connected to the last-mentioned sprocket for normally holding said loop in a predetermined position but normally exerting materially less pull on the loop than required to overcome the starting resistance of the portion of the conveyer behind the loop whereby the loop starts to shorten when said driving means starts operating, the pull means being adapted to increase its pull on said loop as the loop becomes shorter until the increasing pull is sufficient to overcome said starting resistance.

15. An article carrier for an endless traveling chain comprising a bracket adapted to be pivotally connected at its upepr end to the side of the chain, an arm projecting laterally from the lower end of the bracket, a horizontal ring connected to the outer end of the arm, said arm being divided into two parts having longitudinally overlapping portions provided with a pair of transversely aligned openings, a pin removably disposed in said openings and projecting therefrom, a sleeve encircling said overlapping portions, and a coil spring encircling the arm and biasing the sleeve against the projecting end of the pin.

16. Apparatus for aiding in starting a traveling endless conveyer having a loop between two of its supporting means adjacent the tension side of its driving means, said apparatus comprising means connected to said loop for normally holding the loop in a predetermined position but normally exerting materially less tension on the loop than required to overcome the starting resistance of the portion of the conveyer behind the loop whereby the loop starts to shorten when said driving means starts operating, and means for increasing the pull of said loop-holding means on said loop as the loop becomes shorter until the increasing tension is sufficient to overcome said starting resistance.

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