April 9, 1935. F. CROZIER 1,997,360

TWISTED STRAP CONVEYER

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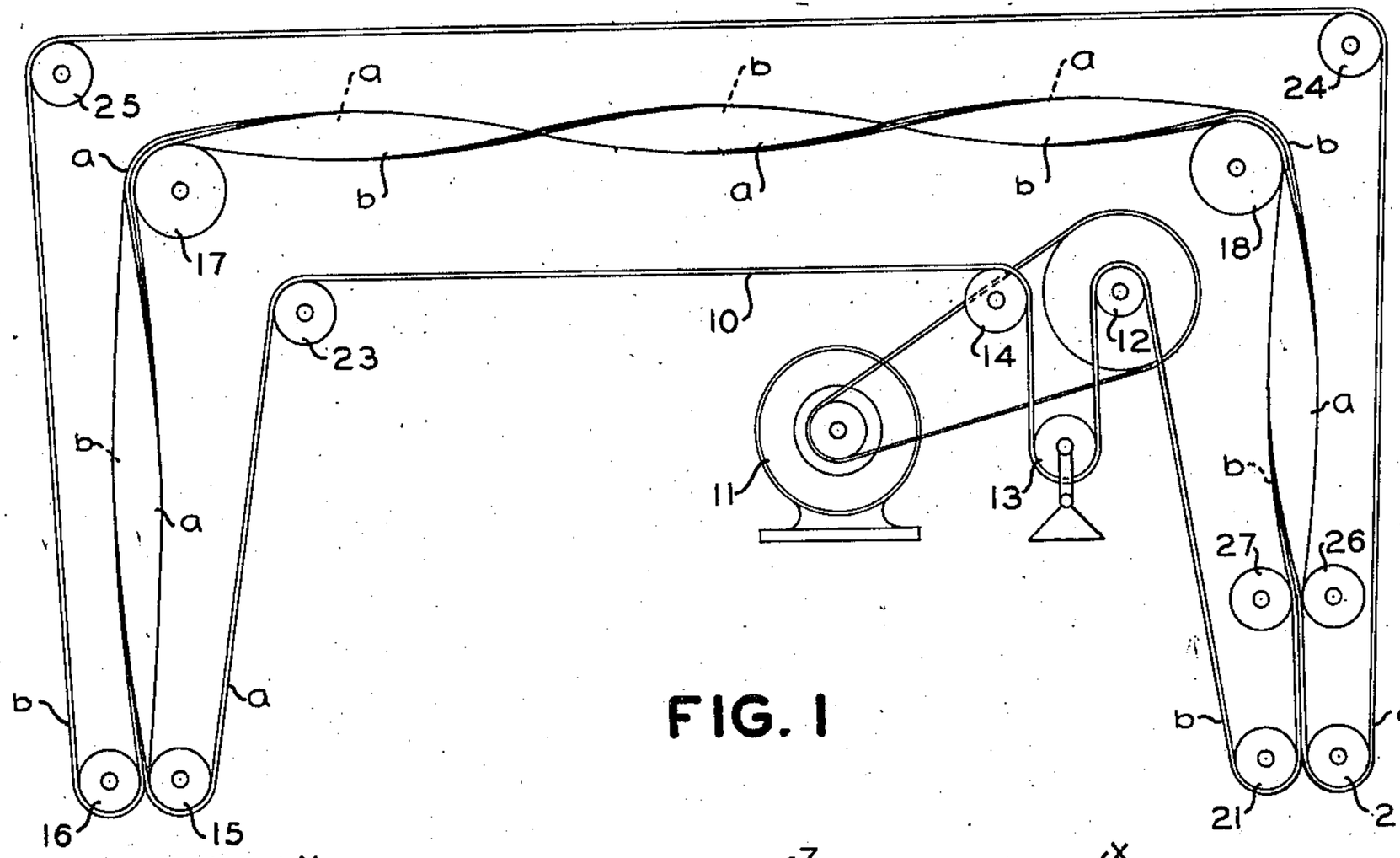

FIG. 1

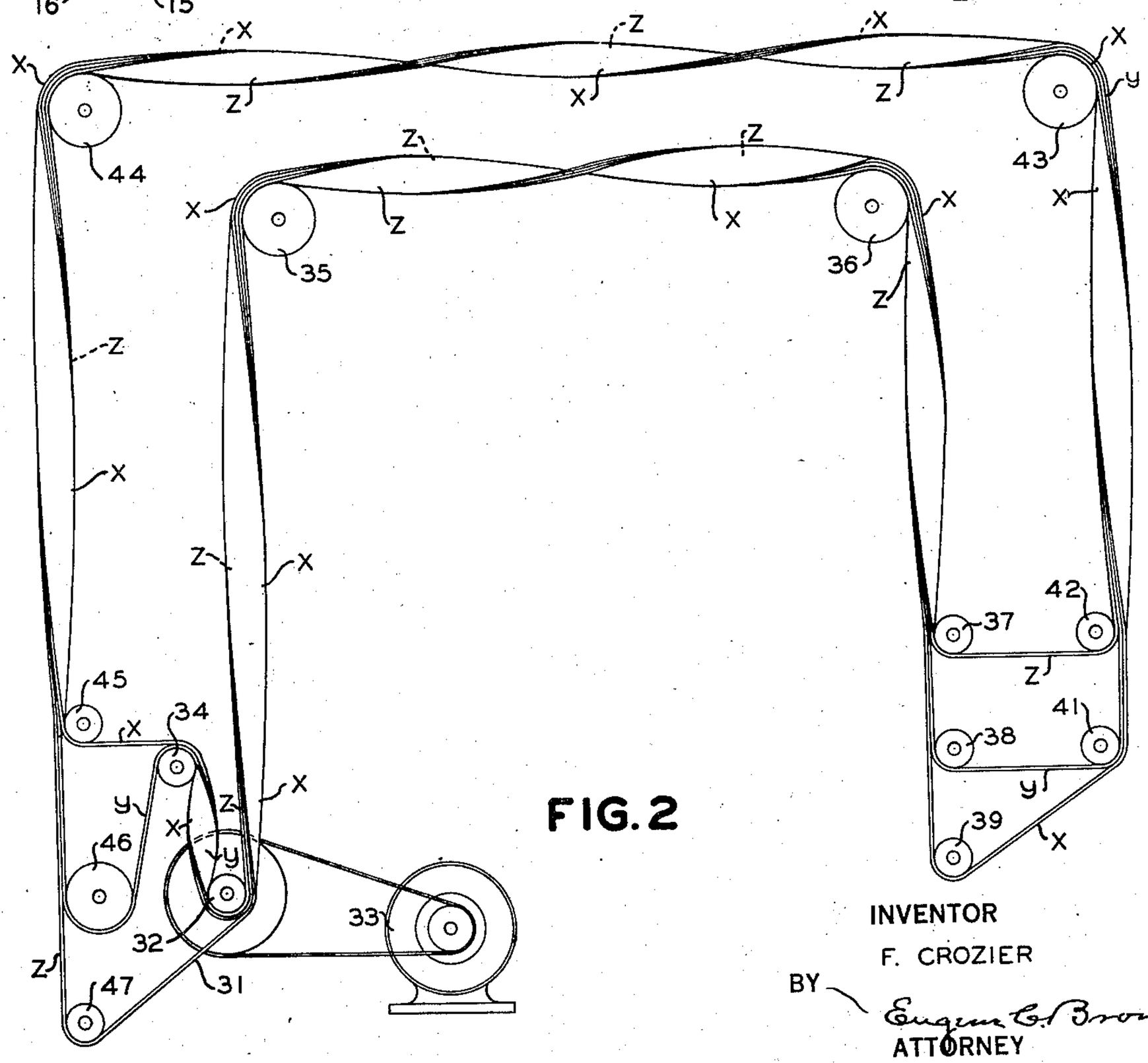

FIG. 2

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TWISTED STRAP CONVEYER

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5 Claims. (Cl. 198—165)

This case is a substitute for abandoned application Serial No. 652,375.

This invention relates to belt conveyers and more particularly to the conveyers in which material is carried between two flat belts as it is transported along the conveyer.

It has been proposed heretofore to twist the two contacting belts or straps of the above type of conveyer so that the material is more firmly gripped between the adjacent surfaces of the belts. The double or multiple strap conveyer has been found to be admirably adapted to carry certain types of light flexible sheet material such as tickets, coupons, message blanks and the like when arranged with the contacting straps twisted together along the conveyer run.

The principal object of this invention is to provide a twisted strap conveyer arrangement which will enable a single endless conveyer belt to serve to provide both of the conveying straps, strap folds, or strands so that the entire belt system of the conveyer may be driven by applying a driving force through a suitable pulley at one point.

Another object of this invention is to adapt the same system to a conveyer embodying more than two folds of a single strap arranged to provide two or more conveyer paths along the same route.

When double strap conveyers are passed around pulleys for changing their direction of travel, the strap farthest from the face of the pulley due to the larger effective diameter or radius of travel will tend to creep ahead of the strap nearest the face of the pulley. Where there are several changes of direction in the double strap portion of the conveyer, this creeping tendency becomes quite pronounced having, at times, a distinct detrimental effect on the conveying action of the straps. In other words, when one strap tends to continuously creep over the other, the grip of the strap surfaces upon the material being conveyed may be materially weakened and in some cases even permit the material to fall out of the conveyer.

Another object of this invention is, therefore, to cut down as far as possible, and even substantially eliminate the tendency of one belt or strap to creep over another when they are both passing around the same direction changing pulley.

These and other objects will be apparent from the following description and claims taken together with the accompanying drawing forming a part of this application in which:

Fig. 1 is a diagrammatic view illustrating a double strap twisted conveyer employing a single belt folded to provide two straps along the active run of the coveyer; and,

Fig. 2 is a diagrammatic view illustrating a multiple strap conveyer employing a single belt folded to provide three straps arranged to convey material in both directions of travel.

The arrangement illustrated in Fig. 1 comprises an endless conveyer belt **10**, driven by a motor **11**, or other suitable driving means, through a drive pulley **12**. The belt extends from the drive pulley preferably around a take-up idler pulley **13** and a secondary idler pulley **14** which brings the belt back in proper alignment. The directions in which the conveyer unit employing a single belt may be extended are not limited. In the illustration the active route of the conveyer extends upwardly from a pair of idler pulleys **15** and **16** to a direction changing pulley **17**, thence along a horizontal direction to another direction changing pulley **18**, thence downwardly to discharge the material at a pair of return pulleys **21** and **22**.

As the sheets travel along the twisted strap portion of the conveyer they revolve in a spiral and may become partially wrapped around the straps due to the resistance of the air in travel. If desired a pair of pulleys **26** and **27** may be disposed above the outlet or discharge end of the conveyer route for straightening out the twisted portion of the conveyer before the two folds of the belt or strap reach the discharge pulleys **21** and **22**. The purpose of this is to give the sheets time to straighten themselves with the edges of the belt before they pass between the final pulleys.

The travel of the belt through the system of pulleys from the drive pulley **12** around both sides of the conveyer route will now be traced to show how the single endless conveyer belt is arranged or folded to provide the belts or straps at both sides of the conveying path and also how the tendency for the belts to creep in passing the direction changing pulleys is substantially overcome. For convenience, the portion or fold of the belt passing along the lower return path and entering the inlet at the right will be designated as *a*, while the other fold passing along the upper return run and entering the inlet from the left will be designated as *b*. The same designation will be followed through the twisted portion of the conveyer until the fold *a*, joins the *b* fold and vice versa.

The *a* fold of the belt or strap may be readily followed from the exit or discharge pulley **21** to the entrance pulley **15**. From this point

the *a* fold passes around the outer or front side of the twist between the entrance and the first direction changing pulley 17 while the *b* fold passes around the rear side of the twist. At the pulley 17 the *b* fold comes against the face of the pulley while the *a* fold is at the outside. Continuing along the second half turn the *a* fold comes to the front and the *b* fold is behind. Through the third half turn the *b* fold comes to the front again with *a* fold behind where they arrive at the second direction changing pulley 18. They pass around this pulley with the *a* fold on the inside next to the face of the pulley and the *b* fold on the outside. From the second direction changing pulley 18 the straps extend with another half turn to the guide pulleys 26 and 27. At the same time, the *a* fold passes from the inside or left position over to the right side, while the *b* fold passes underneath to the left side. Since there is no twist between guide pulleys 26 and 27, the folds pass out at the end of the conveying path with the *a* fold at the right passing around the discharge pulley 22 and the *b* fold at the left passing around the discharge pulley 21.

Tracing these belt sections or folds back along the idle path, it will be seen that they become or merge into the folds opposite that first assumed. In other words, the *a* fold of the belt passes in at the entrance on the inside or lower position and out at the outlet on the outside or upper position. Following a particular point along the belt as it moves around this path or course of travel from the drive pulley 12 around entrance pulley 15, it passes through the twist of the belt, which it will be noted has an odd number of half turns, as belt fold *a*, thence out at the discharge around the pulley 22 upward around the outside pulleys 24 and 25 back to the entrance and around the pulley 16, through the twisted section as belt fold *b*, along the odd number of half turns to the outlet or discharge end around the pulley 21 thence to the starting point at the pulley 12.

From the foregoing description several features and advantages will be noted. The first of these is that an odd number of half turns is required to enable the reversal of the idle or return folds of the belt to make the complete circuit of travel. Any number of twists or half turns may be made in the belt which is desirable to produce the well known additional gripping action of a twisted belt or strap conveyer. As it is known the number of twists are limited somewhat by the rigidity of the straps and the dimensions of thickness and width. The second item is that a single belt forms both sides of the double strap conveyer so that they may be driven at one point thus assuring that the same tension and speed will be exerted on both of the sides of the twisted portion, which will tend to eliminate the creeping.

Another item to be noted is that when an odd number of half turns are employed in each of the various sections extending between direction changing pulleys the belt fold which is traveling against the face of the pulley at one direction changing point, will be traveling in the outer position at the other direction changing point. This means that the tendency to creep at any one of the several pulleys due to the difference in the effective travel radii is counteracted by a similar tendency at adjacent pulleys acting on the folds in reverse order so that in the belt as a whole there is no resulting cumulative tendency for one of the folds to creep along relative to the other.

In connection with twisted strap conveyers another advantagous arrangement has been discovered for keeping down this tendency of creeping when the conveyer changes direction. That is by employing a belting having a minimum thickness. It has been found that certain types of belting provide all of the necessary properties otherwise desirable with only a small portion of the thickness ordinarily thought necessary. Certain types of fabric or webb belting are found to have these properties. The particular advantage to be gained is that thin belts reduce travel radii differential and to that extent reduces quantitatively the creeping tendency at direction changing pulleys.

Fig. 2 illustrates another embodiment of this invention. It shows an arrangement of a single endless belt providing a plurality of conveyer paths along a single route. It also illustrates how the belt may be arranged or folded to provide conveyer paths in both directions of travel of the belt. A single conveyer belt 31 moves or travels three times through the conveyer route, each time assuming a different one of three positions along the route to provide two double strap conveyer paths therealong. For convenience the turns of the belt entering the inlet end of the conveyer in a certain position will be designated the same throughout both the forward and return routes. The entrant end of the conveyer is provided at the left end where the belt assembly is driven by means of a drive pulley 32 receiving power from a suitable motor 33 or other source. The belt fold at the lower or extreme outer side of the drive pulley 32 will be designated belt *x*. The fold in the middle portion on pulley 32 will be designated belt *y*, while the fold next to the pulley will be designated belt *z*. It will be noted that the entrance between belts or folds *y* and *z* is at a pulley 34 elevated above the pulley 32. The forward or lower route of the conveyer extends from pulley 32 upwardly around a direction changing pulley 35, thence in a horizontal direction to another direction changing pulley 36, thence downwardly to the exits between the various belt pairs formed at pulleys 37, 38 and 39.

The belt folds will now be traced through their half turns from pulley 32 to the exit pulleys 37, 38 and 39. Between the pulleys 32 and 35 the fold *x* passes from an extreme outer right position to an extreme outer left position at the pulley 35. The fold *y* will assume a middle position throughout the entire forward route. However, the fold *z* moves from an extreme left inward position at pulley 32 to an extreme right inward position at the pulley 35. It will be noted that the assembly makes only one-half turn between pulleys 32 and 35. Between pulleys 35 and 36 the assembly makes two half turns, the fold *x* moving over around the back through the first half turn and over around the front through the second half turn to assume an extreme outer position at the pulley 36. Likewise the fold *z* moves from an inner position over the front through the second half turn to an inner position around the pulley 36. Between the pulleys 36, 37, 38 and 39 the assembly makes one-half turn, the fold *x* moving to an extreme outer position and passing around the lower pulley 39. The fold *y* in the middle position passes around the middle pulley 35. The fold *z* passes from the inner position at pulley 36 around over the

front to the pulley **37** and is separated from the fold *y* at **37**. It will be noticed that the folds *x*, *y* and *z* are separated from each other to form the discharge by the pulleys **37**, **38** and **39** being spaced apart. This point constitutes the end of the first conveyer path.

It will be noted that the belt assembly is passed through an even number of half turns in the first portion of the conveyer route. Even though the belt passes through only two half turns between pulleys **35** and **36** which prevents it from having the advantages outlined in connection with the embodiment of Fig. 1, such an arrangement is not necessary. If the number of half turns between either the entrant or exit end and one of the direction changing pulleys is made an even number, the half turn between the direction changing pulleys may be an odd number, which then gives it the advantage above referred to.

At a point adjacent the outlet or discharge end of the first conveyer route the entrant end of the second conveyer route is located. The inlet between folds *x* and *y* is provided by permitting them to come together around a pulley **41** while the inlet between the folds *y* and *z* is provided by arranging the fold *z* to contact the folds *x* and *y* as they pass a pulley **42**. From the inlet of the second route the belt assembly passes upwardly around a direction changing pulley **43** thence along the horizontal run to a direction changing pulley **44** and downwardly around pulleys **45**, **46** and **47** providing exits or discharges for the paths of the second route. Tracing the belt portions or folds the fold *x* passes over the front through a half turn between pulleys **42** and **43** to assume an inner position at the face of the pulley **43**. The *y* fold is still in the intermediate position throughout the second conveyer route. The *z* fold moves from an inner position around the back of the first half turn to the outer position at the pulley **43**. From the pulley **43** the assembly is passed through three half turns. The fold *x* passes around the back of the first half turn, around the front of the second half turn, around the back of the third half turn to assume an outer position at the pulley **44**. The fold *z* passes around the front of the first half turn, around the back of the second half turn and around the front of the third half turn to assume an inner position at the pulley **44**. From this point the assembly passes to the discharge pulleys through a single half turn. The fold *x* passes around the front of the half turn to be separated from the central fold *y* at the pulley **45**. The fold *y* passes around the pulley **46** at which point it is separated from the *z* fold which is passed around the back of the half turn to the pulley **47**.

It will now be noted that the various belt folds continue over the inlet pulleys **32** and **34** respectively. It will be particularly noted, however, that the various belt folds in passing over the latter pulleys become a fold other than that first assumed. For instance, the fold *x* which passes around pulleys **45** and **34** meets the fold *y* at the pulley **34** and makes a half turn around the back between pulleys **34** and **32** to assume a middle position at the pulley **32** and joins with what was assumed originally occupied a mid-position, in making the half turn between pulleys **34** and **32** with the fold *x*, assumes an inner or left position and joins with what was originally assumed to be belt fold *z*. Finally, fold *z* passes around the outside of pulleys **47** and **32** and joins with what was originally assumed to be fold *x*.

If the travel of any particular point of the continuous belt **31** is followed three times through the forward and return routes of the conveyer it will be seen that it will finally arrive at the same position from which it originally started. Thus it is demonstrated that a single belt can be arranged to form a plurality of conveyer paths along both forward and return routes of a twisted double strap conveyer. This arrangement provides all of the several advantages pointed out in connection with the embodiment of Fig. 1, such as a single drive for the whole belt system, a tendency to cut down creeping by employing an odd number of half turns between direction changing pulleys. It has been found also that if the type of conveyer belt described in connection with the foregoing embodiment is employed the effective difference in the travel radii about the direction changing pulleys will be minimized, which in turn further minimizes the tendency for creeping of the belts one with relation to the other. In addition to the advantages pointed out in connection with the foregoing embodiment this embodiment demonstrates how a single endless belt may be arranged to form active conveyer paths along both the forward and return directions of travel of the belt.

Although the embodiment of Fig. 1 was described as providing only one conveyer route it may be arranged to provide an additional conveyer route along the return travel of the belt by employing the principles illustrated in the embodiment of Fig. 2. It will further be noted that although only one half turn of the conveying sections of the belts or straps is provided in the vertically extending sections any suitable odd number of turns may be employed.

Although it has been pointed out that odd numbers of turns in the belt arrangement have been employed it should be particularly noted that such number of turns are not necessarily to be arranged in the order illustrated so long as the essential arrangement of having an odd number as the total number of half turns included in the entire perimeter of the route or path of travel of the belt.

From the above description it will be seen that a conveyer arrangement has been provided which enables a single belt to form the straps at both sides of the conveyer path in a double strap type of conveyer, particularly of the twisted belt type. Further, a single belt may be arranged to form not only a single double strap path but a plurality of paths. Such number of paths may be extended to any desired suitable number. It should further be noted that an arrangement has been provided which substantially eliminates the tendency for the belts to creep one with respect to the other as they pass around the direction changing pulleys in this type of arrangement.

While this invention has been described in but two forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible to various other changes and modifications without departing from the spirit thereof, and it is desired, therefore, that only such limitations shall be placed thereon as are imposed by the prior art or as specifically set forth in the appended claims.

What I claim is:

1. In a flat belt conveyer, conveying means disposed along a conveyer route embodying a pair of adjacent belts twisted together with their faces in contact to form a conveyer path along

said route, direction changing pulleys along said route common to both belts and around which said belts pass, one belt in an outer position and the other in an inner position, whereby the inner belt travels at a certain effective diameter and the outer belt travels at a relatively larger effective diameter, producing a tendency for one belt to creep with respect to the other, the portion of said belts disposed between adjacent direction changing pulleys being twisted for reversing the relative position of the belts with respect to the face of the pulley, whereby the creeping tendencies at adjacent pulleys are opposed to each other.

2. In a belt conveyer in which a plurality of conveying paths are formed along a conveyer route by means of the adjacent contacting surfaces of oppositely disposed belt sections being positioned to travel in contact with each other, a single belt providing an arrangement for forming several paths, said arrangement being characterized by the fact that the number of half turns in the belt section along the forward route together with those in the sections along the return route equal an odd number and by the fact that all of the belt sections save one are twisted an odd number of half turns between the point where the forward and return sections merge into each other.

3. In flat belt conveyer, conveying means disposed along a route and embodying a pair of adjacent belts twisted together with their faces in contact to form a conveyer path along said route, guide pulleys around which the belts travel, one belt in an outer and the other in an inner position, at points along said route where changes of direction occur, said pulleys being common to both belts, whereby the different effective diameters at which the belts travel tend to produce a creep of one belt with respect to the other, said belts being of minimum thickness, whereby said creeping tendency is reduced to a minimum, the section of the belts between the pulleys at adjacent direction changing points being twisted to reverse the relative position of the belts with respect to the face of the pulleys so that such creeping tendency as is still produced upon the belts at one pulley is counteracted by a like tendency produced in the opposite order at the adjacent pulley.

4. A belt conveyer comprising a single belt and guide pulleys arranged to support the belt, said belt embodying a plurality of folds disposed to travel in contact with each other, said folds being so arranged in a series of half turns that different folds engage adjacent guide pulleys.

5. A belt conveyer comprising a single belt and guide pulleys arranged to support the belt where it changes its direction of travel, said belt embodying a plurality of folds disposed to travel in contact with each other, said folds being so arranged in a series of half turns that opposite folds engage adjacent guide pulleys, whereby the normal tendency for belt creepage at the change of direction pulleys is counteracted.

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