July 2, 1946. J. F. RIXON 2,403,024

FLIGHT CONVEYER

Filed March 17, 1944 2 Sheets-Sheet 1

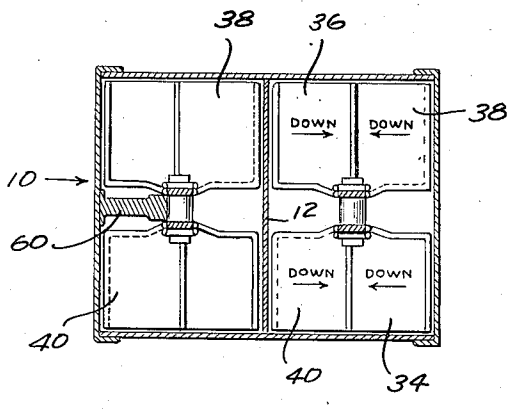

Fig. 2.

Fig. 1.

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Fig. 3.

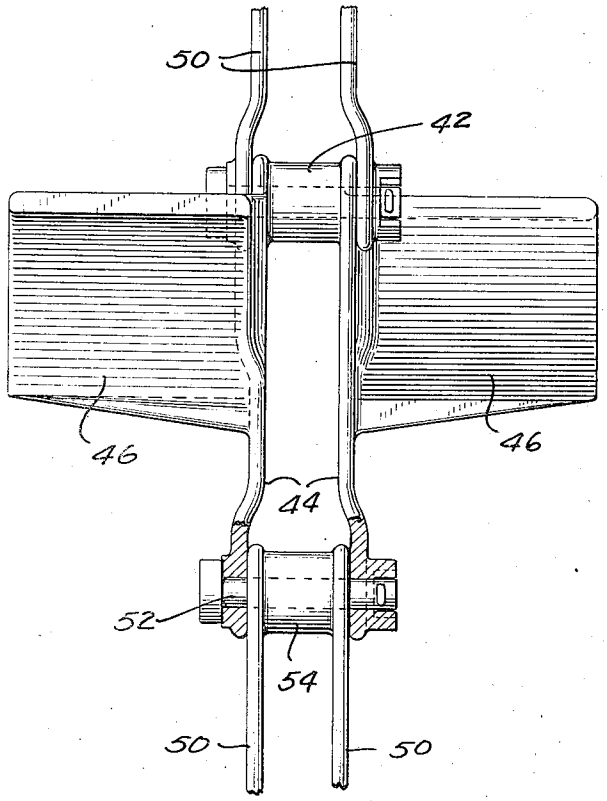
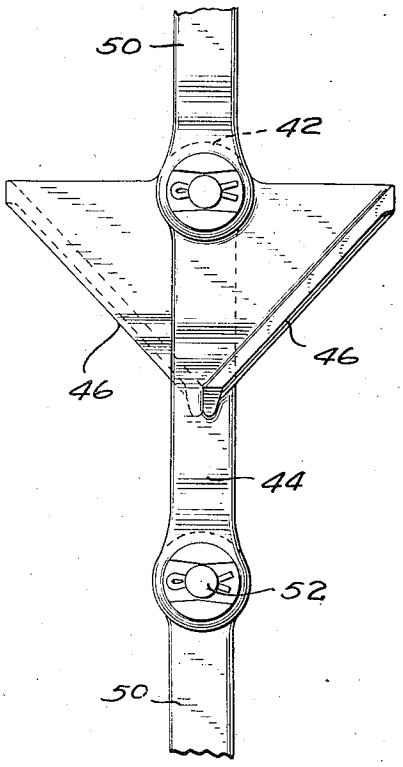


Fig. 4.



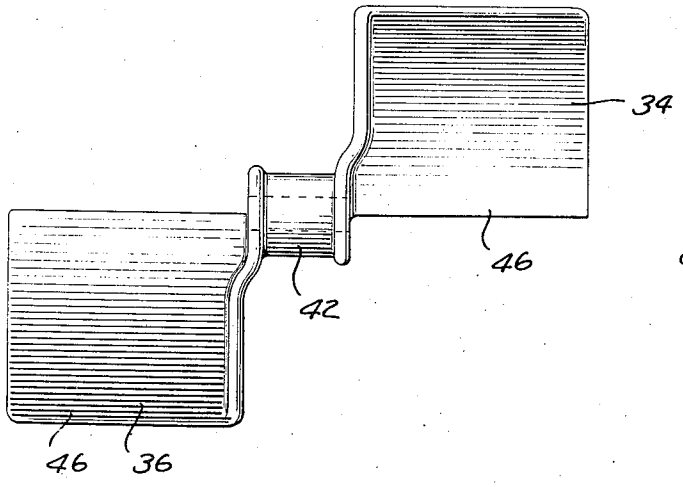


Fig. 5

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FLIGHT CONVEYER

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10 Claims. (Cl. 198—171)

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This invention relates to flight conveyers and is adapted for use both as a conveyer for granular, lump or powdered material in horizontal and inclined paths, and as an elevator for raising material in vertical directions. It may also be used for conveying material in any combination of such directions, as partly horizontal and partly vertical.

An important object of the invention is to provide a conveyer able to discharge the materials conveyed equally well whether the direction of the travel is horizontal, inclined or vertical.

A further object of the invention is to provide a flight construction which minimizes the side pressure of travelling material against the casing walls thereby reducing the power required to operate the conveyer and minimizing wear of the side walls.

A further object of the invention is the provision of a flight construction which will permit rapid and complete discharge of the material, particularly at points in a vertical or steeply inclined conveyer leg, without danger of the material being carried over the head wheel, and without necessitating special constructions and enlargements of the trunk at the point of discharge. Owing to the rapid discharge of the material from the flights, the conveyer may be operated at higher speeds than is usual with flight-conveyers, thus increasing the capacity.

A further object of the invention consists in providing a flight construction which, while permitting rapid and complete discharge, operates with less slip and allows less settling and packing of the material to be conveyed than conveyers with open type flights.

Another object of the invention consists in providing a flight and chain construction which is of great simplicity and durability and of low manufacturing cost.

Other objects and advantages will appear in the course of the following description.

Flight conveyers as at present constructed are usually of either the open flight or solid flight type. Open flight conveyers have serious drawbacks due to excessive slippage, and the material tends to pack, causing excessive side pressure on the walls of the casing. Open flight conveyers also can be operated only at or near their maximum capacity, because at low rates of feed, slippage becomes excessive.

Conveyers with flat solid flights, on the other hand, while operating with less slippage, do not discharge the contents of the flight rapidly and therefore have to be operated slowly in order to

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prevent excessive carry-over of the material at the head of the conveyer. Attempts have been made to remedy this defect, one of which comprises making the flights of convex or V shape facing in the direction of travel of the flights, such conveyers having what are known as "peak-top" flights. Such conveyers have the disadvantage that as the peak of the flight is pointed in the direction in which the material is moved, the flight acts like a wedge and tends to force the material laterally against the sides of the casing, thereby increasing the friction against the casing walls. Such flights also require special chute constructions and enlargement of the casing on the inside opposite the point of discharge, because part of the discharge is backwards or towards the inside, and this has to be collected and conveyed to the outside where the final discharge occurs.

In my present construction I have overcome these objections. In general my construction comprises a chain or endless belt carrying a series of solid flights, each of which fills only a part of the cross section of the casing, successive flights being arranged in alternate series so that each successive flight complements the preceding flight, and fills a part of the cross section of the casing not filled by the flight ahead. In this way, while no single flight fills the whole cross section of the casing, substantially the whole cross section is covered by a series of successive flights, each flight filling its particular area of the casing. This results in effective conveying of the material, and at the same time, owing to the construction of the flights, freedom of discharge is permitted such as is not found in other solid flight conveyers. Preferably the flights are so constructed as to tend to direct the material during conveying towards the median line of the casing thereby relieving the friction of the material against the casing walls.

In the accompanying drawings I have shown one preferred embodiment of my invention which is to be understood as illustrative only, as the invention may be embodied in modified constructions.

In the drawings:

Figure 1 is a diagrammatic vertical sectional view of a typical installation, showing the conveyer as having a horizontal leg connected with a vertical or elevator leg by a curved portion.

Figure 2 is a horizontal section on line 2—2 of Figure 1.

Figure 3 is a detail front elevation of one of

the flights with portions of the chain links connected thereto, parts being broken away.

Figure 4 is a side elevation of the parts shown in Figure 3.

Figure 5 is a plan view of one of the flights.

Referring to the drawings in detail, the construction shown comprises a casing **10**, which is divided by a partition **12** into two trunks or channels through which the conveyer chain and flights move.

The casing is shown as comprising a horizontal section **14**, a curved or inclined section **16**, and a vertical section **18**. Any combination of horizontal, vertical and inclined sections may obviously be employed depending upon the location of the points between which it is desired to convey the material.

For the purposes of illustration, the feed hopper **20** is shown as discharging into the horizontal leg of the conveyer, while discharge takes place through a discharge opening **22** in the side of the vertical leg into a discharge chute **24**. Obviously the discharge opening may be located in a horizontal or inclined section, if that should be desired.

At the top of the casing is a head sprocket wheel **26**, while at the other end of the casing is a tail sprocket wheel **28**. Either or both of these sprocket wheels may be driven from any suitable source of power, not shown. The conveyer proper comprises an endless belt construction **30** which may be formed by any suitable flexible means such as by a series of articulated links carried over the sprocket wheels and driven thereby. Carried by the belt or chain are the flights indicated generally by the numeral **32**. In the particular construction shown the flights are illustrated as being formed integrally with certain of the links of the chain, but this is not essential as the flights may be attached to the chain or other flexible carrying member in any suitable manner.

In the construction shown, which may be conveniently referred to as a "quarter-flight" conveyer, each flight comprises two blades or quarter-flights which are differently placed on alternate flights. One series of alternate flights has blades or "quarter-flights" **34** and **36** which are of such size and shape as to substantially fill in cross section two diagonally opposite corners of the casing. The other series of alternate flights has "quarter-flights" or blades **38** and **40**, so placed as to fill the diagonally opposite corners of the casing not filled by the blades **34** and **36** of the first series of flights. Thus one flight fills or sweeps through two diagonally opposite corners of the casing, and the next flight fills or sweeps through the other two diagonally opposite corners of the casing, and each two successive flights fill and sweep through practically the entire cross section of the casing, except for the necessary clearance near the margins and for narrow spans directly opposite to the chains. The spaces opposite to the chains permit the chains to pass over the sprockets without interference from the flights.

The quarter-flight arrangement described has advantages irrespective of the inclination of the flights, but preferably each quarter-flight is inclined from its outer edge towards its edge near the median plane of the casing, rearwardly against the direction of travel of the chain. The quarter-flights thus all tend to direct the material toward the median plane of the casing away from the side walls of the casing, thereby tending to relieve the pressure of the material against such side walls, reducing friction and wear, and requiring less power for the driving of the conveyer. Looked at from the side the two quarter-flights present a sort of V shape having a mouth open in the direction of movement of the chain. This is the opposite of the so-called peak-top flight construction of the prior art, in which the peak of the flight points in the direction of movement, and the material is forced into contact with the side walls of the casing by the wedging action of the flight. The quarter-flights may be given any desired degree of inclination depending upon the nature and angle of repose of the material to be handled.

The described arrangement and inclination of the flights provide for the free and rapid discharge of the conveyed material. Each flight has a quarter-flight portion or blade which is inclined in the direction of the discharge opening, as clearly shown in Fig. 1, so that the material slides directly off the same and into the discharge chute. The material on the other quarter flight, which has not fallen out when the flight passes the bottom of the discharge opening slides into the part of the casing vacated by the material discharged from the outwardly inclined blade and is directed immediately to the discharge chute, or if picked up by the next succeeding flight blade, it slides off of the same out of the discharge. Before the head sprocket is reached all material has cleared itself from the quarter-flights. No material is carried over the head sprocket even though the conveyer is operated at relatively high speed. Furthermore no enlargement of the casing is required on the inside opposite the point of discharge, and no special chutes have to be provided for catching rearwardly discharged material.

A preferred form of chain and flight construction is illustrated in detail in Figs. 3, 4 and 5. In this construction each flight comprises a hub **42**, carrying a pair of combined link and flight blade members each of which comprises a shank portion **44** having projecting therefrom a blade portion **46**. As illustrated the hub, shank and blade portions are all made of single malleable casting, although it is obvious that they may be assembled from parts secured together by welding or in any other suitable manner. These flight links are assembled into a chain with ordinary links **50** to which they are connected by pintles **52** of any suitable construction. Each pair of links **50** may be connected at their upper ends by a hub **54**, the hubs **42** and **54** being adapted to engage with notches **56** in the sprockets. Hubs **42** and **54** also form bearing surfaces adapted to engage with supports of any suitable kind which may be placed where required to guide the chains in desired paths. For instance in the example shown in Fig. 1, guide rail sections **60**, **62**, **64** and **66** are provided wherever the chain passes around curved portions of the casing.

With the construction described it will be seen that a single centrally located chain is formed by the link portions of the flights and the intermediate links, and that the total load of the conveyer is equally balanced on the quarter-flights around such central chain. At a particular flight there may be a slight torsional stress, but this is reversed at the next flight, and is insufficient to cause any difficulty, as the flights are held in position by the chain, and by the guide rails, and by contact with the casing walls. It is obvious, however, that a multiple chain construction might be used if desired. Various modifications in the number and disposition of the flight blades

may also be used, the important consideration being the use of the series of flights, each of which fills only a part of the cross section of the casing, so as to leave another part thereof free for the discharge of material, the flights being arranged in alternate series so that portions of the cross section not occupied by the blades of one flight are taken up by the blades of a successive flight or flights.

In my construction it will be seen that the freedom of discharge of an open flight conveyer is secured, while many, if not most of the advantages of reduction in slippage and increased efficiency of a solid flight conveyer are obtained. Furthermore great reduction in friction of the material against the casing walls is secured.

While I have illustrated and described in detail certain preferred forms of my invention, it is to be understood that changes may be made therein and the invention embodied in other structures. I do not, therefore, desire to limit myself to the specific constructions illustrated, but intend to cover my invention broadly in whatever form its principles may be utilized.

I claim:

1. A flight conveyer comprising a casing, a flexible travelling member movable therein and a series of quarter flight blades carried by said flexible member, each of said quarter flight blades filling approximately a quarter of the cross section of the casing, successive blades filling different portions of the cross section so that substantially the entire cross section of the casing is covered by the combined action of four quarter flight blades.

2. A flight conveyer comprising a casing, a flexible flight carrying member movable longitudinally through substantially the middle of said casing, and quarter-flight blades carried by said flexible member, said quarter-flight blades being arranged in pairs on said member, the blades of a pair travelling in diagonally opposite corners of said casing, each alternate pair of blades travelling in the diagonally opposite corners of the casing not traversed by the preceding pair of blades.

3. A flight conveyer comprising a casing, a chain movable longitudinally through substantially the middle of said casing, and quarter-flight blades carried by said chain, said quarter-flight blades being arranged in pairs on said chain, the blades of a pair travelling in diagonally opposite corners of said casing, each alternate pair of blades travelling in the diagonally opposite corners of the casing not traversed by the preceding pair of blades, all of said blades being inclined rearwardly from the margins of blades nearest to the side walls of the casing towards the margins lying nearest to the median plane of the casing, against the direction of travel of the chain.

4. A flight conveyer comprising a casing, a chain movable longitudinally through substantially the middle of said casing, and quarter-flight blades carried by said chain, said quarter-flight blades being arranged in pairs on said chain, the blades of a pair travelling in diagonally opposite corners of said casing, each alternate pair of blades travelling in the diagonally opposite corners of the casing not traversed by the preceding pair of blades, and sprocket wheels over which said chain passes, the quarter-flight blades being spaced so as to pass on either side of said sprocket wheels.

5. A flight conveyer comprising a casing, a chain movable longitudinally through substantially the middle of said casing, and quarter-flight blades carried by said chain, said quarter-flight blades being arranged in pairs on said chain, the blades of a pair travelling in diagonally opposite corners of said casing, each alternate pair of blades travelling in the diagonally opposite corners of the casing not traversed by the preceding pair of blades, sprocket wheels over which said chain passes, the quarter-flight blades being spaced so as to pass on either side of said sprocket wheels, and chain guides for supporting said chain, and placed so that the flight blades pass on either side of said guides.

6. A flight conveyer comprising a casing, a chain movable longitudinally therethrough at a distance from the casing walls, quarter-flight blades carried by said chain and projecting from opposite sides thereof said quarter-flight blades being arranged in pairs on said member, the blades of a pair travelling in diagonally opposite corners of said casing, each alternate pair of blades travelling in the diagonally opposite corners of the casing not traversed by the preceding pair of blades, and chain guide rails projecting into the casing and in contact with which said chain is adapted to travel, said flight blades passing on either side of said rails.

7. An articulated conveyer member comprising a series of links at least some of which have flight blades rigidly attached thereto and projecting from the sides thereof, said blades being arranged in pairs inclined in opposite directions to the line of travel of the conveyer, one blade of each pair projecting laterally and forwardly from the link to which it is attached, and the other blade of a pair projecting laterally and rearwardly from said link.

8. A conveyer element comprising a link having a pair of shanks connected at one end by a hub, and a flight blade projecting laterally from each shank, the flight blade projecting laterally from one shank, also projecting forwardly from said shank, but not rearwardly thereof, and the flight blade projecting laterally from said other shank also projecting rearwardly from said shank but not forwardly thereof.

9. A conveyer element comprising a link having a pair of shanks connected at one end by a hub, and a flight blade projecting laterally from each shank, each of said flight blades extending from substantially the longitudinal axis of the shank to a position laterally at one side of the shank, the flight blades at opposite sides of the link being oppositely inclined in directions at right angles to the directions of the lateral projections of the blades.

10. A conveyer element comprising a link having a flight blade projecting laterally from the link and also forwardly thereof, but not rearwardly of the link, and a second flight blade projecting laterally from the other side of the link from that at which the first flight blade projects, said second flight blade projecting rearwardly from the link but not forwardly thereof, said flight blades being respectively oppositely inclined to the longitudinal axis of the link.

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