(12) UK Patent Application (19) GB (11) 2 063 201 A

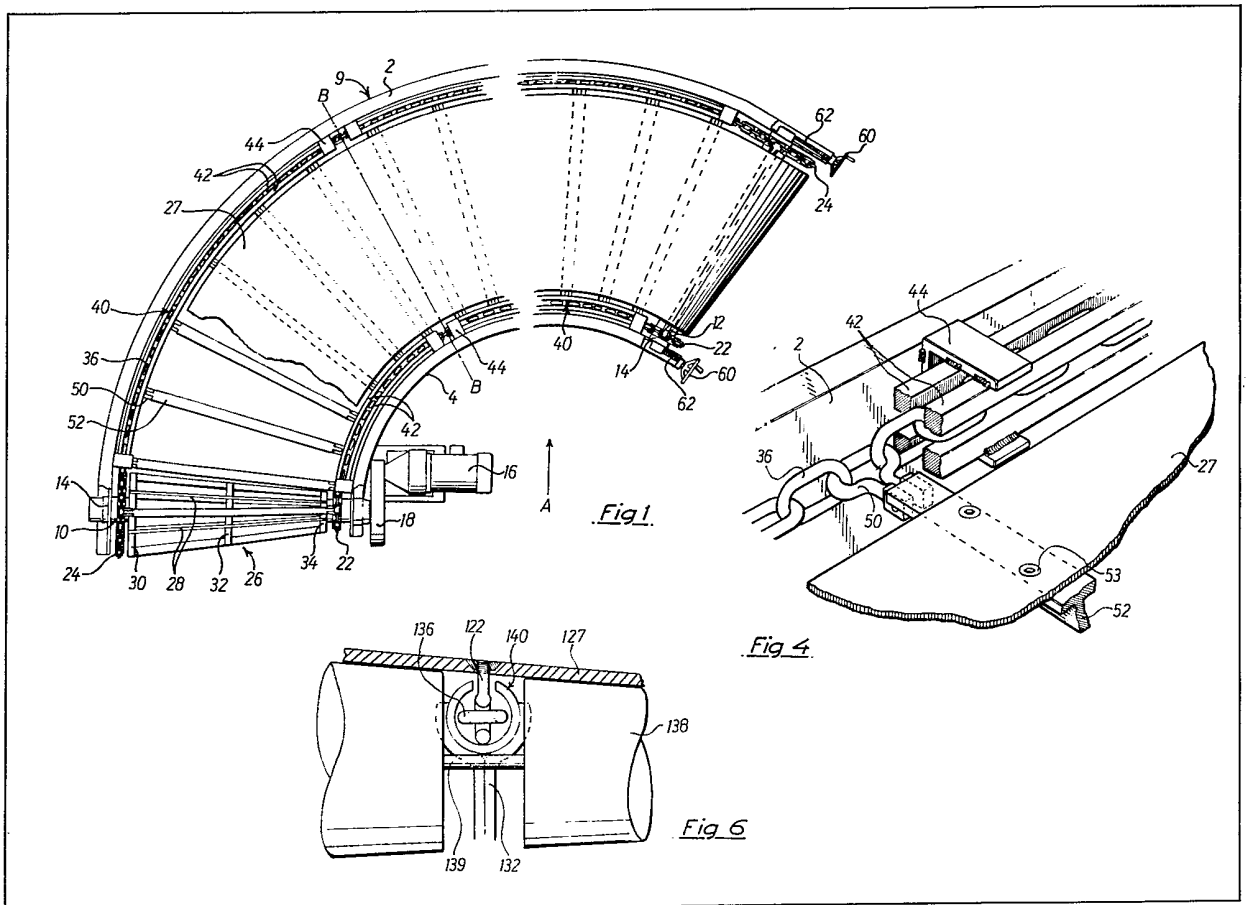
(21) Application No **8035624**
(22) Date of filing **6 Nov 1980**
(30) Priority data
(31) **7938472**
(32) **6 Nov 1979**
(33) **United Kingdom (GB)**
(43) Application published
3 Jun 1981
(51) **INT CL³**
B65G 15/02
(52) Domestic classification
B8A LC R8
(56) Documents cited
GB 2035943A
EP 0011962A
GB 1317515
GB 1237552
GB 1234840
GB 1012253
GB 944489
GB 829807
GB 514508
GB 514478
GB 451161
(58) Field of search
B8A

(71) Applicants
J.H. Fenner & Co. Limited,
Marfleet,
Hull,
North Humberside,
HU9 5RA.
(72) Inventors
Peter Shuttleworth,
Edwin Oldfield.
(74) Agents
Messrs. W.P. Thompson & Co.,
Coopers Building,
Church Street,
Liverpool L1 3AB.

(54) **Conveyor apparatus**

(57) Conveyor apparatus for the handling of fragmentary or particulate material. It is frequently necessary to transfer fluent material from a first conveyor to a second conveyor which is moving in a different direction. Almost invariably this gives rise to spillage of the material due to the sudden change in direction at the point of transfer.

In order to overcome this problem the present invention provides a conveyor apparatus having an endless belt (27, 127) arranged for movement along an arcuate path between a feed end and a discharge end, the belt having secured thereto chain means (36, 38, 136) which are received in chain guide means (40, 140) which serve to locate the chain to prevent the belt moving radially inwardly when tensioned, and the belt being supported on either travelling supports (52) secured to the chains (36, 38) or on stationary supports, e.g. idler rollers (138).



GB 2 063 201 A

The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

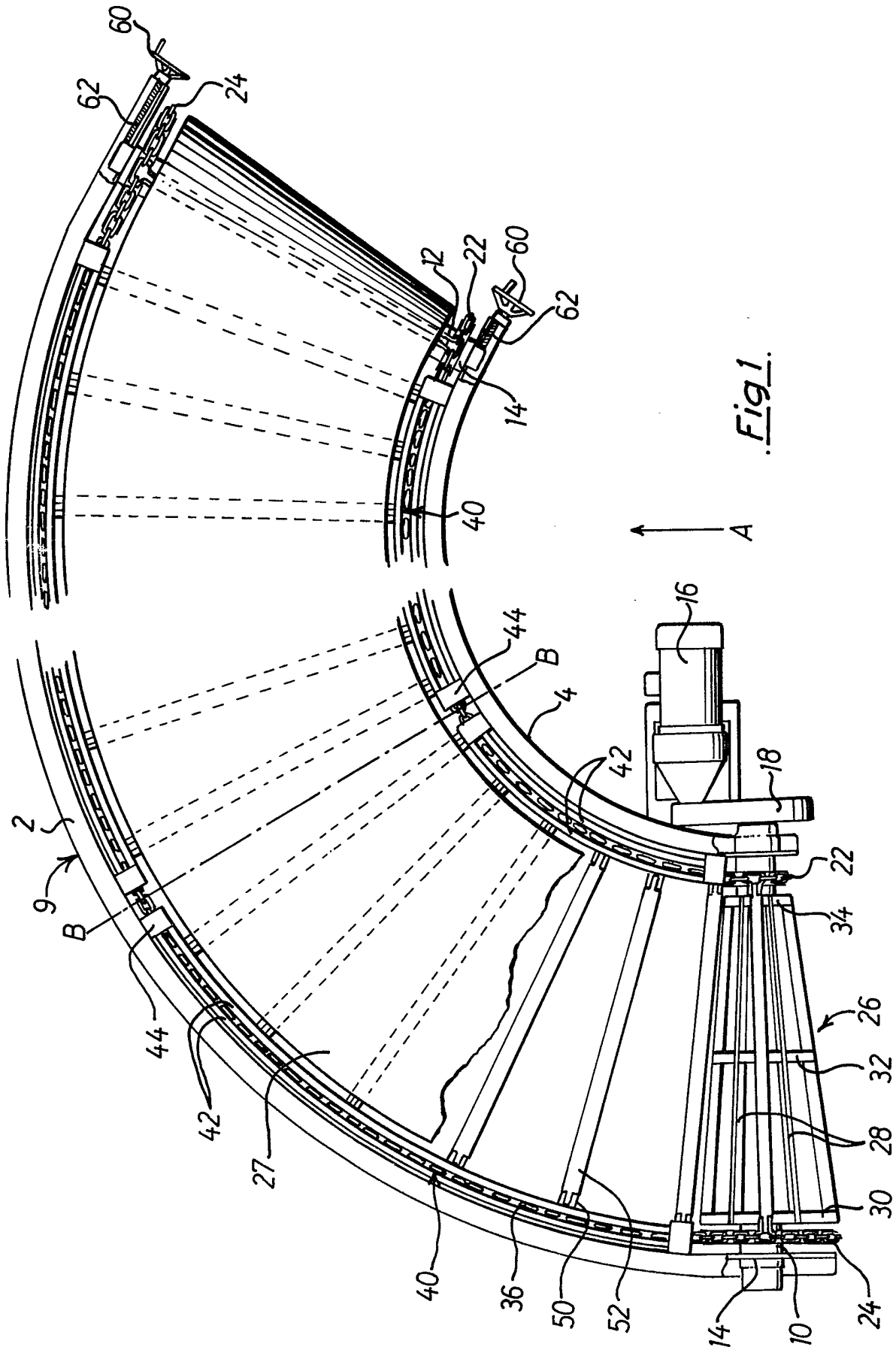

60
62
24
12
22
60
62
14
40
A
16
44
B
4
42
18
2
22
9
34
B
26
44
32
42
28
27
30
40
36
50
52
14
10
24

Fig 1.

2063201

Fig 2.

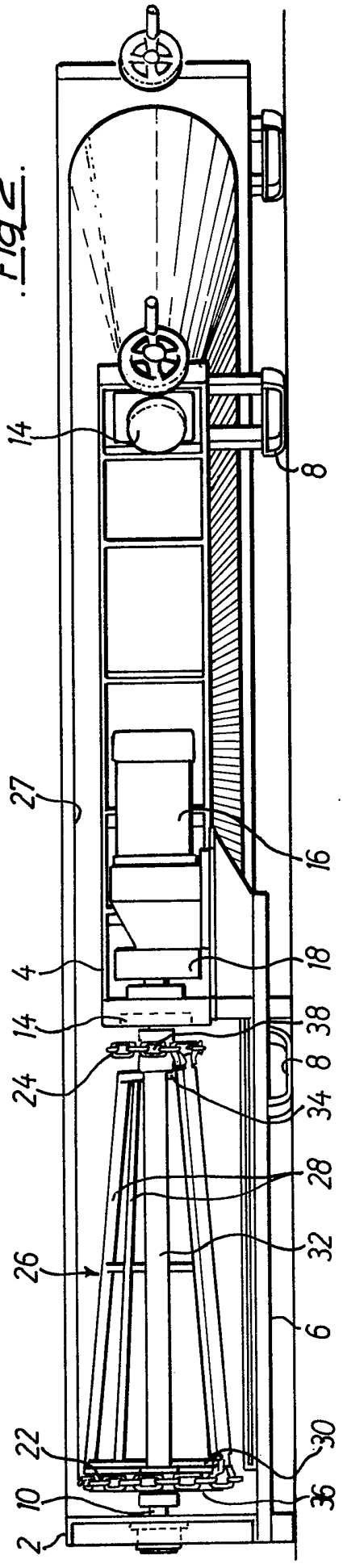
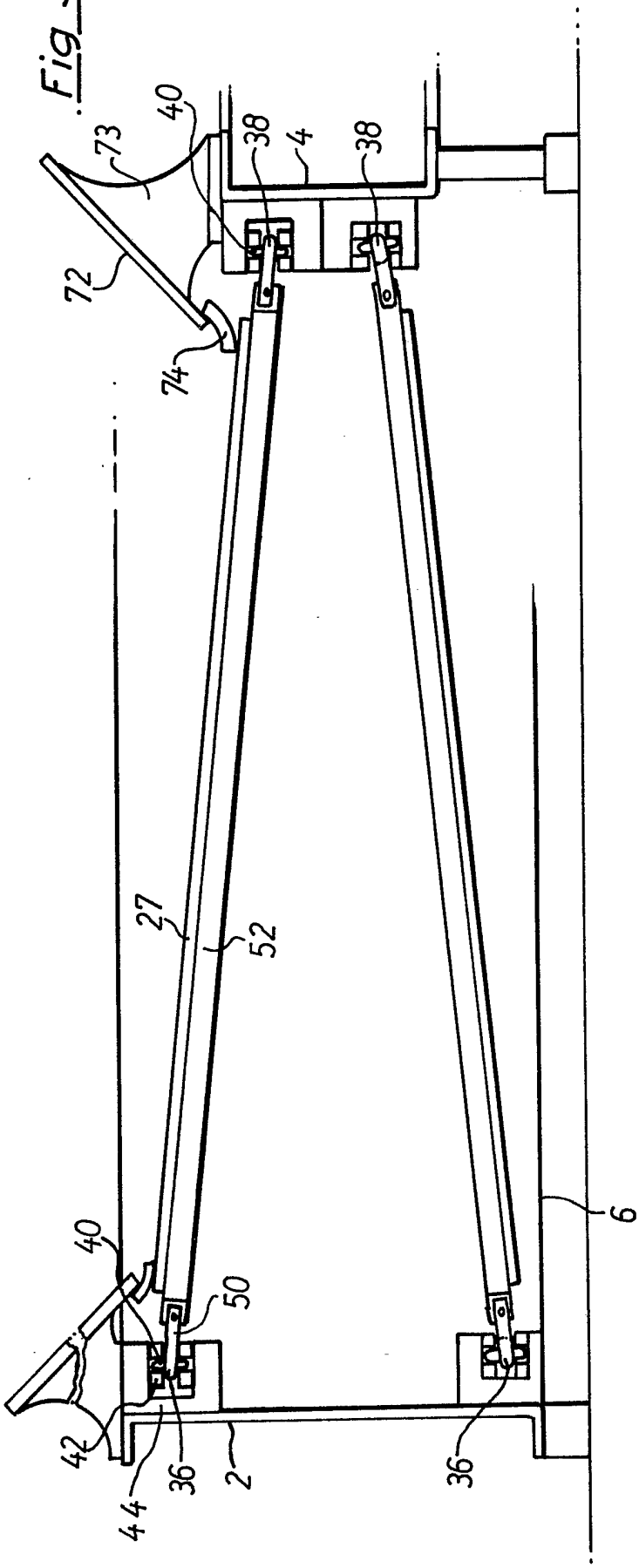


Fig 3.



2063201

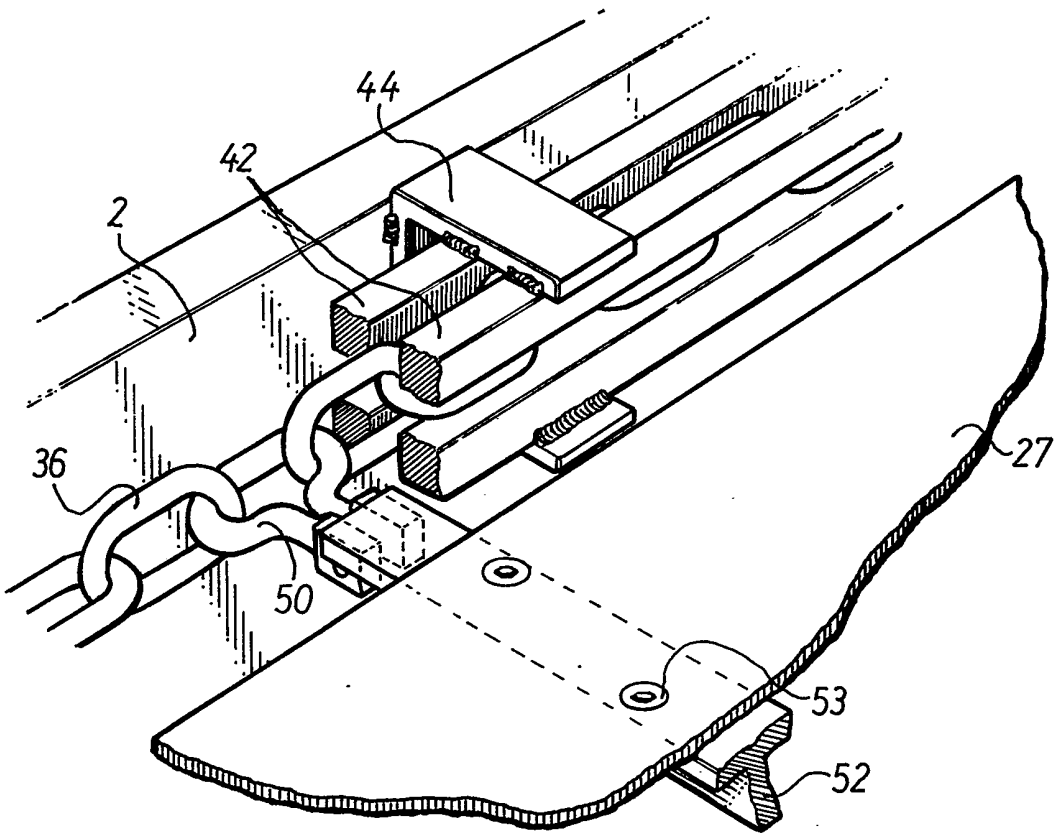


Fig 4.

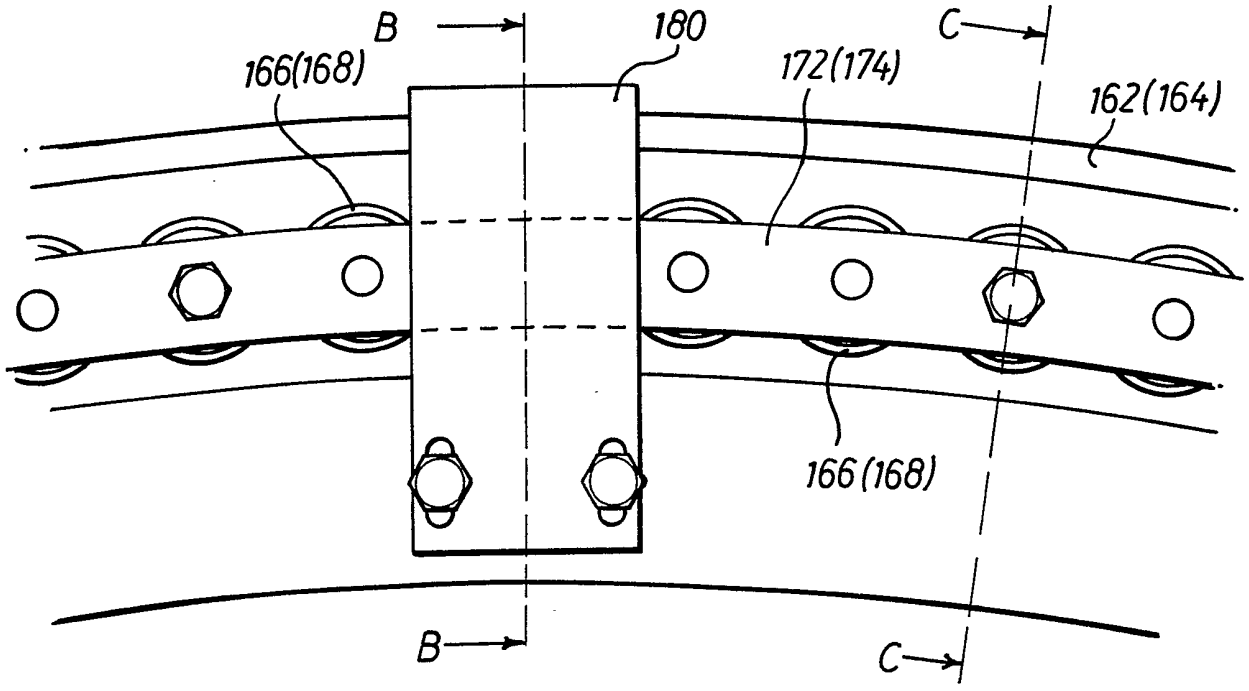


Fig 8.

2063201

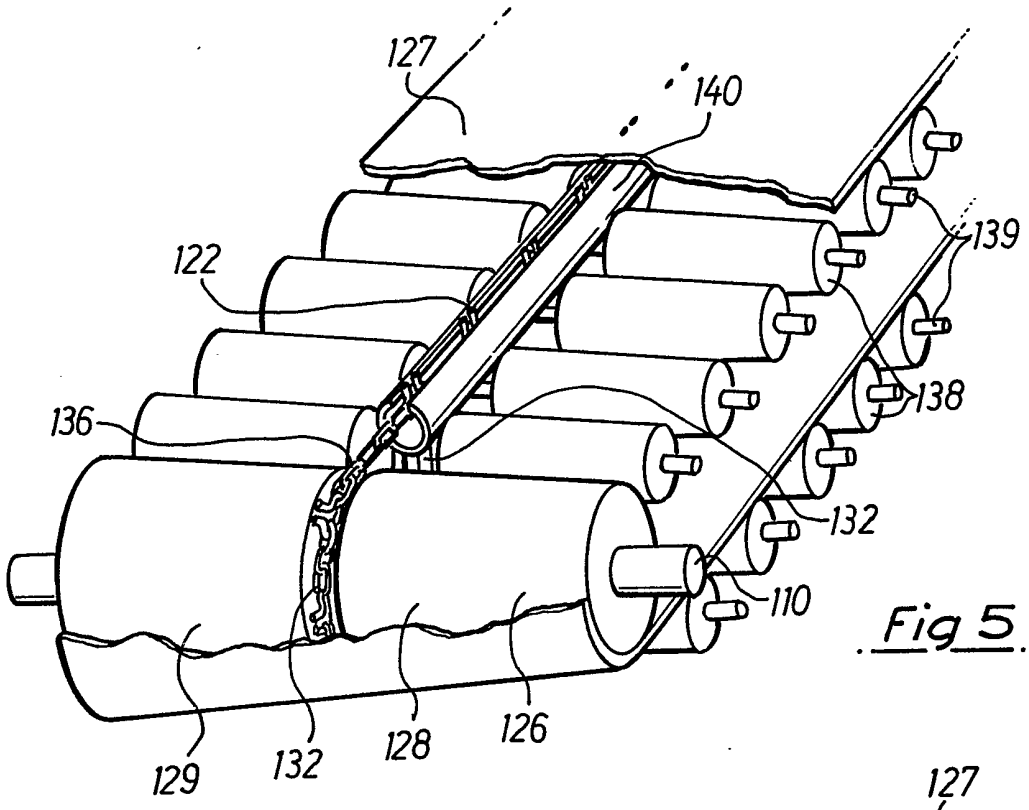


Fig 5.

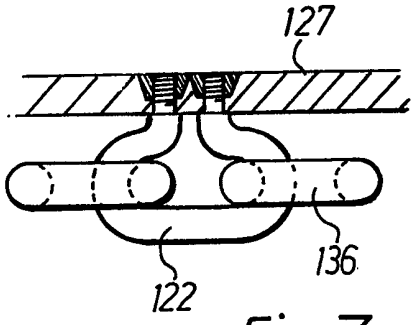


Fig 7.

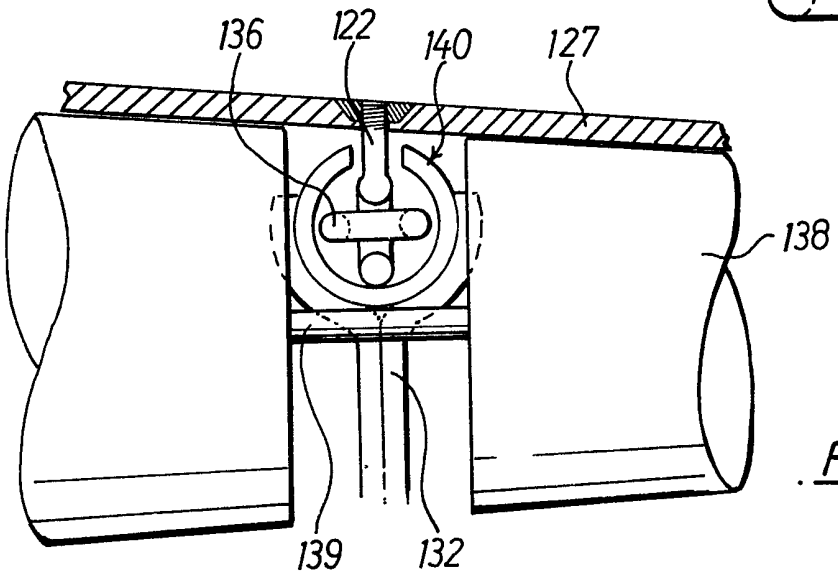


Fig 6.

2063201

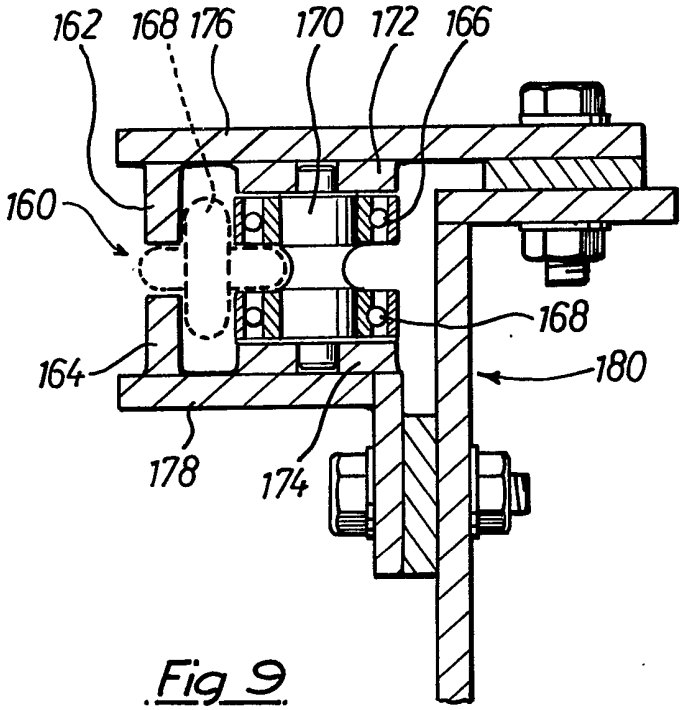


Fig 9

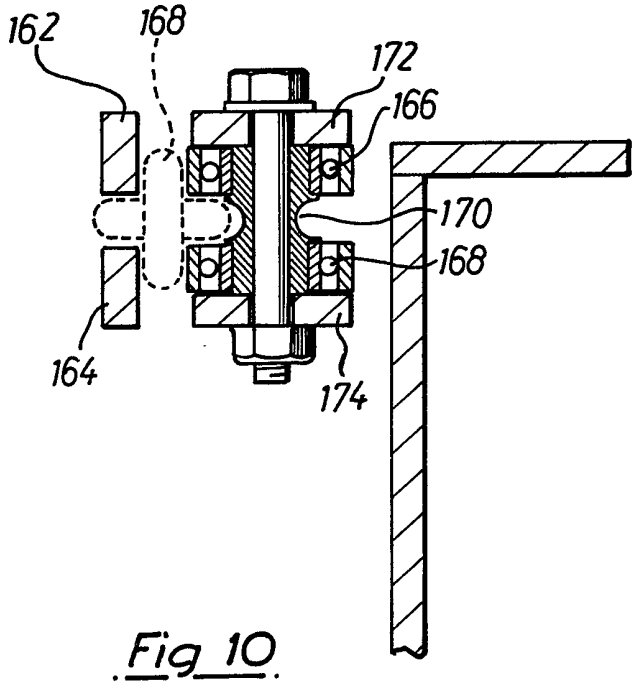


Fig 10

SPECIFICATION

Conveyor apparatus

This invention concerns conveyor apparatus and relates more particularly to such apparatus for the conveying of fragmentary or particulate or other so-called fluent material. Coal, mineral ores and some fertilizers are examples of the fluent materials with which the invention is concerned.

Occasions not infrequently arise when it is desired to transfer a fluent material from a first conveyor to a second conveyor which is moving in a different direction. Almost invariably, this gives rise to spillage of the material due to the change in direction. The invention seeks to overcome this problem by providing conveyor apparatus in which spillage due to a change in direction at the transfer point is avoided.

Conveyor apparatus according to the present invention comprises a frame defining an arcuate path having a feed end and a discharge end, an endless belt arranged for movement along said path and carried by at least one endless chain, a channel member positioned within said frame and constituting chain guide means extending around at least a major portion of said arcuate path, belt pulleys around which the belt passes at the end regions of said path, said pulleys having sprockets for engaging co-operation with the chain means, and transverse or generally radial supports spaced along said path between the said belt pulleys to impart load-carrying capability to said belt.

By virtue of the arcuate configuration of the curved conveyor apparatus provided by the invention, the fluent material is discharged from, for example, a feeder conveyor on to the aligned feed end of the curved conveyor apparatus by which it is carried through the required change of direction and is then transferred on to another conveyor, moving in the new direction, by the aforementioned discharge end, which again is aligned with the latter conveyor. Abrupt changes in direction of the fluent material at the point of discharge from one conveyor to another are thereby avoided, with consequent elimination of contingent factors tending to promote spillage.

Conveniently, the apparatus provided by the invention includes lateral sides or skirt plates carried by the frame and serving laterally to confine the material on the belt. Flexible sealing strips may be arranged to depend from the lower edges of the skirt plates so as to contact the belt and prevent substantially any material from escaping therefrom.

Preferably the channel member for guiding the chain means is fabricated by welding four elongate square section members to a substantially 'U' shaped bracket member so as to define a cruciform channel in which the chain is guided.

In an alternative embodiment the channel member for guiding the chain means is of tubular cross-section with an appropriately directed longitudinal opening to permit a mechanical connection to be established between the chain and the belt.

In a still further embodiment, the channel member comprises a plurality of roller type guides having roller races which take the thrust from the chain thus reducing the frictional drag.

One single, centrally situated chain may be provided to drive the belt or there may be a pair of driving chains and chain guides located in the frame, one each side of the belt.

In a preferred embodiment two laterally spaced driving chains are provided, and the transverse supports take the form of stiffening beams such as angle- or T-pieces secured to and carried along with the belt. Alternatively the transverse supports may be idler rollers which are preferably tapered and are journalled for rotation in bearings mounted on the frame.

The present invention will now be described further by way of example only with reference to the accompanying drawings, in which:-

Figure 1 is a plan view partially cutaway of one embodiment of the invention;

Figure 2 is an end view of Figure 1 looking in the direction of the arrow A;

Figure 3 is a transverse section along the section line B-B of Figure 1 to an enlarged scale;

Figure 4 is a perspective view showing the connection between the belt and the chain;

Figure 5 is a perspective view of one end only of a second embodiment of the invention;

Figure 6 is a detail view showing the support roller, guide channel and locating chain of the second embodiment;

Figure 7 is a detail view of the belt/chain connection of the second embodiment;

Figure 8 is a plan view of an inner channel member incorporating roller races for guiding the chain;

Figure 9 is a cross-sectional view taken on the section line B-B of Figure 8; and

Figure 10 is a cross-sectional view taken on the section C-C of Figure 8.

The conveyor apparatus illustrated in Figures 1 to 4 has a pair of arcuate members 2, 4 interconnected by cross beams 6, and support members 8 (shown in Figure 2) which together constitute a frame 9. A pair of shafts 10,12 positioned at end regions of the frame are journalled for rotation in bearings 14 secured to the frame. An arcuate path is defined between the end regions of the frame, which arcuate path may typically be a quadrant of a circle. The frame may conveniently be built up in sections and Figure 1 is broken away to illustrate that the length of the arc is variable.

The shafts 10,12 both carry two chain sprocket wheels 22,24 at the radial innermost and outermost edge which sprockets are located axially on and keyed to the respective shafts. Each shaft 10, 12 also carries a spider 26 which comprises three disc members 30,32,34 of different diameters and a plurality of connecting rods 28 which are secured to the discs, preferably by welding. The resulting spider has a tapered configuration with the larger diameter adjacent to the outermost periphery of the arcuate frame.

The spiders 26 support an endless belt 27 which may be assembled from a number of separate pieces shaped to conform the belt to the arcuate path which

it has to describe, but which may be specially woven and/or moulded in the required shape in a single piece.

The shaft 10 has a drive pulley 18 secured thereto and is driven through a power transmission belt and reduction gearing by an electric motor 16. The motor is mounted on a sub-frame connected to the frame of the conveyor apparatus. The chain sprocket wheels 22,24 driven by the motor 16 engage with a pair of endless chains 36,38 which are guided in channel members 40 positioned within the frame. Each channel member 40 which defines an arcuate path is fabricated from four elongate square section members 42 (shown in Figure 3 and Figure 4) which are secured to bracket members 44, preferably by welding. These bracket members 44 are spaced at intervals along the arcuate path and are attached to the frame of the conveyor apparatus. A cruciform channel is defined in which the pair of endless chains are guided. Channel members are provided to guide both the upper chain run and the lower chain run. The channel member locates the chain to ensure that it conforms to the required arcuate path and prevents it from straightening out under tension. Alternatively elongate members of round cross-section may be used, in place of the square section member 42, to construct the required channel for guiding the chain.

The chains 36,38 have connecting links 50 (shown more clearly in Figure 4) in the form of D links, located at predetermined intervals along the endless chains. Because of the arcuate path, the innermost chain 38 is shorter than the chain 36 and accordingly the connecting links are closer together on the innermost chain. Corresponding D links 50 on each chain connect with a common connecting member or "flight bar" 52. Any other convenient connection other than a D link may be used.

The aforementioned flight bars 52 are attached to the endless belt 27, by bolts 53 and nuts 55 as illustrated more clearly in Figure 4. Thus as the chains are driven by the chain sprocket wheels the belt is driven by virtue of its connection to the flight bars 52. Alternatively the belt may be connected directly to the chains. As illustrated in this preferred embodiment the flight bars act as transverse supports, for the belting 27. Thus the chains both guide the belting, drive the belting and take the load carried by the belting.

The channel members 40 are so arranged that the connecting links or flight bars 52 pass through a longitudinal opening in the channel member.

The shaft 12 carrying the chain sprocket wheels 22,24 and the spider 26 is not driven and the bearings 14 in which the shaft is journalled for rotation are resiliently displaceable in the frame by means of tension screws. These enable the proper degree of tension to be set up in the upper run of the belt and also facilitate adjustment of the tension in the chains 36,38. A hand wheel 60 operating in conjunction with a screwed rod 62 is provided for this purpose. Additionally a spring (not shown) is included to maintain the tension setting so that only periodic adjustment by use of the hand wheel is necessary.

Secured to the frame by brackets 73 towards each lateral edge of the belt (and shown only in Figure 3) is an arcuate skirt plate 72 which in conjunction with an elongate sealing strip 74 depending from its lower edge and bearing against the belt surface, serves to confine material carried on the belt to the requisite arcuate path and prevents it from escaping from the belt. It will be appreciated that the conveyed material is introduced on to the illustrated apparatus at one end thereof, preferably adjacent the shaft 12 and is carried through a gradual change of direction to the opposite end, where it is delivered to a discharge conveyor (not shown).

If desired, a scraper or doctor knife (not illustrated) may be mounted in the frame adjacent the lower run of the belt 27, to remove any material remaining on the belt on the return run.

In the embodiment illustrated in Figures 1 to 3 the axes of the shafts 10,12 are horizontal, and in the same plane. The plane of the belt is inclined with respect to said shaft axis. Alternatively the belt plane may be horizontal and the shaft axes inclined accordingly.

In a further embodiment illustrated in Figure 5 which illustrates only one end of the conveyor apparatus, the shafts 110,112 corresponding to the shafts 10,12 in Figures 1 to 3, each carry a single chain sprocket wheel 132 in a central radial position which engages with a single endless chain 136. Each shaft carries a tapered cylindrical roller 126 which as illustrated is in two parts 129, 128 and which supports the belting in the end region. The belt is tensioned between the two rollers 126 by a tensioning device similar to that described for the previous embodiment. The shaft 110 is driven by an electric motor and the two roller parts 129,128 are keyed to the shaft and are consequently driven by the motor. Rotary drive from any other convenient conventional source may be applied to the roller 126 through the drive shaft 110. The friction between the belt 127 and the rollers, achieved by virtue of the belt tension transmits the drive to the belt. The central sprocket is also keyed to the shaft 110 and attachment links 122 spaced at intervals and forming part of the chain secure the belt 127 to the chain 136.

By virtue of the connection of the belt to the chain and the keyed connection of the chain sprocket to the shaft 10,110, the chain serves as a partial driving means for the belting.

The chain 136 is an endless chain and is constrained to follow the arcuate path defined by the frame by means of the chain guide generally designated 140, the latter being mounted in the frame by way of brackets 132 carried by frame cross members. In the alternative embodiment illustrated in Figure 5, 6 and 7, the chain guide 140 is of hollow, tubular shape and is slotted to allow passage of the attachment links 122. Chain guide means are provided for both the upper chain run and for the lower chain run.

In an alternative embodiment the two tapered rollers 126 are provided with circularly spaced and centrally situated sprocket teeth appropriate to engage and drive the chain links rather than having separate parts 129,128 to the rollers 126. In a still

further embodiment the sprocket 132 is not driven by the shaft, although the chain is attached to the belt in a similar manner to that described above. Thus the chain does not act as a partial drive but merely as a location means.

In the alternative embodiment having a central chain the transverse, generally radial support for the belt 127 is provided intermediate the driving and return rollers 126 by means of spaced idler rollers 138 mounted in the frame on shafts 139 and supporting both of the belt runs. All of the rollers, including the rollers 126 are tapered so as to accommodate for the differential speed of the belt between the inner and outer periphery of the arcuate path. Idler rollers would likewise be provided to support the lower belt run. However, in some situations it is possible to replace the tapered rollers 138 each by a pair of laterally spaced, simple cylindrical rollers individually journalled, in which case the shorter length of the roller would give rise to less scrubbing between the rollers and the belting.

In an alternative embodiment (not illustrated) utilising a pair of chains guided in channel members located adjacent to the inner and outer periphery of the belt, the endless belting 27 is secured directly to the pair of chains 37, 38 and the transverse supports in the form of flight bars 52 in the previously described embodiment of Figures 1 to 4 are replaced by idler rollers. These idler rollers are journalled for rotation on shafts mounted on the frame. The spiders 26 of the previous embodiment are replaced by tapered cylindrical rollers carried by the shafts 10,12. The tapered cylindrical rollers support the endless belt in the end regions. The belt drive may originate from the tapered roller mounted on the shaft 10 or from the chains 36,38 or a combination of both.

The idler rollers may be continuous tapered rollers extending the full width of the transverse section of the belting or may comprise a plurality of individual rollers. In the latter case either the diameter of the rollers may be different or they may be of the same diameter if they are each individually journalled for rotation on a suitable positioned shaft.

The chain serves to locate the belt to prevent the belt moving away from or towards the centre of curvature of the arcuate path, i.e. creeping up or down the tapered rollers. The drive to the endless belting may be by virtue of its contact with the tapered rollers between which the belt is tensioned and one of which may be driven by a motor in a similar manner to that described with reference to the first embodiment. Thus the chain sprocket wheel may be free to rotate or alternatively the chain wheel or wheels also may be driven. A resiliently displaceable mounting would be provided to facilitate adjustment of the belt tension.

Referring now to Figures 8 to 10 there is illustrated a roller type chain guide. It will be appreciated that a chain running in a guide generates a frictional drag and this is especially true on a curved conveyor because as the conveyor is tensioned the belt has a tendency to migrate toward the centre of the curve. In order to reduce this frictional drag and any heating caused thereby the chain runs on roller races which take the thrust.

An inner chain guide 160 has an arcuate cruciform channel defined on the radially outer side by a pair of vertically spaced apart flange members 162, 164 and on the radially inner side by a plurality of circumferentially spaced pairs of vertically spaced apart rolling element bearings 166,168. Each pair of rolling element bearings is carried by a roller bobbin 170 the opposite ends of which are received in bores in respective arcuate frame members 172,174. Circumferentially spaced bracket members 180 having radially extending upper and lower arms 176,178 carry respectively the upper flange and frame members and the lower flange and frame members.

An inner guide chain 182 is received within the cruciform channel with the radially inner portion of the horizontally disposed links being disposed between the rolling element bearings 166,168 and with the vertically disposed links in engagement with the outer circumference of the rolling element bearings 166,168. The chain 182 has arms (not shown) which depend therefrom and which project through the opening formed between the two flange members 162, 164. Each arm connects with the radially inner end of a flight bar, the other end of which bar is connected to the outer chain links, whereby any inward thrust from the outward chain is also taken by the inner chain rollers.

The outer chain guide may incorporate rolling element bearings to take directly the inwardly directed thrust at the outer chain.

It will be appreciated that the features of the various alternative embodiments may be varied and features of one embodiment combined with features of another embodiment. Thus the tubular guide means may be used with the embodiment of Figures 1 to 4. Alternatively two endless chains located at the inner and outer periphery of the belt, but not driven, may be used in conjunction with a pair of tapered cylindrical rollers at the end regions at least one of which imparts drive to the belt. The belt may be supported between the rollers on tapered idler rollers.

Alternatively the chains may be driven and be used to drive the belting.

Conveyor apparatus according to the present invention comprises a frame defining an arcuate path having a feed end and a discharge end, an endless belt arranged for movement along said path and carried by a single centrally disposed chain which is received within chain guide means extending around at least a major portion of said arcuate path, belt pulleys around which the belt passes at the end regions of said path, said pulleys having sprockets for engaging co-operation with said chain, and generally radial supports spaced along said path to support said belt.

CLAIMS

1. Conveyor apparatus comprising a frame defining an arcuate path having a feed end and a discharge end, an endless belt arranged for movement along said path and carried by a pair of laterally spaced endless chains, a respective channel

member positioned within said frame and constituting chain guide means extending around at least a major portion of said arcuate path, belt pulleys around which the belt passes at the end regions of said path, said pulleys having sprockets for engaging co-operation with the chain means, and transverse or generally radial supports spaced along said path between the said belt pulleys to impart load-carrying capability to said felt.

2. Apparatus as claimed in claim 1 in which the laterally spaced chains which are secured respectively to the belt at radially inner and radially outer locations.

3. Apparatus as claimed in any of claims 1 or 2 in which the supports for the belt comprise idler rollers journalled in bearings mounted on the frame.

4. Apparatus as claimed in claim 1 or 2 in which the supports for the belt comprise stiffening beams connected between the inner and outer laterally spaced chains and secured to the belt.

5. Apparatus as claimed in any preceding claim, in which each of the chain guide means comprises four arcuate flange members carried by bracket means depending from the frame, which flanges define a cruciform channel in which the chain is guided.

6. Apparatus as claimed in any of claims 1 to 4 in which the chain guide means is an arcuate tube having an opening in the wall thereof through which connection links depending from the chain project.

7. Apparatus as claimed in any preceding claim in which the one or both guide means incorporate rolling elements which receive the thrust from the chain.

8. Apparatus as claimed in claim 7 in which the rolling elements comprise a plurality of pairs of rolling bearings, each pair of bearings being carried by a respective spindle mounted on the frame, the bearing pairs being spaced apart on the spindle such that a portion of the chain is received therebetween for guiding purposes and the outer race of the bearings being engaged by the chain links.

9. Apparatus as claimed in any preceding claim in which the belt pulleys in the form of spiders are tapered with decreasing diameter in a direction radially inwardly and the drive to the belt is by way of the chains and sprockets.

10. Apparatus as claimed in any preceding claim in which lateral side skirts are carried by the frame to confine material to the belt and sealing strips depend from the lower edge of the skirt to contact the belt.

11. Conveyor apparatus constructed and adapted to operate substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

Printed for Her Majesty's Stationery Office by Croydon Printing Company Limited, Croydon, Surrey, 1981.
Published by The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.