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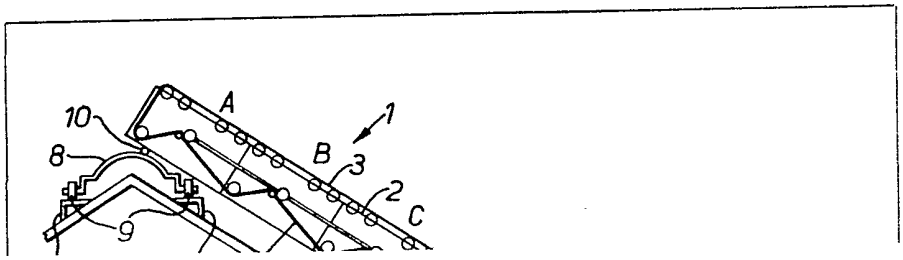
(54) **Conveyor belt system**

(57) A conveyor belt system for elevating materials on a building site, for example, consists of a number of bolt-together modules (A–H) supporting corresponding lengths of belt. When assembled the modules form a rigid structure. Various different types of modules are disclosed including straight sections (B, C, E and F), hinged sections (D, G) for altering the angle of elevation of the belt, a head section (A) where materials can be unloaded and a load station (H) where the materials can be loaded onto the belt and containing a drive motor. The system may be supported at intervals by props (11–13) and the head section may be supported on a trolley (8). The belt 3 may either run continuously around the entire system or individual lengths may run around the individual modules.



ERRATUM

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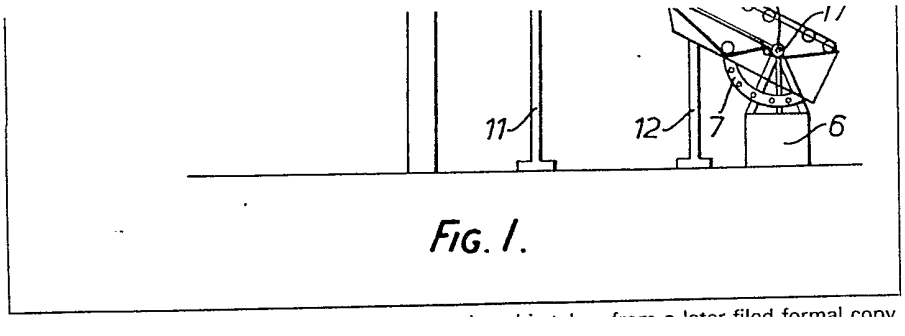

FIG. 1.

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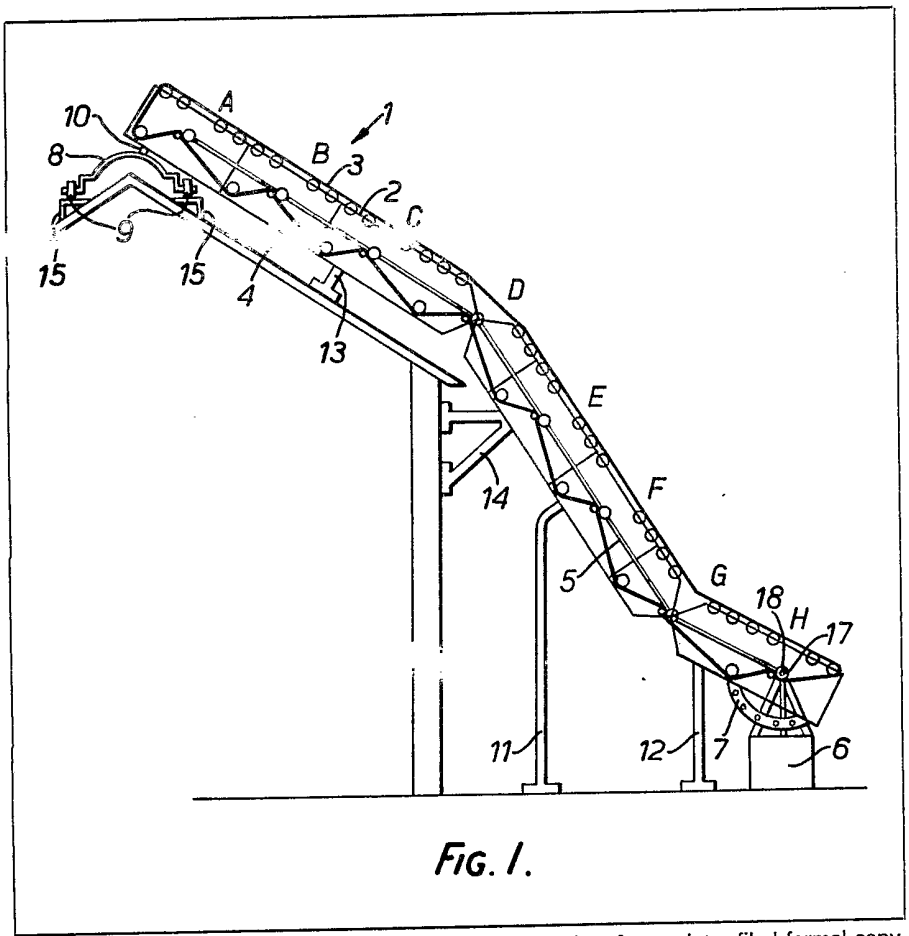

FIG. 1.

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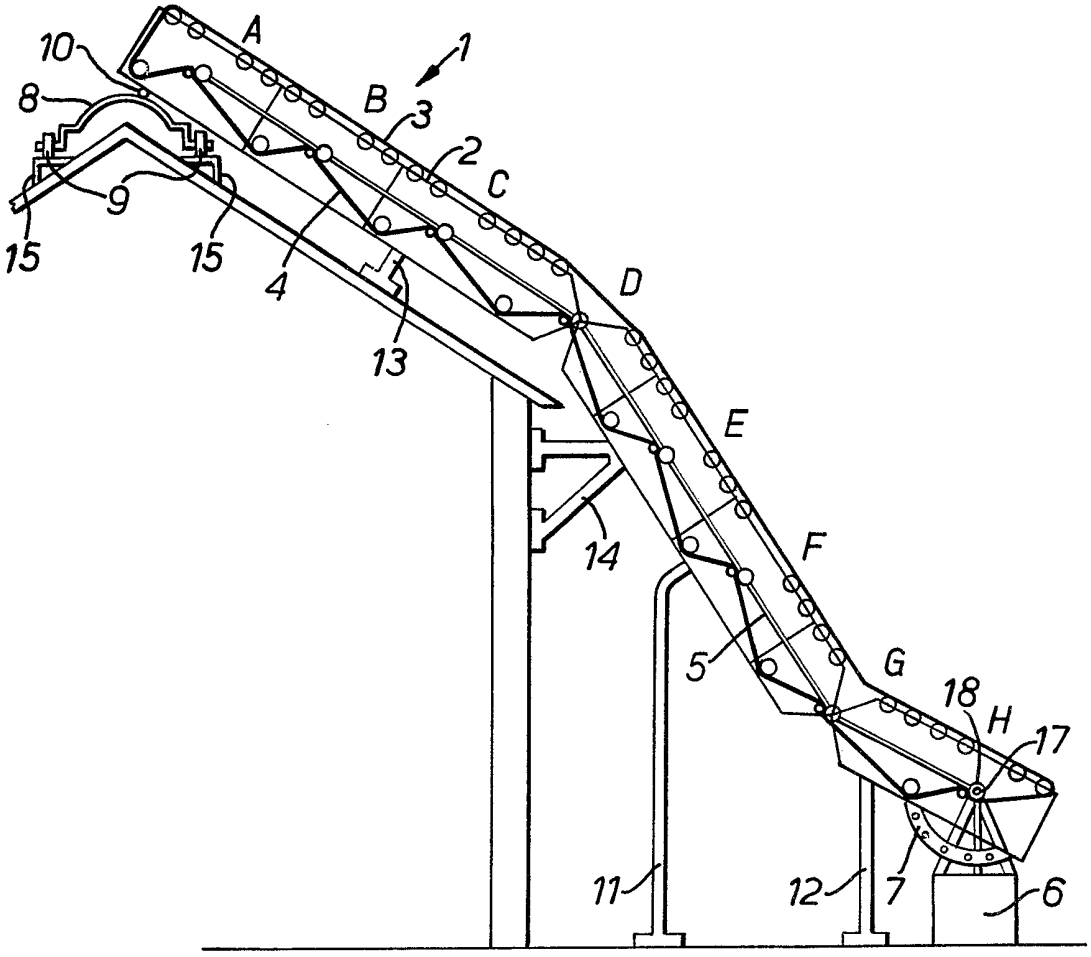

FIG. 1.

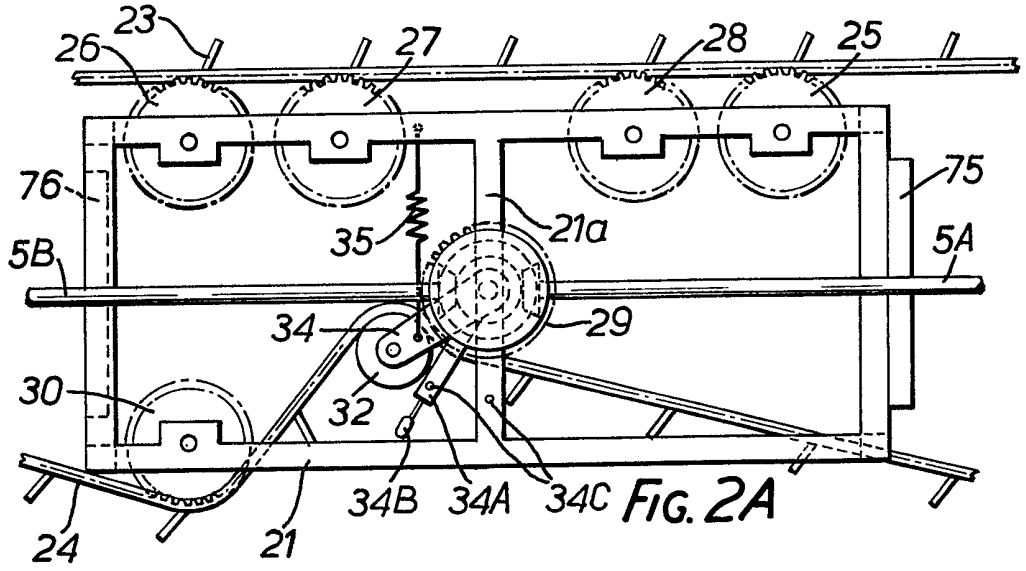

FIG. 2A

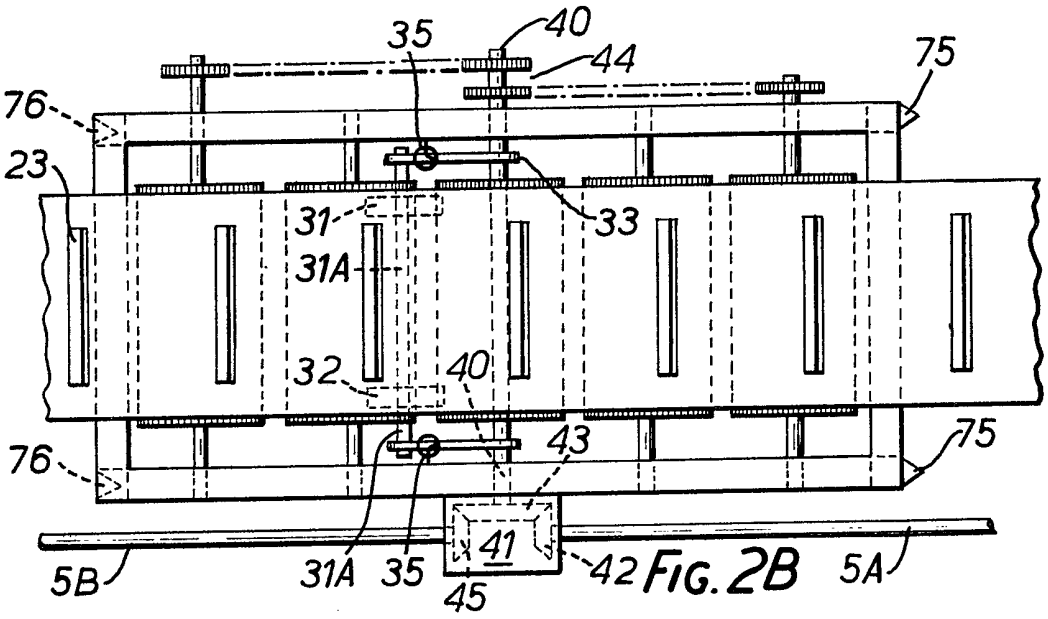

FIG. 2B

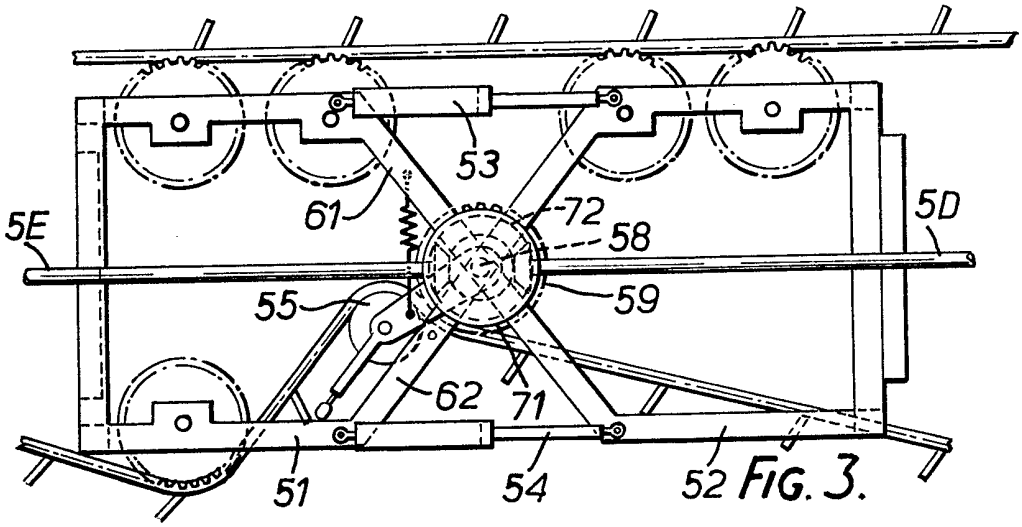

FIG. 3.

SPECIFICATION

Conveyor belt system

This invention relates to a conveyor belt system and in particular a portable conveyor belt system suitable for use in the building industry.

In most building operations, particularly general housing, the raising of heavy building materials up through multiple floors is both extremely labour intensive and inadequtely catered for by labour saving devices, for example, hoists and cranes. Generally in the industry today, hoists are inflexible and for many smaller building operations, too expensive or not able to cope with the loads involved. Cranes are invariably too expensive and too complex to erect and operate.

It is an object of the invention to provide a conveyor belt system in which these problems are, at least to some extent, alleviated.

According to the present invention there is provided a conveyor belt system including a plurality of modules each having a frame, means mounted on the frame for guiding and supporting a conveyor belt along a forward path, means mounted on the frame for guiding the conveyor belt along a return path, the frame being arranged to be connectable to the frame of an adjoining module to form a substantially rigid beam structure. Each module may be of the same length and may have means for driving the belt. The drive may be imparted to the belt by one or more rollers which also support and guide the belt. A tensioning device may be provided in the return path to tension the belt. One module may include a motor and drive may be coupled to all the modules by drive shafts passing from one module to the next. The motor may include a clutch which may be electrically operated and operable by remote control from at least one of the other modules. Each module may include two lengths of conveyor belt which can be linked together or linked to the other lengths to form a long belt passing over and back along the connected modules. The frame of at least one module may consist of two parts pivotable relative to each other about an axis across the module and the module may have a device to enable the two parts to be locked at any desired angle within a given range. The two parts may be pivotable at the centre and the drive means for each module may include a gear box for driving a shaft at the centre, so that the length of shaft is the same for applying the drive to one module and passing the drive on to the next module irrespective of the angle through which the module may be pivoted.

A conveyor belt system embodying the present invention will now be described by way of example only, making reference to the accompany drawings in which

Figure 1 shows the system erected on a partially completed building;

Figure 2a shows an elevation of module B of the system of Fig. 1;

Figure 2b shows a plan view of the module of Fig. 1;

Figure 3 shows an elevation of a hinged module such as module D.

Referring to Fig. 1 of the accompanying drawings, a conveyor belt system 1 consists of eight modules A to H of four different types. These are a head station (module A), straight sections (modules B, C, E and F), hinged sections (modules D and G) and load station (module H). Each module is typically 6′ to 9′ long and weighing up to 60lbs and can be linked to any other module to form the desired configuration.

Each module consists essentially of a frame 2 supporting two lengths of conveyor belt 3 and 4. When the module is in position it is clamped to each adjacent module to form a rigid beam. The lengths of belt link with corresponding lengths of belt of the adjoining modules so as to form a single continuous belt passing around the whole conveyor belt system 1. This linking may be by means of spring-loaded, gated hook and eye connections or may alternatively be formed of interleaved rings with a transverse rod passing through the rings. When the conveyor belt system is dismantled, the top length of belt 3 may be linked to the lower length of belt 4 to form a continuous length of belt around the individual module. Also, where only a shallow gradient is required, the conveyor belt system may be operated with the belt for each module passing only around the individual module. In this case. the load could be transferred from one section to the next via a metal comb which interleaves with longitudinal grooves on the belt.

Power to the modules of the conveyor belt system is transmitted via a system of drive shafts 5 from a motor in a base unit 6. This base unit is associated with the load station module H. The motor has an electrically operated clutch and gear box. Emergency stop buttons are situated throughout the system. These are connected to the clutch to disconnect the drive when actuated. A set of controls for stop, start and reverse is provided at the head station module A. These controls and the stop buttons are connected to the motor by cables. A length of cable with a connector at each end is provided with each module.

The straight section, for example module B, is illustrated in greater detail in Figs. 2. It consists of a duralumin tubular type frame 21, typically 6′ to 9′ long, 2′ wide and 1′ 6″ deep. A conveyor belt 22, typically 22″ wide is provided of a plastics material, rubber or canvas and which is semi-rigid in the transverse direction but flexible along its length. At

intervals of typically 2' are raised plastic or aluminium plates 23 which are 6" high. Each of these plates 23 does not extend to the outer margins of the belt. It is anticipated that the conveyor will carry loads at up to 75 degrees from the horizontal, and these plates are to hold loads of tiles, bricks, cement, etc. Shallower raised plates may be used where the system is to be used for shallow gradients. Alternatively, the plates could be replaced by rings or hooks and the load suspended from them.

The belt 22 is transversely grooved on the underside and is propelled by two castellated drive rollers 25, 26 and supported by two additional rollers 27, 28. The belt may be restrained in the vertical direction by periodically disposed brackets that overlap the margins of the belt by about 1". The drive rollers have ring-pull clutches to enable them to be disconnected from the drive for easing the assembly and dismantling of the system.

On the underside of the module the returning belt 24 is guided as it enters the module by a castellated roller 30. It then feeds through a tensioning device consisting of a castellated roller 29 on the grooved side of the belt and a pair of wheels 31, 32 on the other side. The roller 29 is supported freely on an axle 40 which is also the main drive shaft for the whole module, as is described below. This drive shaft is supported between two vertical struts 21a of the frame 21. The wheels 31, 32 are mounted on an axle 31A between two cantilever arms 33, 34 which are pivoted on the shaft of the roller 29. The cantilever arms 33, 34 are urged upwards by springs 35 to take up any slack and to tension the belt by increasing its effective path length. Attached to and integral with the cantilever arms 33, 34 is a lever 34A with a handle 34B. The lever 34A enables the tensioning device to be released manually. This may be necessary during assembly and dismantling of the conveyor belt system. The tensioning device can be locked in the released position by the insertion of pin through holes 34C which are aligned.

Power is transmitted to the straight section module of Fig. 2 by a drive shaft 5A. This couples with the central drive shaft 40 in a gear box 41. The shaft 5A terminates in a bevel gear 42. This bevel gear 42 meshes with a crown gear 43 attached to the central drive shaft 40. The other end of the drive shaft 490 carries a pair of sprockets 44 forming part of a chain drive to the two drive rollers 25 and 26. The crown wheel also meshes with another bevel gear 45 on the end of a drive shaft 5B. This drive shaft 5B passes power on to the next module in the conveyor belt system. The shafts 5A and 5B are detachable from the bevel gears for ease of dismantling and reassembly.

Power may alternatively be transmitted throughout the conveyor belt system by means of two cogs and a chain per module (the chain would be similar to a motorcycle chain and a standard part). The first cog would be integral with the first drive roller. The second cog would be larger and protrude from the front of the box section frame 21 so that it married up with the first cog of the next section. These cogs would have isosceles teeth with fairly acute angles to facilitate the marriage of the cogs. A disadvantage of this arrangement is that dust and dirt would soon damage the chains and cogs.

Another way of transmitting power through the system may be by using shafts and universal joints.

Referring back to Fig, 1 module H, the load station is of essentially similar construction to the straight section except that it has a base 6 which houses a motor. The motor may typically be 10HP and powered by petrol, diesel, electricity, liquid petroleum gas or from a pneumatic compressor. It has an automatic electrically actuated clutch and a gearbox with a reverse gear. Also it has an overload cutout.

The frame of the module is pivotally mounted on the axle 17 of a central roller (not shown). This enables the frame to be supported at any angle up to about 30° from the horizontal. Once set at a desired angle, the frame may be clamped in position by means of a clamp on the base 6 acting on an arcuate bar 7 carried by the frame.

The load station has fixings to enable other modules to be attached to either end.

The gearbox 18 on the side of the load station trasmits drive to the load station itself and to the rest of the conveyor belt system. The gearbox has a cover with a sliding section to prevent entry of grit and dust as will be described in more detail in respect of the hinged section module of Fig. 3.

Referring to Fig. 3, the hinged module is essentially similar to the straight module except that the frame consists of two parts 51 and 52 and the central roller 59 is mounted on an axle 58 supported at the junction of two diagonal struts 61, 62 on each part 51, 52 of the frame.

The parts 51, 52 of the frame 21 are pivotable with respect to each other about the axle 58. "Acrow" type telescopic clamps 53, 54 are provided so that the module may be set and held at any angle to about 30° from a straight line.

In order to allow free anglular movement of one drive shaft with respect to another, without at the same time allowing grit to enter the gearbox. The gearbox cover 71 has a slideable section 72 which is carried by the input shaft 5D and maintains a seal against a fixed section 73 of the cover 71 throughout the working angular range of the module.

Referring again to Fig. 1, the head station (module A) is the module from which the

conveyor is unloaded. This module has a device to stop the conveyor if the load approaches to within 2′ of the end of the conveyor. When the load has been removed, the conveyor automatically restarts. This device may be an arm actuating a microswitch or a light beam and photo-cell combination or a pressure sensitive pad under the belt.

This device may be coupled electrically to the electrically operated clutch on the motor in the load station module H. At the head station module there may be a stop/start switch, also operating the clutch, and a switch connected to operate the gearbox at the motor to control the speed of the movement of the belt or its direction.

The head station module A in Fig. 1 is shown resting on a generally upturned U-shaped frame 8 mounted on wheels 9. This frame 8 will generally be as wide as the conveyor belt system which it supports on a pivot joint 10. The wheels of the frame 8 may either run directly on tiles of the roof or may run on rails 15 supported on the tiles or roof timbers.

When erected, each section of the conveyor belt system has a pair of vertical projections of triangular cross section which engage with a corresponding pair of vertical grooves on an adjacent module. This prevents lateral movement of the modules with respect to each other. Over centre clamps are provided to prevent longitudinal movement.

Alternatively, the modules could be aligned by the telescopic mating of a tubular member on the end of one module with another tubular member on the end of the adjacent module and held together by a cross pin passed through the tubular members. This arrangement, however, suffers from the disadvantage that, with constant use, the tubular members are liable to lock together.

In addition to the modules, the conveyor belt system includes a number of accessories. One of these has already been described in connection with the head section A and is the wheeled U-shaped frame 8.

Other accessories include a variety of support members. These include upright supports such as those designated 11, 12 and 13 in Fig. 1 and a wall support such as that designated 14 in Fig. 1. The upright supports are duralumin tubes and may be from 6″ to 20′ tall and have a telescopically adjustable section.

The wall support consists of a pair of duralumin tubes held together at an acute angle.

Both the upright supports and the wall supports may be used in pairs, one on each side of the conveyor belt system, and tied together by cross members. In the case of the wall supports, the resulting structure resembles a trestle.

The support members may be further linked together and triangulated by cross members to give the system additional rigidity. If the supports are so linked, the conveyor belt system can easily be moved bodily in its fully assembled state. Wheels may be provided to facilitate this further.

To improve stability further outriggers or guys may be provided.

Another useful accessory is a bucket, shaped so as to fit and clip to the raised plates 23 (Fig. 2) on the conveyor belt. This enables non-solid loads such as cement, screed, plaster, water, etc. to be carried. The bucket could be made the width of the raised plates 23 and sufficiently shallow to enable it to return to the load station on the returning belt. Alternatively, a taller bucket could be used but this would need to be removed at the head station A. Typically such a bucket would weigh about 40lbs when full.

To erect the conveyor belt system, the load station module H needs to be placed in approximately the correct position and supported by upright support members and cross members. This position relates to the height that the conveyor belt system needs to achieve. The various straight and hinged sections can then be clamped in place, ensuring that the system is adequately supported along its length as construction progresses using upright supports and cross members and wall support trestles. After all sections are assembled and supported, it is then necessary to check the system throughout. The electrical connection needs to be made for each section.The ring-pull clutches need to be disengaged so that the rollers are free. It is then necessary to check that the remote stop/start switch works. The sections of the conveyor belt are then connected together to form a continuous belt around the whole system. The tensioning devices can then be pulled on and the ring-pull clutches engaged. Once this is done, the motor can be started.

By provision of hinged couplings between the modules, the conveyor belt system could be folded up in its fully assembled state. It could then be incorporated into a lorry. The folding and unfolding may be done by hydraulic cylinders controlled by the driver. It is envisaged that four or six sections of 8′ conveyor be folded into a space behind the cab of a lorry, giving the lorry an ability to unload up to approximately 25′ high.

It is envisaged that a right angle conveyor section be attached to the head section so as to give the conveyor belt system a right angle change of direction. It may, however, be necessary for the load to be transferred manually on to the right angle section. It is also envisaged that the sections of the conveyor belt system could have a power take off which could be used for raising loads that the conveyor belt system cannot carry, such as large building sheets. Another possibility is that the

conveyor belt system could be used to raise its own sections during construction. This could be done by connecting the belt after the addition of each section and using the partially completed system to raise the next section. Dismantling could be done by reversing the process

An alternative to transmitting power to each module would be to drive the belt in only one place, for example, at the head station. This would require a stronger belt, as it would need to support the entire load carried by the belt at any one time, and a secure, positive drive to the belt.

CLAIMS

1. A conveyor belt system including a plurality of modules each having a frame, a section of conveyor belt for the module, the length of the section being related to the length of the module, means mounted on the frame for guiding and supporting a conveyor belt along a forward path, means mounted on the frame for guiding the conveyor belt along a return path, the frame being arranged to be connectable to the frame of an adjoining module to form a substantially rigid beam structure.

2. A system according to claim 1 wherein the frame of at least one module consists of two parts pivotable relative to each other about an axis across the module and the module has means for locking the two parts at any desired angle within a given range, the pivoting being arranged so as to have no substantial effect on the overall length of the path of the belt.

3. A system according to claim 1 or 2 wherein one of the modules includes a motor coupled to drive the belt.

4. A system according to claim 3 wherein the motor includes a control which is operable by remote control from at least one of the other modules.

5. A system according to claim 3 or 4 wherein each module has driving means for coupling drive to the belt at that module.

6. A system according to claim 5 wherein the driving means has one or more rollers for imparting drive to the belt and which also support and guide the belt.

7. A system according to claim 5 or 6 wherein the drive means for each module includes a shaft for receiving drive from an adjacent module and a gear box so arranged that the length of shaft necessary to couple each module is the same.

8. A system according to claim 5, 6 or 7 wherein the section of conveyor belt includes two lengths of conveyor belt which can either be linked together to form a belt passing around the module or linked to the other lengths to form a long belt passing over and back along the connected modules.

9. A system according to any preceding claim wherein the means for guiding the conveyor belt along the return path includes a tensioning device for tensioning the belt.

10. A system according to any preceding claim wherein the belt carries at spaced intervals on one side transverse supports for a load.

11. A system according to claim 10 wherein the transverse supports consist of buckets.

12. A system according to claim 10 or 11 wherein the transverse supports do not extend to the edges of the belt and wherein the means for guiding the belt along the return path includes a pair of wheels so arranged in operation to run on the outer margins of the belt.

13. A system according to any preceding claim further including a trolley to allow the system when assembled to be readily moved bodily.

14. A conveyor belt system substantially as herein described with reference to the accompanying drawings.

15. A module, for a conveyor belt system according to any preceding claim, substantially as herein described with reference to Figs. 1 and 2 or Figs. 1 and 3 of the accompanying drawings.

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