This invention generally relates to an extensible ladder structure which may be supported between a building structure and the ground with which a conveyor hoist cooperates to carry materials from the ground level to the building structure. In the past, roof repairmen, having ascended a ladder structure to the roof, have found themselves without the necessary materials to complete the repair job or have need for additional materials. Having no access to the ground level where such materials are usually stored without the character indicated, the repairmen would, in a hurry, descend the ladder to the ground level, pick up the needed material and again ascend the ladder to the roof. This became a tiresome and wearisome process insuch as not only did the repairman have to descend and ascend the ladder once again, but he had to carry the material usually in one hand braced against his body when ascending the ladder, thus making for a dangerous and tiring situation. Alternatively, some hoisting mechanism or the like would have to be arranged adjacent the ladder structure so that materials could be hoisted to the repairman on the roof. This involved additional structure, cost and materials. In distinction, this invention contemplates the combination of a conveyor hoist mounted directly upon an extensible ladder so as to obviate the above-mentioned problems.

Accordingly, it is the primary object of this invention to provide an extensible ladder structure including an endless chain conveyor cooperating with detachable carriages supported from the chain to convey packages of building materials or the like from a point adjacent the bottom of the ladder to a point adjacent the top thereof.

A further object of this invention is to provide a device of the character indicated wherein a package of building materials or the like may be suspended on a ladder above the endless chain and automatically picked up by said carriage means to carry it to the building top.

Yet another object of this invention is to provide a device of the character indicated wherein a plurality of carriages may be arranged on said endless chain dependent on the load that is to be handled.

A still further object of this invention is to provide a device of the character indicated which is easy to assemble and yet inexpensive to manufacture.

These objects, together with other objects and advantages which will become apparent hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is an end elevation view of the extensible ladder forming the subject matter of the instant invention and showing a carriage and endless belt mounted thereon for conveying building materials from a point adjacent the ground level to a point adjacent a roof top.

FIGURE 2 is a view in front elevation taken substantially along the plane indicated by line 2-2 of FIGURE 1 and indicating certain operational features of the device.

FIGURE 3 is a detail sectional view taken substantially along line 3-3 of FIGURE 1.

FIGURE 4 is a fragmentary detailed sectional view taken substantially along line 4-4 of FIGURE 2 and illustrating certain details of an upper supporting means of the ladder.

FIGURE 5 is a fragmentary detail sectional view taken substantially along line 5-5 of FIGURE 1 and illustrating certain details of the invention.

FIGURE 6 is a detail fragmentary sectional view taken along line 6-6 and indicating certain details adjacent the lower portion of the ladder.

FIGURE 7 is a perspective view of the upper supporting means for the ladder.

Referring now in more detail to the drawings, an extensible ladder generally indicated by the reference numeral 10 is shown. Said extensible ladder 10 comprises two outer side rails 12 and 14 generally channel shaped in cross section. Mounted within said side rails 12 and 14 are two ladder sections, one above the other, generally designated by the numerals 16 and 18. The lower ladder 16 comprises side rails 20 and 22 which are generally I-shaped in cross section disposed at the ends of a cylindrical ladder rung such as 24. The side rails 20 and 22 are disposed on the lower horizontal flanges 26 and 28 of the channel-shaped side flanges 12 and 14 respectively. The upper ladder section 18 comprises side rails 30 and 32 which are also generally I-shaped in cross section and are disposed in abutting relationship to the upper flanges of the lower I-shaped side rails 20 and 22 and the upper flanges 34 and 36 of the channel-shaped side rails 12 and 14. The side rails 30 and 32 have a plurality of cylindrical ladder rungs 38 extending therebetween at points spaced longitudinally therealong. The lower ladder section 16 is made integral with the channel-shaped side rails 12 and 14 by having the side rails 20 and 22 rigidly attached to the bottom flanges 26 and 28 of the channel-shaped members 13 and 14 by any suitable means such as by welding or the like or by having various rungs of the ladder formed integral with the bight portions of the channel-shaped side rails 12 and 14. The upper ladder unit 18 is sidewise disposed within the side rails 12 and 14 between the upper flanges 34 and 36 of the channel-shaped members and the top of the side rails 20 and 22 of the lower ladder unit 16.

The channel-shaped side rails are supported from the ground surface by means of a pair of extension members such as shown at 40, 42 which are attached to the side rails by any suitable means and may comprise any suitable shaped beams or the like such as pieces of angle iron. The upper portion of the ladder structure is adapted to be supported upon the roof 44 of a building or the like 46 by means of a supporting structure generally designated by the numeral 48 which is pivotally connected to the side rails 30 and 32 of the upper ladder section 18 as shown at 50. The supporting structure 48 generally comprises a pair of base tubular members 52 and 54 which telescopically receive telescoping members 56 and 58 respectively therein. The telescoping members 56, 58 or leg supports may be adjustably positioned in the tubular members 52 and 54 and fixed thereto by means of thumbscrews or the like such as shown at 60. The tubular members 52 and 54 are connected by means of a brace 62 and the members 56 and 58 are connected by means of a brace such as 64. Adjustable foot portions
66 and 68 are pivotally mounted as shown at 70 by any suitable means to the telescoping members 56 and 58. The tubular members each have formed therein an aperture therethrough such as shown at 72 to receive extensions 74 and 76 of the uppermost ladder rung 78 of the upper ladder section 18. The upper supporting structure 48 is pivoted about the ladder rung extensions and locked in adjusted position by the means depicted in FIGURE 4 of the drawings. The ladder rung extensions 74 and 76 have three apertures such as 80 formed therewith through which aperture such as 82 formed in the corresponding tubular members 52 and 54 is registrable. A bolt 84 is secured through each series of aligned apertures 80 and 82 to lock the upper support means 48 in adjusted position. If it is desired to change the angular relationship of the ladder with respect to the ground level the bolts 84 may be removed from the apertures 80 and 82 and the tubular members 52 and 54 may be rotated until the apertures 82 formed therein align with another pair of apertures 80 formed in the rung extensions 74 and 76. The bolts may then be replaced in the aligned apertures to lock the structure means in place. While only three such apertures are shown it is obvious that this invention contemplates that as many angularly adjusted positions as one would want could be accommodated. The support structure 48 not only serves the function of supporting the ladder at its upper end upon a building structure but acts as an unloading platform as will hereinafter become apparent.

The extendible ladder also comprises means contemplating manual rotation of one of the ladder rungs of the lower ladder section to manually enable one to extend the upper ladder section from the ground level. A rung such as shown at 86 of the lower ladder section is rotatably journalned in said side rails 20, 22, as well as the right and hand channel-shaped side rail 14. A flexible guide wire 88 is wrapped around said rung 86 at one end thereof and rigidly attached thereto by any suitable means. Said guide wire 88 extends around a pulley 90 attached to a rung 92 of the lower ladder section 16 and is finally disposed about the lowermost rung 94 of the upper rail section 18 by means of a loop 96. A crank handle 98 is disposed on an extension of the ladder rung 86 to rotate it. It should be apparent that upon rotation of the crank handle 98 in a clockwise direction the rung 86 will be caused to rotate thereby wrapping the guide wire 88 thereon about the lower ladder section 18 and move upwardly. In order to retain the upper ladder section in its extended position a ratchet such as indicated at 100 is rigidly fixed to run with and on the extension of the rung 86. A suitably disposed pawl 102 movably mounted upon the channel-shaped side rail 14 is adapted to cooperate with the teeth on the ratchet 100 and thereby prevent counterclockwise rotation thereof and of the rung 86 thereby holding the upper ladder section in its extended position.

It will hereinafter become apparent that once the ladder has been extended to its correct height and the upper supporting structure 48 has been adjusted to the desired angle, the ladder may be disposed between the ground level and the building roof 44 and the conveyor hoist may be put into operation. The conveyor mechanism comprises an endless chain shown at 104 entrained over a sprocket member such as 106 disposed on a shaft 108 rotatably received within a pair of bearing blocks 110 disposed on either side of the sprocket 106 while suitably mounted upon a transverse brace 112 rigidly secured between the upper ladder side rails 30 and 32 at their upper ends. The endless belt or chain 104 is also entrained at its lower end about a sprocket member such as 114 rotatable mounted by means of a shaft 116 rotatably mounted between the channel-shaped side rails 12 and 14. The sprocket 114 is driven by means of a gasoline engine such as indicated at 118 or the like having a power take-off shaft 120 to which a sprocket 122 is integrally attached. Said sprocket mounts an endless chain 124 which is entrained about another sprocket (not shown) formed rigidly with and fastened upon a frame 128. Also mounted upon the shaft 126 is a clutch mechanism as shown at 130 which may disengage or engage a suitable pulley mechanism 132 from the power take-off shaft 120 of the engine 118. The pulley 132 mounts an endless belt 134 which is also entrained about another pulley 136 fastened to an extension of the shaft 116. There is a similar pulley arrangement extending between the other end of the shafts 126 and 116. It should now be apparent that upon actuation of the clutch member 130 the power take-off from the gasoline engine may be connected to drive the conveyor chain 104 in an endless endless.

The frame 128 which mounts the gasoline engine 118 comprises a horizontal part 138 and a vertical part 140 and suitable bracing means such as shown at 142. The vertical part 140 has reversely bent hook portions 142 adapted to be mounted upon ladder rung extensions 144. The frame 128 is thus adapted to be in a horizontal position regardless of the angular inclination of the ladder 10. Suitable bracing means such as 146 comprising a turnbuckle 148 or the like pivotally mounted at one end to a bearing member 150 disposed on the ladder extension 42 may be utilized to rigidly position the frame 128. It should be noted that two such bracing members 146 may be disposed on either side of the vertical member 140 and connected to extensions 42 and 40.

Mounted upon the endless chain 104 is a carriage member generally designated by the reference numeral 160. The carriage 160 comprises a frame 162 including a plurality of longitudinal members 164 and a plurality of transversely extending members 166 suitably fastened together such as by welding. The carriage 160 preferably includes a vertically extending portion 168 formed as an extension of the longitudinally extending members 164. The carriage 160 is attached to the endless chain 104 by means of a T-link 179 attached to the bottom of the frame 162 of the carriage 160. Also disposed upon the carriage are a plurality of guide rails such as indicated at 172 and comprising a channel-shaped member 174 attached to the frame 162 of the carriage 160 and having an interund lip portion 176. The interund lip portions 176 are adapted to engage rails 30 and 32 of the upper ladder section 18 and to guide the carriage thereby. Members between the sides of the channel members 174 are wheel means 178 which are adapted to ride on the upper flanges 34 and 36 of the channel-shaped side rails 12 and 14. It should therefore be apparent that upon actuation of the endless chain 104 the carriage will be carried upwardly through the link 170 and guided on the channel-shaped side rails by means of the wheel members 178 and the interund lips 176 adapted to extend beneath the side rails of the upper ladder section.

Disposd on the lower end of the ladder is a pickup station generally designated by the numeral 180 upon which a package such as packet 190 is adapted to be disposed thereon so that the carriage 160 may automatically pick the package up and convey it to the roof of the building structure. The pickup station 180 comprises a pair of side rails such as 184 each of which is integrally fastened to the ladder-extensions 40, 42 and a bridging member 186 connecting the two side members 184. The pickup station 180 further comprises two longitudinally extending members 188 disposed on the channel-shaped ladder rungs 12, 14 and formed integral with and extending upwardly from the side members 184. The pickup station 180 further comprises suitable bracing means for the structural members such as shown at 190 to provide rigidity to the pickup station 180. The members 188 are disposed above the chain belt 104 of the conveyor unit a sufficient distance which is approximately equal to the thickness of the transverse frame member 166 of the carriage 160. With specific reference now to
FIGURE 6, it will be seen that the carriage member 160, shown in phantom lines, is adapted to pass beneath the bridging member 186 of the pickup station and underneath the members 188 so as to pick up the package disposed on the members 188 by the means of the upstanding member 168 on the carriage 160 pushing the package 182 along with the carriage member as it passes the pickup station.

With reference to FIGURE 2, it should be noted that the horizontal flanges 34 and 36 of the channel-shaped members 12, 14 are cutaway as shown at 192. This enables the carriage member when turning about sprocket 114 to come to a position which is substantially flush with the flanges 34 and 36 so that the depending member 174 of the carriage 160 may engage beneath the flanges 34, 36. It should also be noted from FIGURE 6 that the upper ladder section 18 is disposed above the point where the carriage lies flat with the flanges 34 and 36 and the turned lips 176 of the depending members 174 of the carriage 160 are disposed a sufficient distance beneath the flanges 34 and 36 so as to enable them to abut the flanges of the rails 30 and 32 when contact is made further up the ladder.

The lower ladder section 16 is slightly longer than the channel-shaped rails and extends slightly beyond the upper end thereof. A suitable channel-shaped bracket such as 194 is disposed rigidly on this extension of the lower ladder section 16 and has an inturnd flange such as 196 which guides the upper ladder section 18 when it is extended. A camming lug 198 formed integral with the brackets 194 is disposed at an angle thereto and prevents the endless chain 104 from being hung up on the ladder sections as is readily apparent from FIGURE 1.

The operation of the device should now be readily apparent. The upper ladder section is extended relative to the lower ladder section and supported upon the roof of a building unit or the like. An endless chain is then extended between the sprocket members 106 and 114. It should be apparent that one chain of varying length may be used, such as a chain in which link sections may be added or removed or chains of different lengths may be used. A package may then be disposed upon the pickup station 180, the gasoline engine started and the clutch 130 engaged to drive the endless chain 104. The carriage will pick up the package and convey it to the top of the conveyor, whereupon it will be disposed on and guided by the lower telescoping members 50 and 58 which will also act as a runway for the packages to the roof of the building unit where it may be picked up by the repairman thereon. It should be noted that sufficient clearance will be provided between the frame 128 and the carriage 160 when the ladder passes therebetween and furthermore the belts 134 may be changed when the angle of inclination of the ladder sections is changed. The ladder is locked in place by the pawl and ratchet arrangement 100 and 102 which provides a positive retaining means for the ladder sections in their extended positions. It should also be evident that as many carriage means as is feasible may be employed upon the endless chain 104.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be restored to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. In combination with an inclined extension ladder of the type including end overlapped upper and lower sections including corresponding opposite side rails disposed in superposed relation and having their opposite side rails embraced in opposite opening channel-shaped side members to which the side rails of said lower section are secured, upper and lower guide wheels journeled between said side rails and from the upper and lower ends of said upper and wheel section, an endless flexible member entrained about said wheels, a pickup station located on said side members overlying the lower end of said endless flexible member and defined by a pair of opposite side arms carried by said side members and projecting outwardly and upwardly from the lower ends of said side arms and wheel section, said endless flexible member and secured to said carriage intermediate a predetermined distance, an elongated carriage receivable between said arms and including opposite side and longitudinally spaced wheels rollingly engaged with the upper surfaces of said side members and receivable between said side arms, means carried by said endless flexible member and secured to said carriage intermediate the wheels, drive means supported from said lower section and operatively drivingly connected to the lower guide wheel, means connected between said ladder sections for extending said upper ladder section relative to the lower ladder section and locking the sections in their relative extended positions.

2. The combination of claim 1 wherein the upper and lower reaches of said endless flexible member are spaced apart equally throughout their length and a distance substantially equal to the distance between the upper and lower surfaces of said side members, said wheels on said carriage being rollingly engageable with the lower surfaces of said side members when said carriage is traveling down the lowermost reach of said endless flexible member, and guide cam means supported from the upper end of the lower ladder section and including means for camming said carriage outwardly of the lower reach of said endless flexible member to clear the upper end of said side members from whose upper end said upper ladder section projects when said carriage is moving down said ladder and closely approaching the upper ends of said side members.

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