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De Good et al.

[11] **3,800,709**

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[54] **TROLLEY DRIVE FOR OVER AND UNDER CONVEYOR**

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[73] Assignee: **Rapistan Incorporated,** Grand Rapids, Mich.

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[21] Appl. No.: **224,173**

[52] **U.S. Cl.** ..... **104/172 S**

[51] **Int. Cl.** **B65g 17/42**

[58] **Field of Search** ..... 104/172 S, 172, 88, 90, 104/91, 178; 198/177 R; 248/324

[56] **References Cited**

UNITED STATES PATENTS

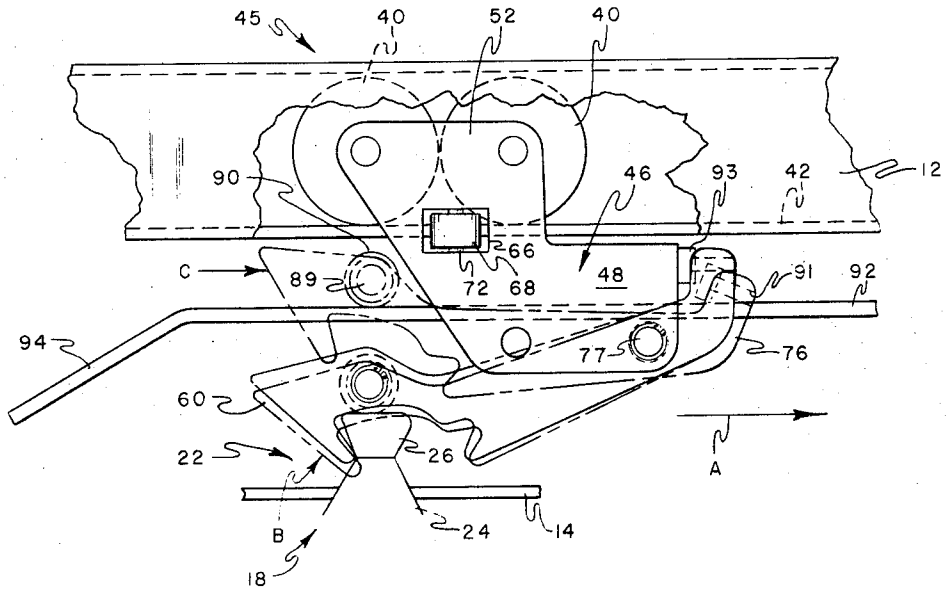
3,667,399	6/1972	Czarnecki	104/172 S
3,724,391	4/1973	Velde	104/172 S
3,726,234	4/1973	Dema et al.	104/172 S

Primary Examiner—Robert G. Sheridan
Assistant Examiner—Richard A. Bertsch
Attorney, Agent, or Firm—Price, Heneveld, Huizenga & Cooper

[57] **ABSTRACT**

The main propelling member is mounted on an overhead power track for selected driving engagement with carriers suspended by trolleys on the free track. The propelling member has a depending puller arm with a socket forming integral puller and holdback dogs engageable with a drive post on the carrier. The upper surface of the socket is irregular with the depth of the holdback dog being less than that of the puller dog portion. A smooth curvilinear shape inhibits accidental disengagement during transistion between levels and inclined movement and assures straight-line force generation between the drive post and drive arm pivot pin when the holdback dog is utilized. An auxiliary pusher arm is also utilized for switching the carrier from one free track to the other and is urged by its own weight into a retracted non-post engaging position. Ramps are positioned for positive cam movement of the auxiliary pusher arm for engagement with or disengagement from a secondary drive post.

12 Claims, 11 Drawing Figures



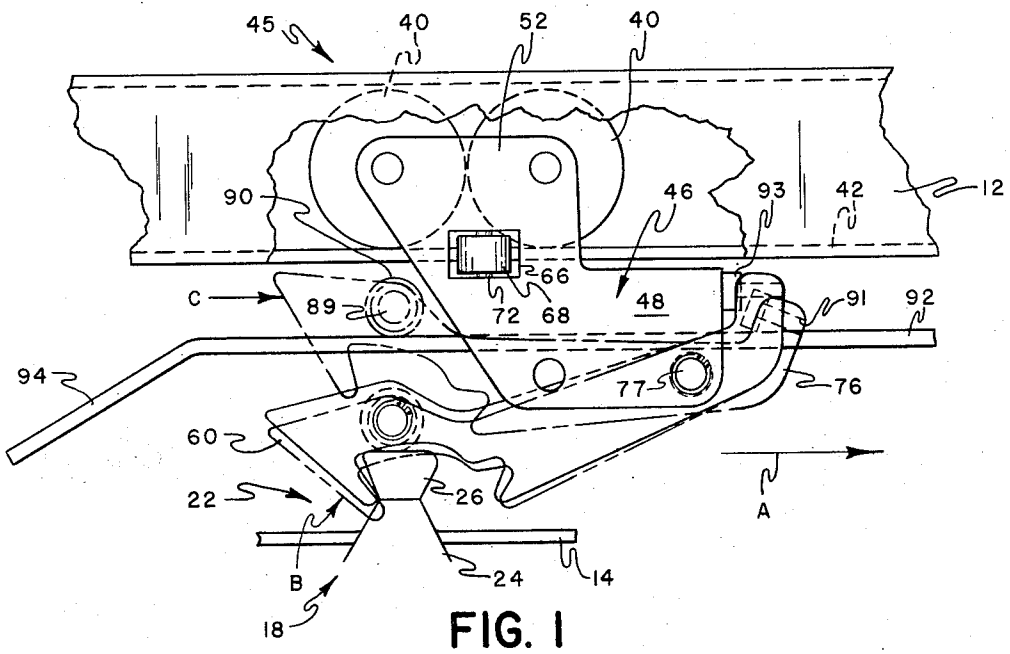


FIG. 1

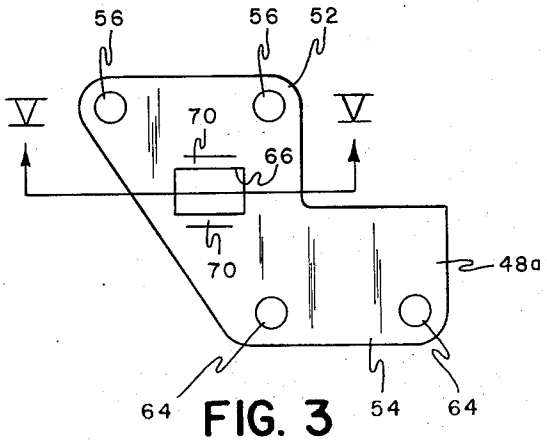


FIG. 3

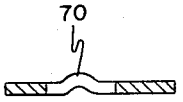


FIG. 5

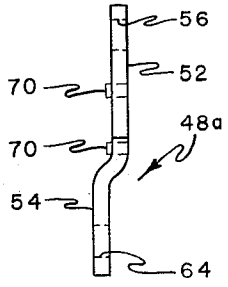


FIG. 4

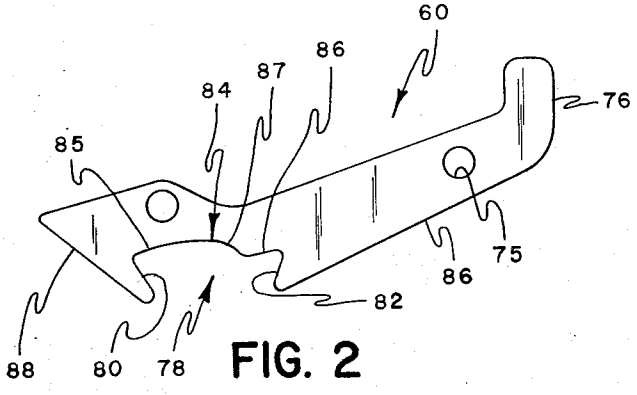


FIG. 2

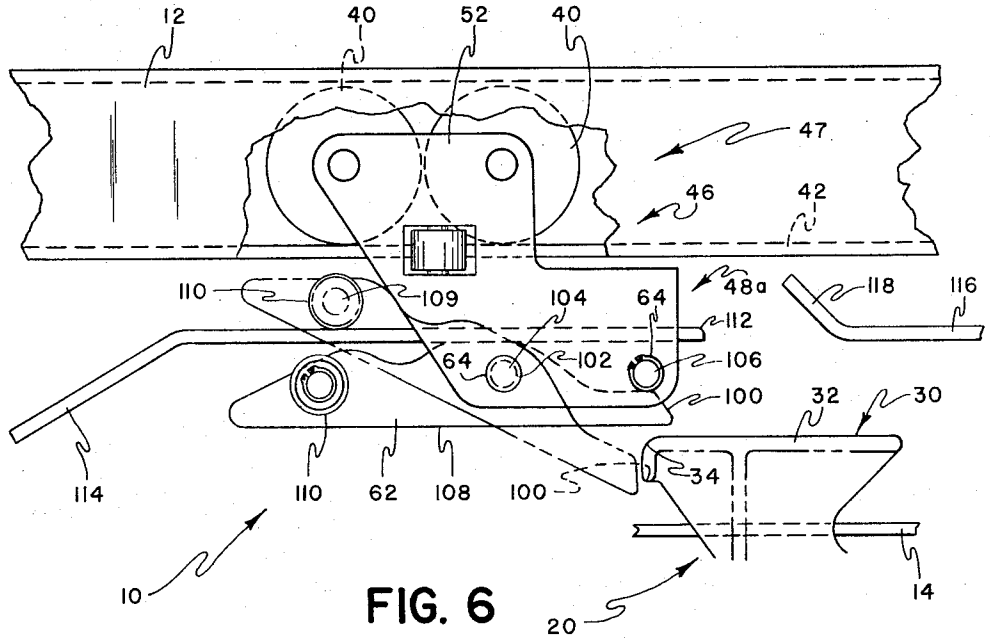


FIG. 6

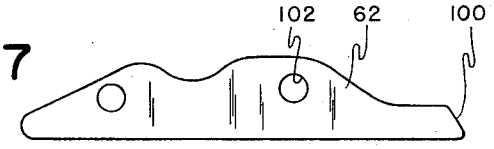


FIG. 7

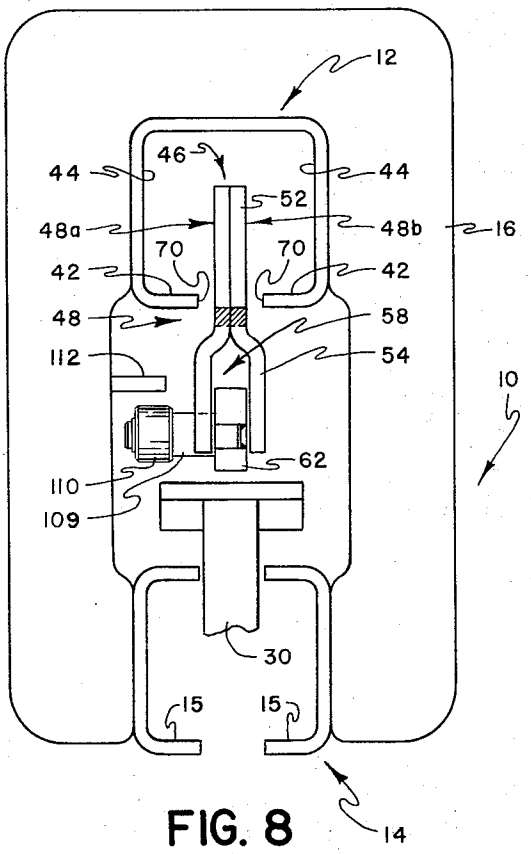


FIG. 8

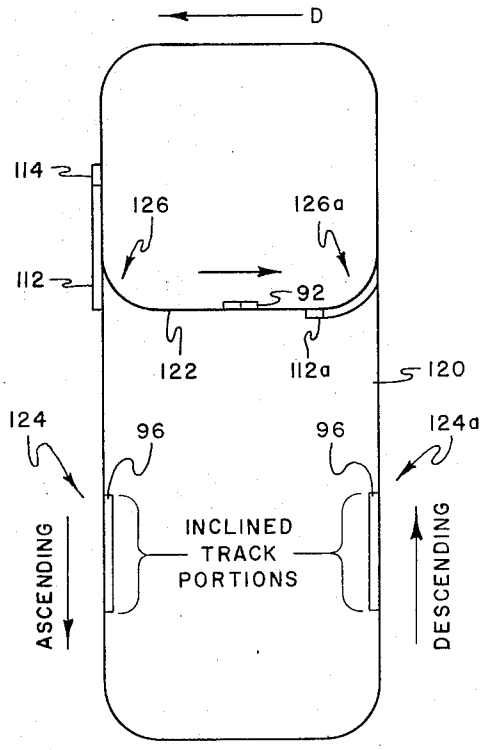


FIG. 9

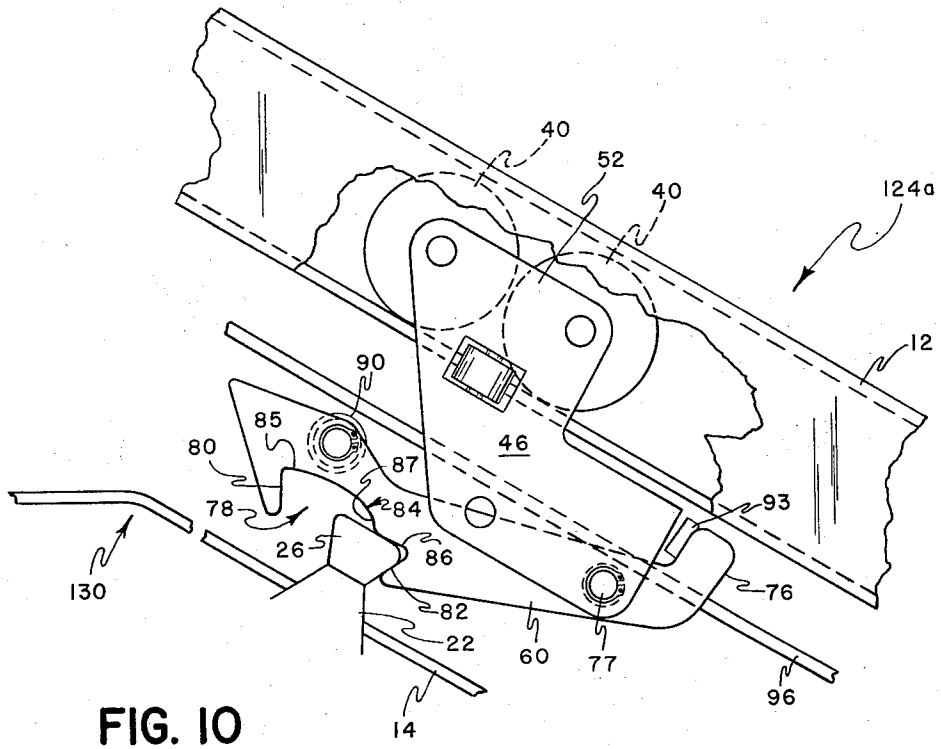

40
52
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124a
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84
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130
76
82
22
60
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96
14

FIG. 10

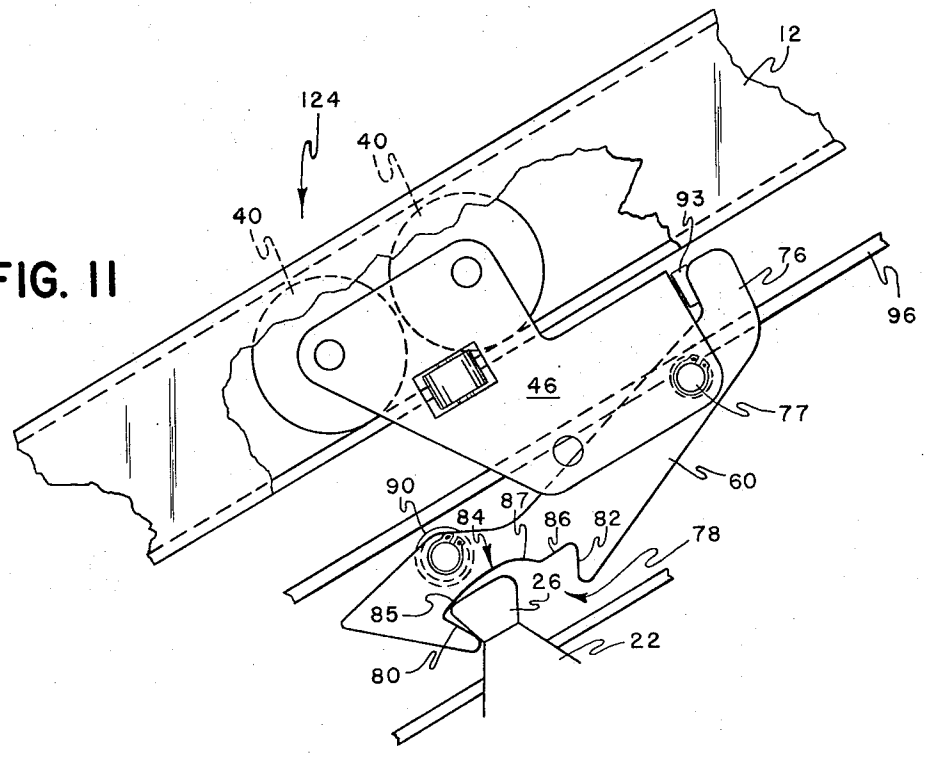

12
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FIG. 11

TROLLEY DRIVE FOR OVER AND UNDER CONVEYOR

BACKGROUND OF THE INVENTION

This invention relates to an improved power and free conveyor system and, more particularly to an improved retractable drive mechanism.

Over and under, power and free conveyors have become widely adopted in moving loads on carriers from one location to another. They are particularly adapted for accumulation of carriers at selected points; transfer of the carriers from one track to another or, the transfer of carriers between different levels by movement up or down inclined track sections. A particularly novel and efficient system is described in an application entitled TROLLEY DIVERTER, filed July 28, 1971, Ser. No. 166,871 having a common assignee with this application. This application has a common assignee and is incorporated herein by reference.

One significant aspect of the invention described in the above incorporated application is the elimination of variations in the track spacings during switching and inclined movement while still retaining the ability to provide accumulation. While there are proposals which have eliminated variations in track spacings, none have done it as efficiently in both cost and operation.

There is a need, however, for constant improvement in conveyors of this type since installations of this type ordinarily are complex and expensive. Thus, any reduction in areas of stress concentration and parts without sacrificing fidelity in performance is significant.

SUMMARY OF THE INVENTION

In accordance with the invention, spaced trolley and power tracks include a driven propelling member mounted on the power track and a load carrier supported on the trolley track for travel therealong. The load carrier includes a primary drive post while the propelling member includes a pivotally mounted drive arm having a socket formed therein for coupling the propelling member to the carrier drive post. The socket opens downwardly and includes longitudinally spaced slope pusher and holdback surfaces for engagement with the drive post. The web or upper surface portion of the socket engages the top surface of the drive post and is curvilinear to cam the holdback dog face when engaged with the drive post to a position whereby the force generated through said drive arm is centered radially through the pivot point of the drive arm.

In other aspects of the invention, the carrier is supported by a pair of trolleys, the front trolley including the main drive post and the rear trolley including a secondary drive post. An auxiliary drive is mounted on the propelling member and is spaced from the primary drive dog a distance greater than the spacing between the primary and secondary drive posts. A constant spacing between the power and trolley tracks is maintained throughout the conveyor and the auxiliary drive includes an auxiliary drive arm pivotally mounted thereon and urged by its gravitational weight into a retracted position disengaged from both the primary and secondary drive posts. An actuating means at selected positions along the conveyor urges the drive arm into and out of an extended position for engagement with the secondary drive post for transmitting motion from the propelling member to the load carrier. In narrow

aspects of the invention, both the main and secondary drive dogs are disengageable from the drive posts by actuating means adjacent the trackway. In addition, the propelling member includes an adjustable stop for limiting the pivotal extension of the drive arm.

The improved drive mechanism provided by the invention specifically reduces the loading on the propelling member when the carrier is held by the holdback dog for example as the carrier rolls down a grade. The reduction in loading reduces wear, tear and eventual fatigue or breakage. In addition, the operation in coupling the main or auxiliary drive to the primary and secondary posts is positive and hence trouble free. Cam disengagement of the auxiliary drive eliminates the necessity of costly biasing mechanisms and eliminates accidental non-disengagement. Thus, a smoother overall operation is achieved at an overall cost reduction.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary side elevation view of the main drive mechanism provided by the invention shown in progressive operational positions;

FIG. 2 is a side elevation view of the main drive arm;

FIG. 3 is a side elevation view of one of the drive arm mounting plates;

FIG. 4 is an end elevation view of the plate shown in FIG. 3;

FIG. 5 is a cross sectional view of the plate shown in FIG. 3 taken along line V—V of FIG. 3;

FIG. 6 is a fragmentary side elevation view of the auxiliary drive mechanism provided by the invention;

FIG. 7 is a side elevation view of the drive arm utilized in the auxiliary drive mechanism;

FIG. 8 is a vertical cross section of the power and free conveyor showing the pusher arm assembly provided by the invention;

FIG. 9 is a schematic representation of a conveyor showing the locations at which actuator ramps are used in accordance with this invention;

FIG. 10 is a fragmentary side elevation view of the main drive mechanism during travel down an incline; and

FIG. 11 is similar to FIG. 10 except that the movement is up an incline.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, FIG. 8 shows a conveyor **10** comprising a pair of vertically spaced tracks **12** and **14** of the well-known over and under, power and free type. The tracks are of conventional enclosed construction and rigidly joined together at suitable intervals throughout the system by a plurality of brackets **16.** The conveyor is propelled by a driven chain (not shown) which travels in and is supported by power track **12.**

Each load carrier (not shown) is supported from the load or trolley track **14** by a pair of spaced trolleys, a front or lead trolley **18** (partially shown in FIG. 1) and a rear or trailing trolley **20** (partially shown in FIG. 6). Trolleys **18** and **20** are connected by a rigid load bar (not shown) which is interconnected to the trolleys by a pivot. The carrier trolley wheels travel on rails **15, 15** of trolley track **14** shown in FIG. **8.** All of the preceding described structure is conventional and well-known to

the conveyor art and a further detailed description is not considered necessary to an understanding of the invention.

Referring now in detail to FIG. 1, the forward or lead trolley 18 has an upstanding drive post 22. Post 22 is a primary drive post and has a downwardly flared base 24 and an inverted frusto-conical top 26 giving a somewhat hour-glass shape to post 22. Lead trolley 18 is generally identical to that described in the above-referred-to copending application which can be referred to for further detail.

Referring to FIG. 6, the rear or trailing trolley 20 has an upstanding, rear drive release member 30 having an elongated top 32 and a rearwardly depending lip 34 serving as a ramp and auxiliary drive. Under certain operating conditions which will be described in more detail hereinafter, the rear drive release member 30 serves as a secondary drive post. The top of post 30 and top 32 of release member 30 are in the same general plane. Rear drive release member 30 is located at the rear end of trailing trolley 20 and a portion of it extends rearwardly beyond the end of the trolley. Again, for more specific detail, reference is made to the above-identified copending patent application.

The drive chain (not shown) includes a plurality of intermittently spaced vertical and horizontally disposed rollers. The vertically oriented rollers 40 (FIG. 1) are preferably arranged in pairs of longitudinally spaced sets in close proximity to each other for riding engagement on the lower lips 42 (FIG. 8) of power track 12. Spaced longitudinally in between each set of vertical rollers 40, 40 are one pair of horizontally disposed rollers (not shown) for engagement against side wall portions 44 of power track 12. The rollers are preferably made of polyurethane and this arrangement provides a quiet, smooth, positive movement of the driven carriers as the drive chain traverses various straight, inclined and curved sections of the track. Any other satisfactory drive chain construction can be used.

The propelling member includes front and rear trolley drive brackets 45 and 47 (FIGS. 1 and 6). Each of the trolley drive brackets 45 and 47 includes clevis 46 which forms the body of the brackets. As shown in FIG. 8, the clevis is comprised of a pair of mating plates 48a and 48b. The clevis has an upper portion 52 which projects into track 12 and is connected to the axles of the chain rollers 40, 40 and a lower portion 54 which projects below track 12 and above track 14. Either a puller arm 60 or pusher arm 62 is pivotally mounted to lower portion 54 as will be described shortly.

Referring to FIGS. 3–5, plate 48*a* is shown from the side to have a generally L-shape with the upper vertical portion when joined to the corresponding portion of plate 48*b* forming portion 52 of clevis 46. Likewise the lower horizontal forms portion 54 of clevis 46. Upper portion 52 of clevis 46 includes a pair of longitudinally spaced openings 56 which receive the axles of rollers 40, 40. The upper portions of plates 48a and 48b are joined together in a face-to-face relationship to form upper portion 52 while the lower portions are offset outwardly to provide a slot 58 (FIG. 8) to receive either a puller arm 60 or a pusher arm 62. The lower portion 54 of each clevis includes a pair of openings 64 similar to openings 56. These openings are utilized for pivotally mounting either a puller arm 60 or a pusher arm 62.

A rectangular opening 66 is provided in each plate 48a and 48b for receipt of a small guide roller 68 which is aligned between lips 42, 42 of track 12. Roller 68 rotates about a vertical axis and acts to stabilize trolleys 45 and 47 as they traverse curves and to limit side sway. Referring to FIG. 5, each plate 48*a* and 48*b* includes an outwardly offset strap 70. The straps 70 provide a pair of sockets for the mounting pin 72 of roller 68.

Referring now to FIG. 1, a puller arm 60 is pivotally mounted by a pin 77 near its forward end 76 to the forward one of the holes 64 in the lower portion 54 of clevis 46. End 76 of puller arm 60 is described as the forward or lead end in relation to the direction of travel which is shown by arrow A in FIG. 1. Puller arm 60 includes an opening 75 (FIG. 2) for receipt of the pin 77. Due to the positioning of the pivot axis well ahead of the center of gravity of arm 60, the rearward or trailing end of puller arm 60 is urged downwardly by gravity. The trailing end includes a socket 78 (FIG. 2) opening downwardly. Socket 78 is partially restricted at its downwardly opening end but the fore and aft length of the socket is substantially greater than that of the top 26 of drive post 22 to permit its entrance in the socket. Socket 78 and the partial restriction of its entrance creates a socket configuration generally conforming to the configuration of post top 26. The longitudinal width of the socket entrance is less than the longitudinal length of the drive release 30 of rear trolley 20 and hence non-complementary therewith so that puller arm 60 is incapable of engaging the rear or secondary drive dog 20.

The rear portion of socket 78 has an inclined wall or face 80 which acts as a drive dog when engaged with top 26 of drive post 22 to pull the carrier along trolley track 14. The forward end of socket 78 includes a generally similar but oppositely inclined wall or face 82 which acts as a holdback dog when engaged by top 26 of post 22 to restrain the load carrier from uncontrolled forward movement relative to puller arm 60. The upper surface or ceiling portion 84 of socket 78 has an irregular curvilinear shape particularly adapted to position puller arm 60, when either drive face 80 or holdback face 82 is engaged with top 26 of drive post 22, such that the force generated between drive post 22 and puller arm 60 acts in a straight line through pivot pin 77. This arrangement eliminates the generation or forces acting to pivot the puller arm up or down with respect to the drive post 22. It also reduces the shear forces acting on the pin 77. The irregular curved configuration also inhibits accidental disengagement during transitional movement of the carriers from or to an inclined track portion the details of which will be described hereinafter.

Describing the socket in greater detail, the upper surface 84 of the socket has a rearward portion 85 having a fore and aft length greater than the fore and aft length of the top of the drive post 26 (FIGS. 1 and 2). The forward portion 86 of the upper surface is downwardly offset, reducing the depth of the socket adjacent the holdback face 82. These two portions are connected by a smoothly secured transition portion 87 which acts to smoothly cam the puller arm 60 about the post 22 as the post shifts for and aft in the socket.

Both forwardly and rearwardly of the entrance to socket 78, the lower face of puller arm 60 is inclined upwardly creating both a forward ramp 86 and a rearward ramp 88. A pin 89 projects laterally from puller

arm 60 adjacent its rearward end and above socket 78. Rotatably mounted on the outer end of pin 89 is a cam roller 90. Roller 90 is selectively engageable with a rail 92 which includes a ramp portion 94 which cams roller 90 and puller arm 60 upwardly to a retracted non-engaging position with respect to drive post 22. In other instances, a similar rail 96 (FIGS. 9, 10, and 11) is provided to lock the drive arm in extended portion and to prevent accidental separation of puller arm 60 from the drive post 22. The terminal ramps of the rails 96 will be inclined oppositely that of the rails 92 since they act oppositely upon the drive arm.

The arm 60 has an upstanding forward end 76 ahead of clevis 46 which acts as a stop when arm 60 is disengaged from trolley 18 to limit the downward extension of arm 60. An adjustable set screw 91 with a non-metallic, preferably polyurethane, head 93 provides adjustment for the stop and prevents metal-to-metal contact between arm 60 and clevis 46. The maximum extension of the arms is illustrated in broken lines in FIG. 1 and indicated by the letter B.

Referring now to FIGS. 6 and 7, the rear trolley 47 of the propelling member is comprised of a clevis 46 and pusher arm 62 mounted to the drive chain. The forward end of arm 62 includes an inclined drive face 100 for engagement with the auxiliary drive 34 and rear drive release member 30 on rear trolley 20 of the load carrier. The auxiliary drive face 100 is spaced rearwardly from the face 80 forming the drive dog of puller arm 60 a distance greater than the spacing between post 22 and auxiliary drive 34. Thus, the spacing of each pair of brackets 45 and 47 is greater than the spacing between the leading and trailing trolleys 18 and 20 of a load carrier.

Pusher arm 62 is pivotally mounted at 102 by a pin 104 received through the rearward opening 64 of clevis 46. The pin 104 is forward of the center of gravity of pusher arm 62 whereby gravity biases the pusher arm 62 into raised or retracted position. A pin 106 is mounted in the forward opening 64 and acts as a stop against the forward end of arm 62 to limit the retraction of arm 62. Preferably, arm 62 is stopped in a horizontal retracted or non-drive position, as shown in FIG. 6 in solid lines. In retracted position, the lowermost edge 108 of pusher arm 62 is spaced vertically above the upper extremity 32 of rear drive release 30 and above the top 26 of drive post 22. Thus, unless positive action is taken to pivot pusher arm 62 clockwise to lower drive face 100 the pusher arm 62 remains retracted. On the other hand, the gravitational bias of puller arm 60 is such that unless affirmative action is taken to raise it into retracted position, illustrated in broken lines in FIG. 1 and indicated by the letter C, the normal position of puller arm 60 is extended into drive position.

Projecting laterally from pusher arm 62 adjacent its rearward or trailing end is a pin 109. On the outer extremity of pin 109 is mounted a cam roller 110 as shown in FIG. 8. Pin 109 and cam roller 110 are identical to pin 89 and cam roller 90 described above with respect to puller arm 60. Cam roller 110 is adapted for selective engagement with a rail 112 (FIG. 6) having a ramp portion 114 at its forward end inclined upwardly to shift pusher arm 62 into the inclined position shown in FIG. 6 so that auxiliary drive face 100 is positioned for driving engagement with auxiliary drive 34 on the trailing trolley 20 of the load carrier.

A second rail section 116 is positioned upstream from the termination of rail 112 and includes an upwardly extending downwardly sloped ramp 118 at its leading end for camming engagement with roller 110 to positively shift pusher arm 62 into retracted position. The specific details and functioning of rails 112 and 116 will be described hereinafter more fully. It should be noted at this point however that the lateral projection of pin 109 and roller 110 is opposite to pin 89 and cam roller 90 mounted on puller arm 60 so that rollers 90 are actuated only by the rails 92 and 96 and the rollers 110 are actuated only by the rails 112 and 116.

Over and under conveyors of the type with which this invention is concerned are so designed as to form a closed loop such as that loop 120 schematically illustrated in FIG. 9. Such conveyors normally incorporate one or more secondary or spur tracks 122. Such secondary tracks may be used for trolley accumulation or as a diversion through a secondary processing area or for any other reason. Frequently, it is necessary that the track change elevation, necessitating inclination of portions of the track as schematically illustrated at 124 and 124*a* in FIG. 9. This invention in one aspect is particularly concerned with the propelling of the trolleys at the switches 126 and 126*a* where the secondary and primary tracks come together. In a second aspect, particular concern is given for propelling the trolleys at the inclined portions 124 and 124*a* of the track.

In application Ser. No. 166,871, of which reference has previously been made, a construction is disclosed by which trolleys can be switched betweeen main and auxiliary tracks and moved through inclined track areas without varying the spacing between the power and trolley tracks. This is true whether or not the auxililary tracks are powered. This invention provides an improvement in the construction taught in that application.

For purposes of this description it is assumed that a load carrier is traveling along loop 120 in the direction of arrow D propelled by puller arm 60 with the arm in drive position generally as shown in solid lines in FIG. 1. Pusher arm 62 on the other hand is in a retracted position as illustrated in solid lines in FIG. 6. Assuming that the carrier is to be diverted onto loop 122 at switch 126, the switch is actuated by shifting a tongue or other conventional means to deflect the forward trolley 18 of the load carrier from main track 120 to the spur track 122. As the lead trolley is forced laterally by the tongue, post 22 slides sideways out of socket 78 releasing it from drive face 80. This results in disengagement, leaving the load carrier stalled partially on and partially off main track 120.

The auxiliary pusher arm 62 now takes over and completes the shunting of the load carrier onto the auxiliary or spur track. Since pusher arm 62 is normally retracted and inoperative, it must be shifted to an operative position to do this. This is accomplished by a rail 112 mounted on the power track 12 (See FIG. 6 and 9). The rail 112 is mounted on the side of the power track to intercept cam roller 110 on the pusher arm 62. The leading end of rail 112 is sloped downwardly to form a ramp 114 which acts to pivot arm 62 into its extended position for engagement of pusher face 100 with the rear drive 34 of trolley 20. The length of rail 112 is such that this occurs at a point just prior to or simultaneously with the disengagement of the puller arm 60 from post 22. Because of the spacing between

drive face **80** and face **100**, there is a short interval during which the load carrier remains stationary or at least slows down since it will ordinarily have some momentum. However, as soon as pusher arm **62** engages the rear end of the trailing release member **30**, movement of the load carrier will be reinitiated and will continue until the rear trolley **20** has been pushed off the main track **120**. During this operation, the rear or trailing release member functions as an auxiliary drive post. After this has occurred, rail **112** is terminated permitting the pusher arm **62** to retract by its own weight. It will be noted that the cam roller **90** on the puller arm **60**, since it projects oppositely from the roller **110** on the pusher arm, is not affected by rail **112**. Because the working environment of many conveyors of this type involves materials which tend to prevent the free movement or movable parts, it is desirable to provide means to provide positive operation. Examples of such circumstances are dirt, spray baths and contact with corrosive chemicals. To insure positive retraction of the pusher arm **62**, a short rail **116** is provided with an upturned lead ramp to forcibly retract the arm, if necessary.

The forward trolley of a diverted load carrier, after it has been pushed off the main track by pusher arm **62**, is positioned such that the next approaching arm (not shown) on the chain of the spur power track will engage drive post **22** of the load carrier and pull it along the spur track. If the spur track is non-powered, the effect of the auxiliary drive of the main track is to push the load carrier to a position where gravity will cause the load carrier to move away from the main track, at least sufficiently to clear the switch area. All of these details are conventional and the preferred apparatus is described in the above identified copending application.

Where the switch is one at which load carriers enter the main track **120** from spur track **126**, (i.e. switch **126***a*) the procedure is reversed. Here the puller arm **60** of the spur track will release the load carrier just before it reaches the switch because the arm and socket will shift laterally with respect to the load carrier. Here a ramp **112***a* (FIG. **9**) is provided on the spur track to activate the following auxiliary pusher arm on the spur track chain. The auxiliary pusher arm will push the load carrier, moving its forward trolley onto the main track where its post **22** will be captured by the next passing puller arm on the drive chain of the main conveyor **120**.

It will be recognized that suitable coordination devices must be provided to prevent movement of a load carrier on to the main track only when an empty drive dog on the main track is approaching. Such devices have long been used in this type of conveyor and are, therefore, not illustrated or described here.

A significant improvement of this invention is the elimination of additional structure required to hold pusher arm **62** in retracted position. Thus, in accordance with the invention, pusher arm **62** remains in a normal retracted position as a result of its gravitational weight in accordance with its unique mounting to clevis **46**. When it is extended, only the pusher arm **62** is positively cammed by the rail **112** and ramp **114** into a drive engaging position.

At inclined track sections, (FIGS. **10** and **11**) it is desirable to lock puller arm **60** into engagement with drive dog **26**. This is accomplished by a rail **96** (FIGS. **9–11**) similar to rail **116** mounted on the opposite side of the power track **12**. Rail **128** is spaced slightly above cam roller **90** on puller arm **60** to prevent unintentional separation of socket **78** from drive post **22**. This prevents inadvertent upward pivoting of the puller arm to release the post due to heavy loads. Again, the use of a rail and cam roller eliminates the necessity for varying track spacing. The lead ramp of the rail **96** is inclined oppositely from that of the ramp **92** because it is designed to shift the drive arm in the opposite direction.

There may be situations in which it is desired to provide positive disengagement between puller arm **60** and drive post **22**. For example, on a spur track after the carrier has been brought to a work processing station, it may be desired to automatically leave it at that point. A retracting rail **92** (FIGS. **1** and **9**) is utilized in these instances. Preferably rail **92** has a ramp **94** at its leading end for camming roller **90** and arm **60** up out of engagement with drive post **22**. Rail **92** can extend as long as positive disengagement is preferred. Once rail **92** is terminated, puller arm **60** will pivot into a drive engaging position by its own weight. Selective disengagement can also be achieved by the utilization of movable ramps in accordance with the skill of the art. Accumulation is also provided by the apparatus of the invention in accordance with the teachings of the referred to copending application incorporated herein by reference.

Referring now back to FIGS. **10** and **11**, FIG. **10** illustrates the position of drive post **26** and puller arm **60** during descent of a carrier down an inclined track portion **124***a*. During descent, the load carrier by its gravitational weight will generally urge the movement of the carrier down the incline at a rate faster than the movement of the drive chain to which puller arm **60** is connected. Thus, the arm **60** shifts its juncture from propulsion to braking. Without some type of holdback means, the carrier would indeed run away from puller **60** and perhaps cause substantial damage at some point down the incline. However, socket **78** in addition to forming a drive face **80**, also includes a holdback face **82**.

As the carrier moves onto or off from an incline portion, it passes through a transition at the track juncture between a level track portion and incline track portion indicated by reference numeral **130** in FIG. **10**. At this transitional point, the upper end **26** of drive post **22** exerts a rotational force on puller arm **60** as it passes or traverses a generally arcuate path from the level direction of travel to an incline direction of travel. By the same token at the bottom of an incline, the upper end of end **26** of post **22** tends to exert a similar force. In some instances, during movement through this transition point, there has been noted a tendency due either to this rotational force or to irregularity of travel or other conditions for the puller arm **60** to be pushed upwards whereby post **22** is not in engagement with the upper ceiling or roof portion **84** of socket **78**. In a conventional socket opening wherein upper portion **84** defines a smooth arcuate surface, the carrier may accelerate such that the post **22** strikes holdback face **82** while the upper surface of post **22** is not in contact with upper surface **84**. To avoid this, this invention provides a surface **84** wherein the ceiling of the holdback portion **82** of socket **78** is offset downwardly forming a ceiling portion **86a** producing a socket of lesser depth. This results in a reduced bearing or impact causing

wear. It can, in some cases result in forces pivoting the arm into disengagement. It can also result in repeated impacting between arm and post, accelerating wear. The transitional portion intermediate these two ceiling portions is curved downwardly to cam against drive post **22** to inhibit separation during transition from a level or incline portion to the other. In addition, the offsetting of drive face **80** vertically from holdback face **82** positions puller arm **60** at a slightly different angle about pivot pin **77** as that the force generated between frusto-conical top **26** of drive post **22** and holdback face **82** is centered through pin **77** to eliminate or at least greatly reduce any moment arm created about pin **77.** In conventional power and free conveyors of this type, the forward end **76** of puller arm was generally in abutment with some portion of the body of the power trolley to prevent further rotation. However, the vector of forces generated by the drive post and puller arm tended to create severe moments about the pivot pin causing accelerated fatigue and in some instances failure. By offsetting the vertical level of the drive face **80** and holdback face **82,** this problem can be significantly reduced of if the angle of descent is properly selected, to match the socket configuration, completely alleviated.

Referring now to FIG. **11,** the carrier is shown being conveyed up an incline **124.** Again, depending on the configuration of socket **78,** a variety of force vectors can be developed about pin **77.** By positioning ceiling portion **85***b* of drive face **80** slightly above ceiling **86***a* of holdback face **82,** puller arm **60** is rotated or positioned slightly more toward the horizontal when in a pulling position than when in holdback position. This tends to reduce the moment acting through power drive rollers **40, 40** connected to the drive chain. Also, moment forces from post **22** are resolved between surfaces **82** and **86** of arm **60** and not between stop **93** and clevis **46.**

Of additional interest, it will be appreciated that when puller arm **60** first begins engagement with drive post **22** on a level surface such as shown in FIG. **1,** the puller arm is pulled up over drive post **22** until it clears the lowermost point of holdback surface **82** wherein puller arm **60** drops down over the upper end **26** of drive post **22.** The abruptness of the vertical movement is reduced somewhat since it will first strike the top of post **22** in the holdback area. The upper surface will then be cammed along into surface **85***b*, thus easing it into its fully lowered driving position before drive face **80** strikes the post.

It will be appreciated that this invention provides a simple and dependable solution to the problems encountered in providing load carrier switching, accumulation, and ascent or descent on an inclined track portion with a safety lock on the inclines. The utilization of a secondary pusher arm **62** which is gravitationally urged into a retracted position simplifies the overall structure thereby reducing the overall cost. In addition, the utilization of a pair of identical clevises **46** to form the body of the bracket on the chain is adaptable for use with either puller arm **60** or pusher arm **62.** This likewise simplifies the power chain arrangement and reduces cost.

Although but one embodiment has been shown and described in detail, it will be obvious to those having ordinary skill in this art that the details of construction of this particular embodiment may be modified in a great many ways without departing from the unique concepts presented. It is, therefore, intended that the invention is limited only by the scope of the appended claims rather than by the particular details of construction shown, except as specifically stated in the claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows.

1. A power and free conveyor having trolley and power tracks spaced a constant distance from each other throughout the system and a driven propelling member mounted in said power track, at least one elongated load carrier supported on said trolley track for travel therealong, said load carrier having a primary drive post at its leading end and secondary drive post at its trailing end, a primary drive on said propelling member adapted to engage said primary drive post, an auxiliary drive on said propelling member spaced from said primary drive a distance greater than the spacing between said primary and secondary drive posts, the improvement in said conveyor comprising: said auxiliary drive having a pusher arm, said pusher arm having a weighted end and a drive end and means pivotally mounting said pusher arm intermediate said ends to said auxiliary drive, said pusher arm urged by its weighted end into a retracted position disengaged from both said primary and secondary drive posts; actuating means at selected positions along said conveyor for engaging said pusher arm to urge said pusher arm into an extended position and holding said pusher arm in said extended position; said pusher arm, when so extended, being engageable with said secondary drive post for transmitting motion from said propelling member to said load carrier.

2. A conveyor as described in claim **1** wherein said actuating means includes a rail means positioned adjacent said power track for engaging said weighted end of said pusher arm, said rail means including a ramp portion inclined upwardly for engagement with said weighted end of said pusher arm to urge said pusher arm into said extended position, said rail means including a second portion extending downstream from said ramp portion, said second portion being generally parallel to the direction of movement of said auxiliary drive and engageable with said weighted end to hold said pusher arm in said extended position.

3. A conveyor as described in claim **2** wherein said actuating means includes a second rail means defining a ramp portion spaced longitudinally from said first rail means, said second ramp portion being inclined downwardly for engagement with said weighted end of said pusher arm to urge said pusher arm into said retracted position to provide positive disengagement by said pusher arm from said secondary drive post.

4. A conveyor as described in claim **3** wherein said weighted end of said pusher arm includes a laterally projecting pin having a cam roller mounted on the end for engagement with said rail means.

5. A conveyor as described in claim **1** wherein said conveyor includes inclined track portions to provide relative vertical ascent and descent of said load carrier; said primary drive including a puller arm pivotally mounted thereon and urged by its gravitational weight into an extended drive engaging position, said puller arm including a downwardly opening socket having one wall defining a drive dog adjacent its rearward end and

a second wall defining a holdback dog adjacent its forward end, said walls being adapted for engagement with said primary drive post, said socket being non-compatible with said secondary drive dog, the upper surface of said socket having a downwardly offset portion adjacent said second wall to limit the distance said puller arm seats down over the primary drive post when the post is in engagement with said second wall; said upper surface having a smooth transition section between its forward and rearward portions for camming said puller arm on said drive post; said forward and rearward portions of said upper surface positioning said puller arm to provide straight-line force generation through said puller arm pivot.

6. A conveyor as described in claim **5** wherein said conveyor includes additional actuating means at selected positions along said conveyor for engaging said puller arm to urge said puller arm into a retracted non-drive engaging position; and means for preventing disengagement between said puller arm socket and primary drive post during movement of said load carrier along said inclined track portions.

7. A conveyor as described in claim **6** wherein said additional actuating means includes a rail means positioned adjacent said power track for intercepting a portion of said puller arm, said rail means including a ramp portion inclined upwardly for engagement with said portion of said puller arm to urge said puller arm upwardly into a retracted, non-drive engaging position, said rail means including a second portion extending downstream from said ramp portion, said second portion being generally parallel to the direction of movement of said puller arm and engageable thereby to hold said puller arm in said retracted position, said means for preventing disengagement between said puller arm socket and primary drive post comprising a second rail means similar to said second portion of said rail means spaced slightly above said portion of said puller arm when said puller arm socket is engaged with said primary drive post to prevent disengagement between said puller arm socket and primary drive post.

8. A conveyor as described in claim **5** wherein said propelling member includes a front and rear longitudinally spaced clevis interconnecting said puller and pusher arms to said power track, each of said clevis members being identical and adapted for receipt of either of said puller or pusher arm.

9. A conveyor having a power track and a propelling member movable along said power track; a puller arm having a lead end and a trailing end, said puller arm pivotally mounted adjacent its lead end to said propelling member; a load carrier movable along a load track, said carrier having a drive post projecting towards said puller arm, said puller arm at its trailing end having a socket formed therein to capture said drive post, said socket being longer than the fore and aft length of said drive post, said socket defining integral rearward drive and forward holdback faces spaced longitudinally from each other to provide and inhibit respectively movement of said carrier with respect to said puller arm when said drive post is captured in said socket, said socket having an upper surface extending between said drive and holdback faces, said upper surface having forward and rearward portions, the improvement comprising: said forward portion of said upper surface of said socket being downwardly offset adjacent said holdback face to restrict the depth or entry of said drive post into said socket when said holdback face is engaged with said drive post so that the pivot angle of said puller arm relative to said power track is larger when said arm is operable to pull said load carrier than when said puller arm is operable to hold back said load carrier.

10. A conveyor as described in claim **9** wherein said upper surface of said socket has a smoothly curved transition section between the forward and rearward portions thereof for camming said puller arm about the top of said drive post as said drive post shifts forwardly or rearwardly within said socket.

11. A conveyor as described in claim **10** wherein said rearward portion of said upper surface has a fore and aft length at least equal to that of the top of said drive post to permit said forward portion of said upper surface to rest on the top of said drive post when said drive post and said rearward drive faces are engaged.

12. A conveyor as described in claim **11** wherein a pin provides said pivotal mounting of said puller arm to said propelling member and said pivot angle of said puller arm both when said drive post is engaged with said drive face and when engaged with said holdback face is such that the forces generated about said pin pass through said pin eliminating bending movements about said pin.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3 800 709 Dated April 2, 1974

Inventor(s) Maynard J. DeGood, et al.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 7, Line 25:

After "approaching" insert --- puller ---.

Column 9, Line 10:

"as" should read --- so ---.

Signed and sealed this 10th day of September 1974.

(SEAL)
Attest:

McCOY M. GIBSON, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents