Aug. 26, 1969 S. J. GARTNER 3,463,329

MATERIAL TRANSFER DEVICE WITH PARALLEL LINK FRAME

Filed May 18, 1967 2 Sheets-Sheet 1

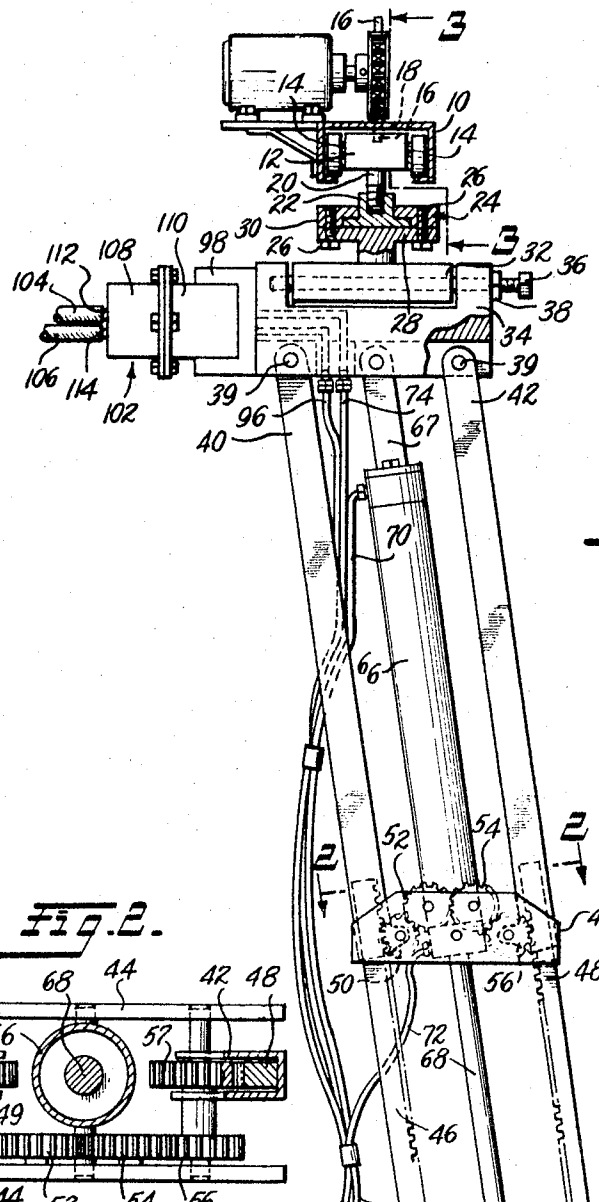


Fig. 1.

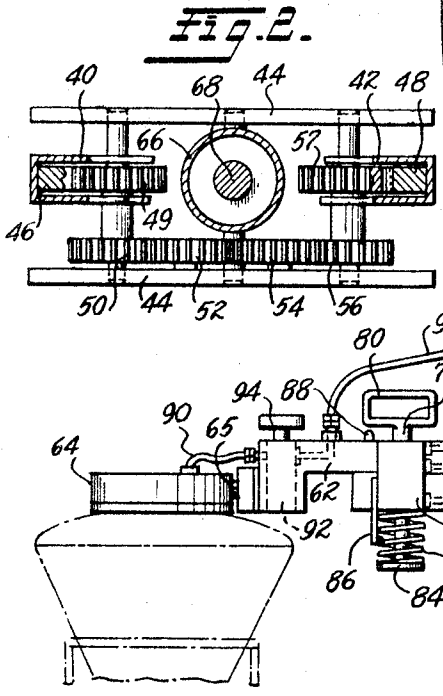


Fig. 2.

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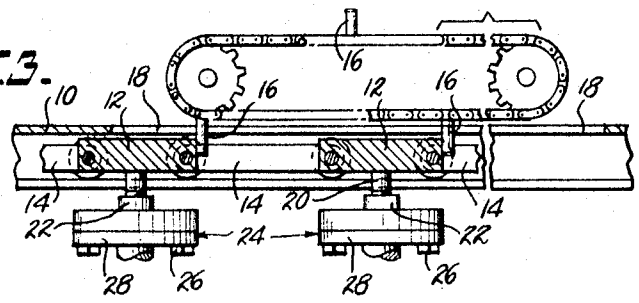
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MATERIAL TRANSFER DEVICE WITH PARALLEL LINK FRAME

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Fig. 3.



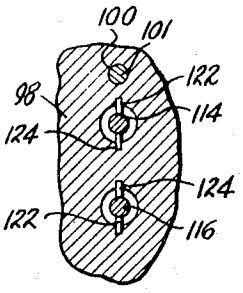


Fig. 5.

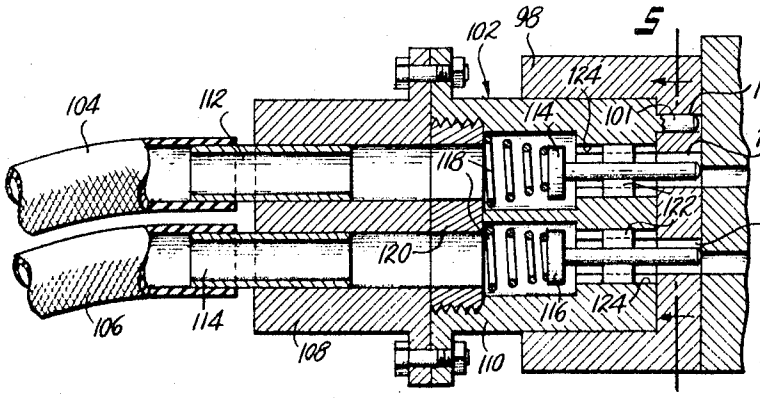


Fig. 4.

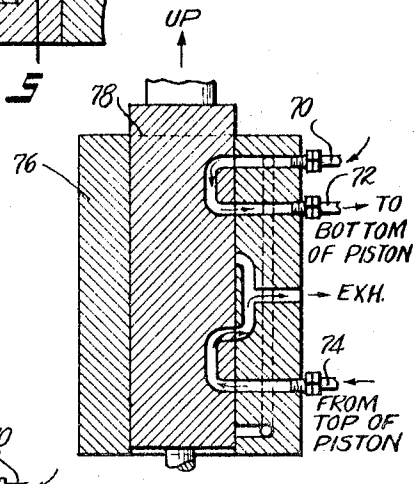


Fig. 8.

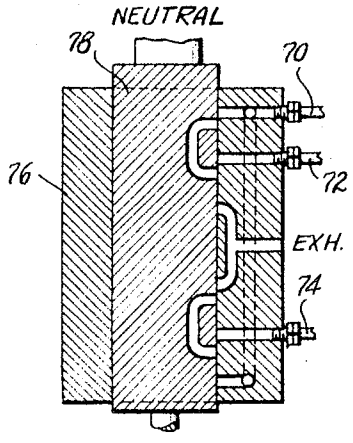


Fig. 6.

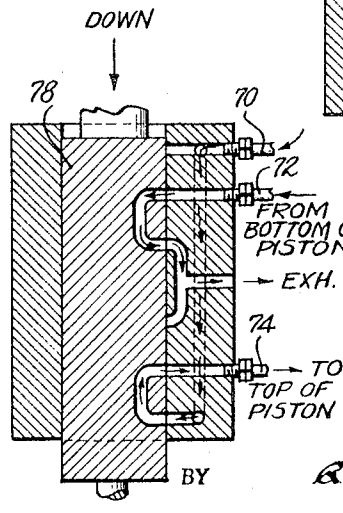


Fig. 7.

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3,463,329

MATERIAL TRANSFER DEVICE WITH PARALLEL LINK FRAME

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Int. Cl. B25j 5/02; B66c 1/02, 19/00
U.S. Cl. 214—1 13 Claims

ABSTRACT OF THE DISCLOSURE

A carrier depending from a roller carriage riding in a trackway has a universal connection with the carriage so that the carrier may at will be moved to any rotative position. The carrier supports at its lower end a suction head for causing objects as television picture tubes to adhere to the head, the carrier itself comprising a parallel link frame with means for enabling contraction and elongation of the frame. Said means and the varied movements of the frame is under control of a handle on the lower end of the frame.

BACKGROUND OF THE INVENTION

The invention relates to material handling devices particularly to devices for holding an object which is to be transferred from one location to another, which locations may be in different horizontal planes and which may also be located in out of vertical planes. As examples of structures approaching the above conditions, but not fully meeting them, note the following patents: 1,959,512, Wall et al.; 2,792,810, Maconeghy et al.; 2,867,185, Hayward.

SUMMARY OF THE INVENTION

The invention, in a specific aspect, is in an article handling device in which a support which may be fixed or be part of a travelling conveyor has connected to the support by means of a universal joint, a vertically telescopic frame in parallelogram form with pivoted joints between the links of the frame so that the angles between the links of the frame may be altered at will. The frame depends from its support and the side links or members thereof are telescopic so that the parallelogram side frame members can be shortened or lengthened. Means are provided on the frame to ensure equalized lengthening and shortening of the side members and a motor effects the change in size of the side members, the motor being under control of a handle mounted to move with the lower portion of the telescopic frame. The collapsing or expanding of the frame follows the direction of movement of the handle, up, to collapse the frame; down, to expand the frame, and, when the handle is in an intermediate position, to hold the frame against change in length. In addition structure is provided for arresting change in length of the frame when relative vertical movement ensues between the object holding means and the lower portion of the frame. The holding means is rotatively mounted on a horizontal axis and is a vacuum chuck whose suction is under control of a valve adjacent the handle. Movement of the handle in any direction will cause follow up movement of the frame whether it be about the universal joint, the pivotal connections of the parallelogram links or the telescopic movement of the side members of the frame.

It is an object of this invention to provide a means for attaining extreme flexibility in the transport of an article from one position to another.

Other objects will become apparent after consideration of the following specification when taken in conjunction with the accompanying drawings in which:

FIG. 1 is a side elevational view, partly in section, of the material transfer device of the present invention;

FIG. 2 is an enlarged horizontal sectional view taken on the line 2—2 of FIG. 1;

FIG. 3 is a fragmentary vertical sectional view taken on the line 3—3 of FIG. 1;

FIG. 4 is an enlarged fragmentary vertical sectional view of a detachable coupling for pressure and vacuum lines used in the device;

FIG. 5 is a fragmentary vertical sectional view taken on the line 5—5 of FIG. 4; and

FIGS. 6, 7 and 8 are diagrammatic views of the actuating valve showing the three positions thereof during manipulation of the transfer device.

Referring to the drawings in greater detail, at **10**, FIGS. 1 and 3, is a trackway supporting carriages **12** connected together by links **14** forming an endless chain which may be driven in any desired manner as by pins **16** extending downwardly from a motor driven chain and engaging in the spaces between the links and behind the carriages, the trackway for that purpose being slotted as indicated at **18**. Depending from each carriage and fixed thereto is a threaded stud **20** to which is screwed one member **22** of a rotatable coupling the other member **24** of which is fastened thereto in any suitable manner as by screws **26** passing through a planar portion or plate **28** of the other member and threaded into a circumferential overhanging lip **30** portion of the said other member. The plate **28** is integrated with a first member **32** of a second rotary coupling, the second member **34** of which is indicated as being U-shaped in elevation and pivotally connected to member **32** by a bolt **36** threaded at the right hand end as seen in FIG. 1, into coupling member **34** and provided with a lock nut **38**. The two couplings form a universal connection.

Pivotally connected to the coupling member **34** of the second coupling, as indicated at **39**, is a pair of channel irons **40** and **42** (see FIG. 2) each pivoted at its lower end by a rotatable shaft affixed to parallel spaced apart gear support plates **44**. The channel irons between their pivot points are of equal length and are parallel to each other whereby the coupling member, channel irons **40** and **42** and plates **44** form a parallel link frame with plates **44** parallel to member **34** regardless of the angularity of the channel irons. The pivots **39** are arranged to be at the same horizontal level.

Guided within the channel irons is a pair of racks **46** and **48** whose motions are coordinated for simultaneous equal telescopic displacement with respect to the channel irons **40** and **42** by a train of gears **49**, **50**, **52**, **54**, **56** and **57**, the gear **49** meshing with the rack **46** and fixed on the same rotatable shaft as gear **50**, also fixed to that shaft, the gear **52** meshing with gears **50** and **54**, gear **54** meshing with gear **56** fixed on a rotatable shaft to which a second gear **57** is fixed, said gear **57** meshing with rack **48**. To the lower end of the racks is pivoted a platform **58**, the platform being arranged so that when the racks, gears and channel irons are assembled, it is parallel to the plates and member **34**, wherefore the entire frame consisting of parts **34**, telescopic channel irons **40**, **42**, racks **46**, **48** and platform **58** includes a parallel linkage motion with the platform horizontal regardless of the angularity of the links **40**, **46** (or **42**, **48**), or of the degree of telescopic collapse of the frame.

The platform **58** extends toward one side of the parallel links, as toward the left, FIG. 1, and is provided along its length but short of the left hand end thereof with a pair of ears **60** pivotally mounting a chunk supporting arm **62**, normally gravitationally resting on the platform in a horizontal position. The free end of the arm is provided with any desired means for grasping an object, here shown as a suction head **64** adapted to cause ad-

herence of the face of a television picture tube to the head. The head is attached to the arm by a swivel joint **65** so that the chuck may be rotated about a horizontal axis.

Hand movement follow up mechanism is provided to control the telescopic movement of the frame. On a line with the pivots **39** is pivoted a bracket **67** rigid with the cylinder **66** of a fluid pressure motor, the lower end of the cylinder being pivoted to the plates **44** on a horizontal line with the lower pivots of channel irons **40** and **42** and midway therebetween, the cylinder of the motor being parallel to the channel irons. The piston rod **68** of the motor is pivoted to the platform **58** on a line with the lower pivots of the racks **46** and **48** and midway therebetween. The motor is a double acting fluid pressure motor and ducts **70** and **72** therefrom as well as a third duct **74** from the coupling member **34** lead to a valve body **76** mounted on the platform **58**. A valve stem **78** by vertical reciprocating motion controls the application of pressure to the two ends of the cylinder and the simultaneous venting of the opposite ends of the cylinder.

The ports in the valve stem and in the body are so arranged that in normal position the valve stem is positioned to block off flow of fluid into or out of either end of the cylinder, as shown in FIG. 6. The frame size is therefore unchanged. In the down position of the valve stem, see FIG. 7, the bottom of the cylinder is vented while the top of the cylinder is supplied with fluid pressure, as air, and the frame therefore elongates. In the up position of the valve stem, see FIG. 8, the bottom of the cylinder is supplied with air under pressure and the top of the cylinder is vented, wherefore the frame collapses. Accordingly, the frame will be expanded or telescoped in accordance with the direction of movement of the valve stem. To facilitate movement of the valve stem, the same is provided with a handle **80**, FIG. 1, and to bias the stem to the neutral position shown in FIG. 6, when the handle is released, there is provided a spring **82** interposed between an abutment disc **84** fixed on the stem **78** and the body **76** of the valve, the spring being held immovable at the center portion of its length by being welded at that portion to a bar **86** fastened to the valve body. Thus the spring **82** tends to centralize the valve stem. On the upper surface of the arm **62** is a rigid projection **88** underlying the handle and normally spaced therefrom. Should the valve stem be depressed as in the position shown in FIG. 8, and the chuck **64** approach too close to the support on which the object, as a TV picture tube, supported by the chuck is to be placed, the arm **62** will tilt about the pivot in ears **60** causing the projection **88** to force the stem upwardly against the hand holding force applied thereto, thereby stopping further outward movement of the piston rod **68** from the cylinder.

The chuck **64** is supplied with air under sub atmospheric pressure by means of a duct **90** connected to a three way rotary valve **92** provided with a cross handle **94**, the suction line indicated as **96** being ganged with the other air lines **70**, **72**, **74** to form a cable for the sake of neatness. The pressure line **74** and vacuum line **96** are connected to outlets or ports in the block **34**, these ports leading to a box **98**, see FIGS. 4 and 5, mounted on the side of member **34**. The box is a square receptacle with two ports **74'** and **96'** connecting with the lines **74** and **96** and a pin receiving hole **100** to cooperate with a pin **101** on a coupling valve member **102**, the member **102** and box **98** providing means for attaining a quick detachable coupling of pressure feed line **104** and vacuum feed line **106** to the member **34**. The block **102** is comprised of a flanged member **108** cooperating with a second flanged member **110**, the two flanges of these members being bolted together. The fluid feed lines **104**, **106** are coupled to nipples **112** frictionally held in the member **108**. In member **110** there is provided a pair of valves **114** and **116**. Each valve has a valve stem which when the block **102** and box **98** are connected together will force the valve head off its seat against the resistance of a conical spring **118** interposed between the head of a valve and a washer **120** screwed into the member **110**. The holes in the washers communicate with the holes in the nipples **112**. To guide the valve stems of the valves, each stem is provided with a flat key **122** riding in grooves **124**, see FIGS. 4 and 5, in the member **110**.

The material handling device just described may be one employed in conjunction with the transport of a picture tube through a machine in which machine many processes are performed upon the picture tube at successive stations such as exhausting the envelope and tipping it off, heating the electrodes in the picture tubes to degassify them, exploding the getter, etc., and wherein after such transport in the machine the picture tube is to be transferred from the conveyor to another conveyor or other receiver. In the transfer process it may be necessary to rotate the carrier for the picture tube or change the elevation of the chuck, all of which may be effected with the disclosed structure while maintaining the chuck in horizontal position. Where the collapsible frame is supended from a conveyor, an attendant will appropriately couple and uncouple the members **98**, **102** at the transfer station. Obviously, the transfer device described need not be supported by a carriage of the chain. The member **22** of the rotary coupling may be screwed onto a fixed stud adjacent the area of transfer of the objects and the transfer device used to transfer an object as from one conveyor to a second conveyor. In the event that the carrier is not transported with the chain, the coupling **98**, **102** may be connected together permanently. Rotation of control valve handle **94** will apply suction to chuck **64** or releive the suction. Manipulation of handle **80** will effect universal movement of the chuck except rotative movement about a horizontal axis and the valve controlled by the handle will automatically be reset to fluid pressure to motor locked position upon downward movement of the chuck being resisted.

I claim:

1. In a transfer device, a support, a frame connected to said support and a chuck carried by said frame; said frame being in the form of a parallelogram with upper and lower parallel end members and two parallel telescopic side members pivoted to the upper and lower end members, a motor for effecting telescoping movement of the side members, means including a rack on each of like portions of the side members for equalizing the extent of movement of the telescopic side members, a bridge mounted on and between the like portions of the side members having pivoted gears carried by the bridge with said gears intermeshing with one another and with the rack to produce like direction and extent of movement of both rack provided portions of the side members, an object retaining means carried by the lower member and means for controlling said motor, said means for controlling said motor comprising a control member mounted on the lower member, said control member having an upper, an intermediate, and a lower position in accordance with which position said side members contract in length, are fixed in position, or extend in length.

2. The structure of claim **1** wherein the control member is a device having a slide member movable in a body portion affixed to a part movable with the lower end member.

3. The structure of claim **2** wherein the object retaining means is carried by a cantilever arm pivoted to the part movable with the lower end member and normally supported in horizontal position by said part, and said slide member is provided with a handle engageable by a portion movable with the cantilever arm when the downward movement of the arm is resisted and while the lower end frame member is moving downward, said engagement of the parts tending to raise the handle and slide member.

4. The structure of claim 1 wherein the connection between the support and the frame includes a universal joint.

5. The structure of claim 1 wherein the connection between the support and the frame includes a universal joint.

6. The structure of claim 1 wherein the support is a carriage forming part of an endless chain.

7. The structure of claim 1 wherein the support is a carriage forming part of an endless chain.

8. The structure of claim 1 wherein the motor is a double acting fluid pressure motor having a cylinder and piston rod and the control member is a slide ported to admit fluid pressure to the upper portion of the cylinder while simultaneously venting the lower portion of the cylinder when the slide is in a fully down position, operate in reverse when the slide is in a fully up position and trap the fluid pressure in both ends of the cylinder when the slide in in an intermediate position.

9. The structure of claim 8 in which the slide is spring biased to said intermediate position.

10. The structure of claim 1 wherein the motor is a double acting fluid pressure motor having a cylinder and piston rod and the control member is a slide ported to admit fluid pressure to the upper portion of the cylinder while simultaneously venting the lower portion of the cylinder when the slide is in a fully down position, operate in reverse when the slide is in a fully up position and trap the fluid pressure in both ends of the cylinder when the slide is in an intermediate position.

11. The structure of claim 10 in which the slide is spring biased to said intermediate position.

12. The structure of claim 1 in which the object retaining means is connected to the frame by a swivel joint.

13. The structure of claim 5 in which the object retaining means is connected to the frame by a swivel joint.

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U.S. Cl. X.R.

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