

[54] **MAGNETIC CABLE TAKEUP DEVICE**

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[51] Int. Cl. **B66d 1/36**

[58] Field of Search 187/20, 22, 95, 81;
254/190 R, 135 R, 147, 138; 212/3 R;
226/94 R, 93 R; 191/29, 22, 28; 174/135 R

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[57]

ABSTRACT

Apparatus for magnetically restraining the lateral movement of a flexible cable or conduit the ends of which are respectively attached to structures which move relative to each other, particularly using magnets to prevent lateral movement of a vertically extending elevator car cable.

9 Claims, 7 Drawing Figures

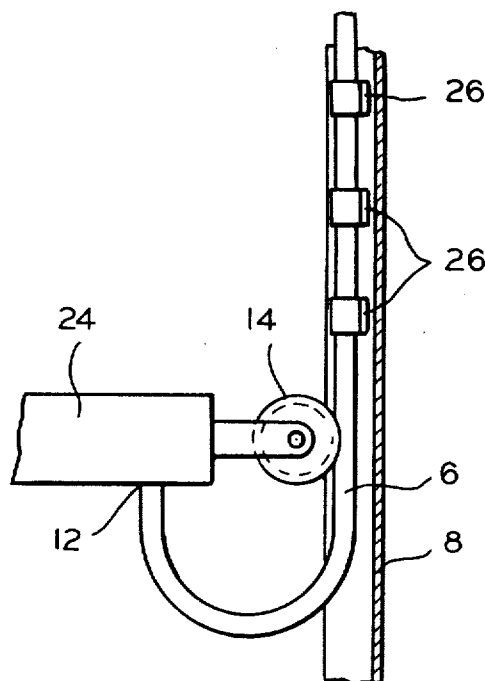


FIG. 1

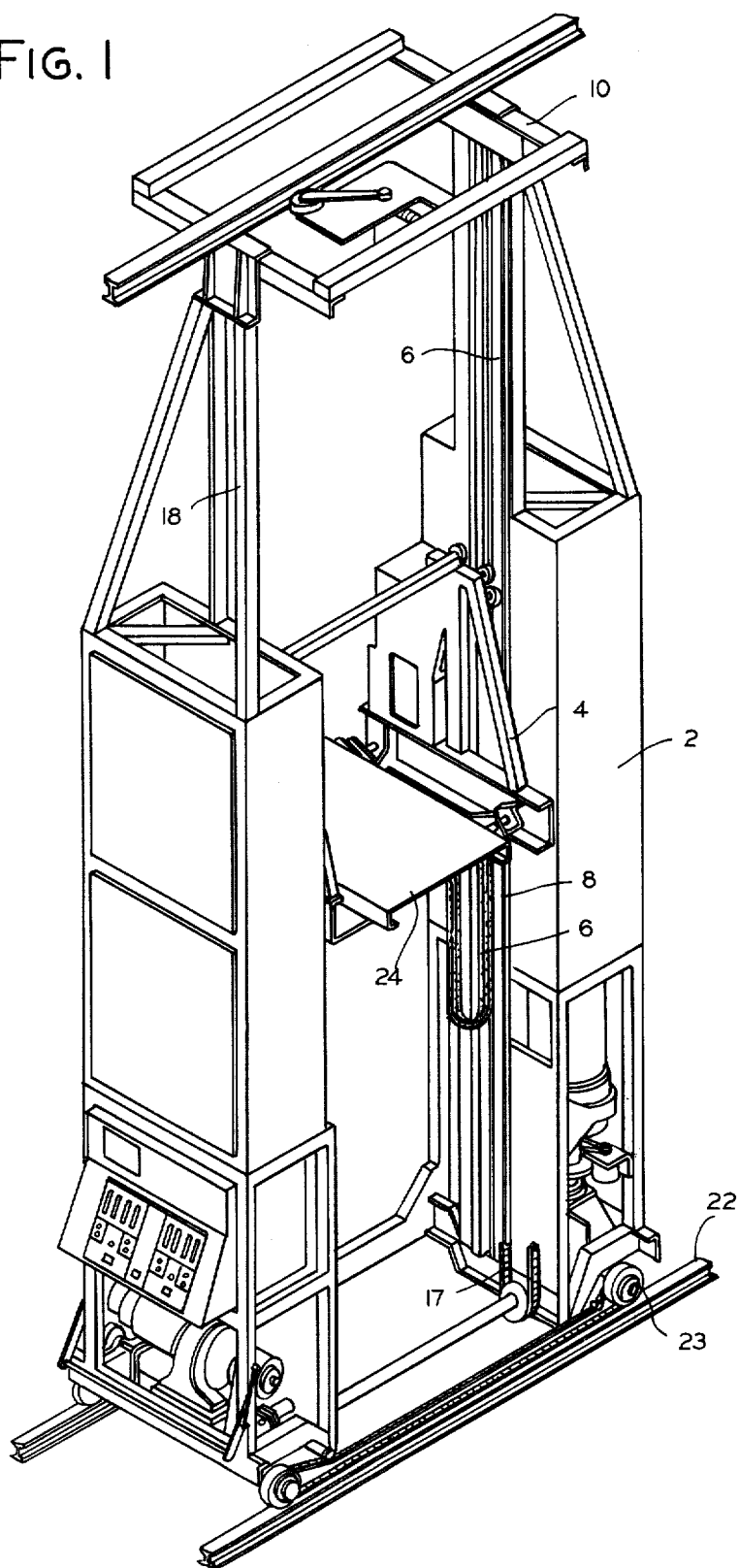


FIG. 2

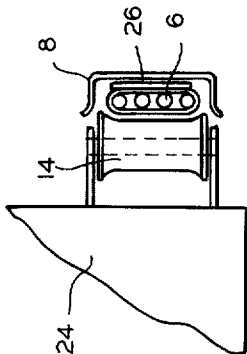


FIG. 4

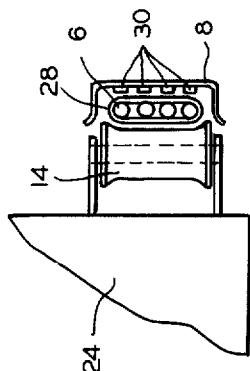


FIG. 6

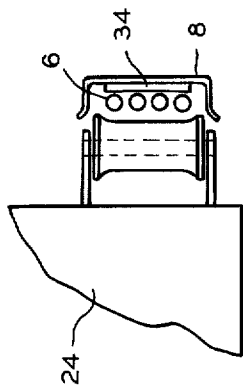


FIG. 3

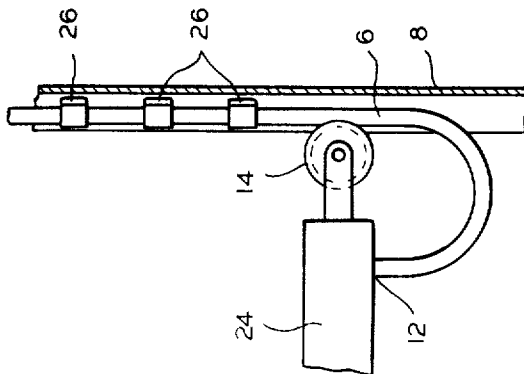


FIG. 5

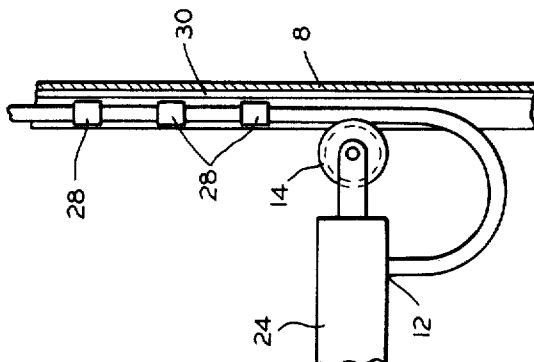
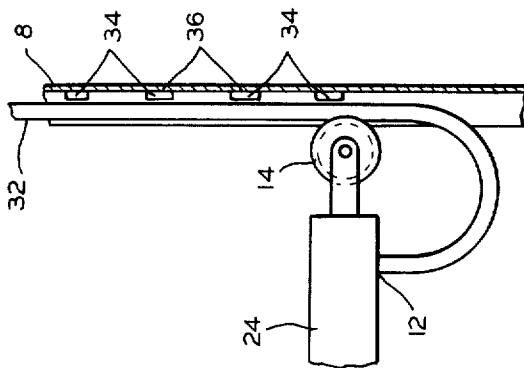


FIG. 7



MAGNETIC CABLE TAKEUP DEVICE

BACKGROUND AND SUMMARY OF THE INVENTION

The present invention relates to apparatus for restricting the movement of flexible cables or conduits connecting an energy source to an energy consumer movable in relation thereto and more specifically relates to magnetic holding means to prevent distortion and lateral movement of flexible cables or conduits on elevators, cranes, construction machinery and the like.

Material handling elevators normally have flexible conduits or cables depending from the elevator supporting structure to furnish energy and control signals to the elevator which moves vertically relative to the elevator supporting structure. The elevator supporting structure in many storage systems is a carriage moving on rails and as it moves, inertia forces tend to cause the flexible cables to move laterally unless restrained. When they move laterally they may become entangled with or interfere with the elevator and the material being elevated. If some means of restricting the movement of cables and hoses is not provided, the twist inherent in these conduits makes itself felt in an annoying manner by the conduits tending to twist and interfere with the movement of the elevator and its load.

Previously guided weights and springs have been utilized to keep elevator power and control conduits taut and thus restrict their lateral movement. These weights or springs place undue stress on the conduit connections and results in wear and potential breakage. Also mechanical guiding means such as shown in U.S. Pat. No. 3,219,317 Merker, have been used to mechanically restrict the movement of the conduits or cables. These mechanical means are expensive and also add to the wear on the cables or conduits.

In the present invention, magnetic means are used to cause the flexible energy conduit or cable to adhere against a restraining member so it will not move laterally into the path of the elevator. As the elevator moves vertically, the flexible conduit or cable is "peeled" from the rigid restraining member to allow the cable to follow the elevator as it proceeds up the shaft.

In one form of the invention, the conduit has magnets thereon and the channel shaped rigid restraining member which extends parallel to the movement of the elevator is made from a material of low magnetic reluctance.

In another form of the present invention the magnets are located in the gutter of a channel shaped restraining member with the metallic shield on the conduit or cable being attracted to these magnets.

It is therefore an object of the present invention to provide a magnetic means for restricting the lateral movement of a flexible conduit or cable.

It is another object of the present invention to provide a means for restricting the lateral movement of a flexible cable or conduit extending between the two members that move relative to each other.

It is to another object of the present invention to provide a means for restricting the lateral movement of a flexible cable or conduit while imposing minimum stress on the conduit or cable.

It is until further object the present invention to provide a flexible cable for automatic storage system stacker vehicles having magnets located on the conduit and utilizing a rigid conduit restraining member having

low magnetic reluctance to control the lateral movement of an electrical cable or flexible conduit extending from the top of the stacker carriage to the elevator car.

Further objects of the present invention will become apparent upon the inspection of the drawings and specifications and will be pointed out in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS:

Referring to the figures on the drawings:

FIG. 1 is a general arrangement view of a material storage system stacker utilizing the present invention.

FIG. 2 is a horizontal cross section view of a first embodiment of the present invention.

FIG. 3 is a vertical cross section view of the first embodiment of the present invention.

FIG. 4 is a horizontal cross section view of a second embodiment of the present invention.

FIG. 5 is a vertical cross section view of this second embodiment of the present invention.

FIG. 6 is a horizontal cross section view of a third embodiment of the present invention.

FIG. 7 is a vertical cross section view of a third embodiment of the present invention.

Referring briefly these figures in the drawings where like numerals refer to like items, 2 is a representative automatic storage system stacker vehicle of the type shown in U.S. Pat. No. 3,503,476, Burch et al. 6 in each of these figures refers to electrical, hydraulic, or pneumatic cables or conduits which are attached to the upper structure of the stacker 2 and to the lower edge 12 of the platform 24 on the elevator 4 carried by the stacker 2. 8 is a vertically extending rigid conduit restraining member which is attached to the stacker 2. 14 are rollers attached to the elevator platform 24 to guide the conduits 6 into the proximity of the restraining member 8 when the elevator 4 is descending.

SPECIFIC DESCRIPTION OF INVENTION

Referring specifically to FIG. 1, a material and handling storage system stacker vehicle 2 which may move along a path over rails 22 by a known moving means (not shown) on wheels 23. This stacker has an elevator 4 having a material support platform 24. It has means for raising and lowering the elevator on the stacker including a driving means (not shown) for driving supporting chains 17 and 18.

Referring now to FIGS. 2, 3, 4, 5, 6 and 7 where like numerals refer to similar items. 6 represents conduits and in this particular instance represents electrical cables carrying electrical energy from the fixed position 10 on the carriage 2 (FIG. 1) to the position 12 on the elevator platform 24. 8 represents a rigid conduit or cable restraining member extending parallel to the direction of movement of the elevator car 4. 14 represents a roller on the elevator platform 24 which guides the cable 6 into the channel formed in the restraining member 8.

Now referring more particularly to the first modification of the present invention as shown in FIGS. 2 and 3. In this modification magnets 26 are secured at spaced positions along the cables 6. The rigid channel shaped conduit restraining member 8 extends vertically parallel to the path of the elevator 4 and is made of mild steel or other material having low magnetic reluctance material. In the alternate, the member 8 may have a low reluctance material facing to which the

magnets 26 will be attracted. In this modification of the invention, the magnets 26 cling to the rigid conduit restraining member 8 to restrict the lateral movement of the electrical energy cable or conduits 6 to which the magnets 26 are attached. The magnets 26 cling to the rigid conduit restraining member 8 thus holding the conduits 6 against the member 8 to restrain lateral movement of the cables or conduits until the elevator platform 24 proceeds upwardly to such position as to pull the magnets 26 away from the member 8.

When the elevator 4 is again lowered, the rollers 14 guide the flexible energy conduits or cables 6 with their attached magnets 26 into the channel portion of the rigid conduit restraining member 8 to a position at which the magnets 26 attach themselves to the member 8.

Referring now particularly to the second modification of the present invention as shown in FIGS. 4 and 5 the flexible energy conduits or cables 6 are banded together by metallic bands 28 of low reluctance material spaced along the length of the cables 6. This material in the preferred embodiments is mild steel. The rigid conduit restraining member or channel 8 has attached thereto vertically extending magnets 30 to which the metallic bands 28 are attracted. In this modification of the present invention the conduits 6 are held against the member 8 to restrict their lateral movement until the movement of the elevator platform 24 upwardly pulls the metal band 28 away from the magnets 30. Conversely when the elevator platform 24 descends the guide rollers 14 force the conduits 6 with their attached metallic bands 28 into the vicinity of the magnets 30 so that bands 28 become attached to the magnets 30.

Referring now to the third embodiment of the present invention as shown in FIGS. 6 and 7. In this embodiment of the invention the flexible energy conduits 6 are encased in a flexible metallic armor 32 of steel or other low magnetic reluctance material. The rigid conduit restraining channel member 8 has attached thereto a plurality of magnets 34 and 36 extending transverse the member 8. The bar magnets 34 and 36 may have their magnetic poles reversed so that the north poles of the magnets 36 are aligned with the south poles of the magnets 34. In this manner of magnet alignment, the magnetic lines of flux travel vertically through each of the metallic armors 32 on the conduits 6.

The magnets 34 and 36 are permanently attached to the channel in the member 8 and attract the armor 32 of the conduits 6 so as to limit the lateral movement of these cables until the vertical movement of the platform 24 pulls these cables away from the magnets 34 and 36. When the platform 24 descends the rollers 14 guide the cables 6 and their attached armor 32 into the proximity of the magnets 34 and 36 so that they are again magnetically attached to the magnets.

It may thus be seen in each of the modifications of the present invention that the flexible energy conduits 6 are magnetically restrained from moving away from the rigid conduit restraining member 8 until the vertical movement of the elevator 4 breaks the magnetic field attaching the cables to the member 8.

The present invention thereby provides a magnetic means for attracting a flexible energy conduit to a rigid conduit restraining member which extends in the direction of the movement of the movable member to

thereby prevent lateral movement of the flexible energy conduit.

Having thus described the preferred embodiment of the present invention it will, of course, be understood that various changes may be made in the form, details, arrangement and proportion of the parts thereof without departing from the scope of the invention which consists of the matter shown and described herein and set forth in the appended claims.

I claim:

1. Apparatus for magnetically restricting the lateral movement of a flexible energy conduit extending between an energy source and an energy consumer movable with relation thereto including:

- an energy source,
- an energy consumer capable of movement relative to said energy source,
- a flexible energy conduit extending between said energy source and said energy consumer,
- a rigid conduit restraining member extending in a plane substantially parallel to the path of relative movement between said energy consumer and said energy sources,
- magnetic means for magnetically attracting said flexible energy conduit to said conduit restraining member and restricting the lateral movement of said conduit from said restraining member,
- whereby said conduit is held against said restraining member and allowed to be removed therefrom against the force of said magnetic means as said energy consumer moves relative to said fixed energy source.

2. Apparatus for magnetically restricting the lateral movement of a flexible energy conduit extending between an energy source and an energy consumer movable with relation thereto as claimed in claim 1 in which:

- the magnetic means attracting said flexible energy conduit to said conduit restraining member includes a portion of said conduit having magnets arranged along the length thereof and,
- said conduit restraining member having a portion thereof made from material having low magnetic reluctance.

3. Apparatus for magnetically restricting the lateral movement of a flexible energy conduit extending between an energy source and an energy consumer movable with relation thereto as claimed in claim 1 in which:

- the magnetic means attracting said flexible energy conduit to said conduit restraining member includes,
- material having a low magnetic reluctance extending along the length of said flexible energy conduit and,
- magnets extending the length of said rigid conduit restraining member.

4. Apparatus for magnetically restricting lateral movement of a flexible energy conduit extending between an energy source and an energy consumer movable with relation thereto as claimed in claim 1 in which:

- said flexible energy conduit is encased in a flexible armor containing material having low magnetic reluctance and,

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said conduit restraining member has included thereon magnets capable of attracting said armor to said conduit restraining member.

5. Apparatus for magnetically restricting the lateral movement of a flexible energy conduit extending between an energy source and an energy consumer movable with relation thereto as claimed in claim 1 in which:

said flexible energy conduit has attached thereto a series of spaced members of material having low magnetic reluctance and, said conduit restraining member includes magnets attached thereto.

6. Apparatus for magnetically restricting the lateral movement of a flexible energy conduit extending between an energy source and an energy consumer movable with relation thereto as claimed in claim 1 in which:

said rigid conduit restraining member has a channel shaped opening into which said flexible energy conduit is contained when said energy conduit is restrained against said restraining member.

7. Apparatus for magnetically restricting the lateral movement of a flexible energy conduit extending between an energy source and an energy consumer movable

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able with relation thereto as claimed in claim 1 including:

a guide member attached to said energy consumer and movable therewith capable of urging said flexible energy conduit into the proximity of said conduit restraining member as said energy consumer moves with relation to said energy source.

8. Apparatus for magnetically restricting the lateral movement of a flexible energy conduit extending between an energy source and an energy consumer movable with relation thereto as claimed in claim 2 in which:

the magnetized members on said conduit are spaced permanent magnets.

9. Apparatus for magnetically restricting the lateral movement of a flexible energy conduit extending between an energy source and an energy consumer movable with relation thereto as claimed in claim 7 in which:

said means for urging said flexible energy conduit toward said conduit restraining member is a roller having its axis in a plane normal to the direction of relative movement between said energy source and said consumer.

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