May 10, 1966 K. PALME 3,250,962

PERMANENT MAGNET LIFTING DEVICE

Filed Jan. 15, 1964 2 Sheets-Sheet 1

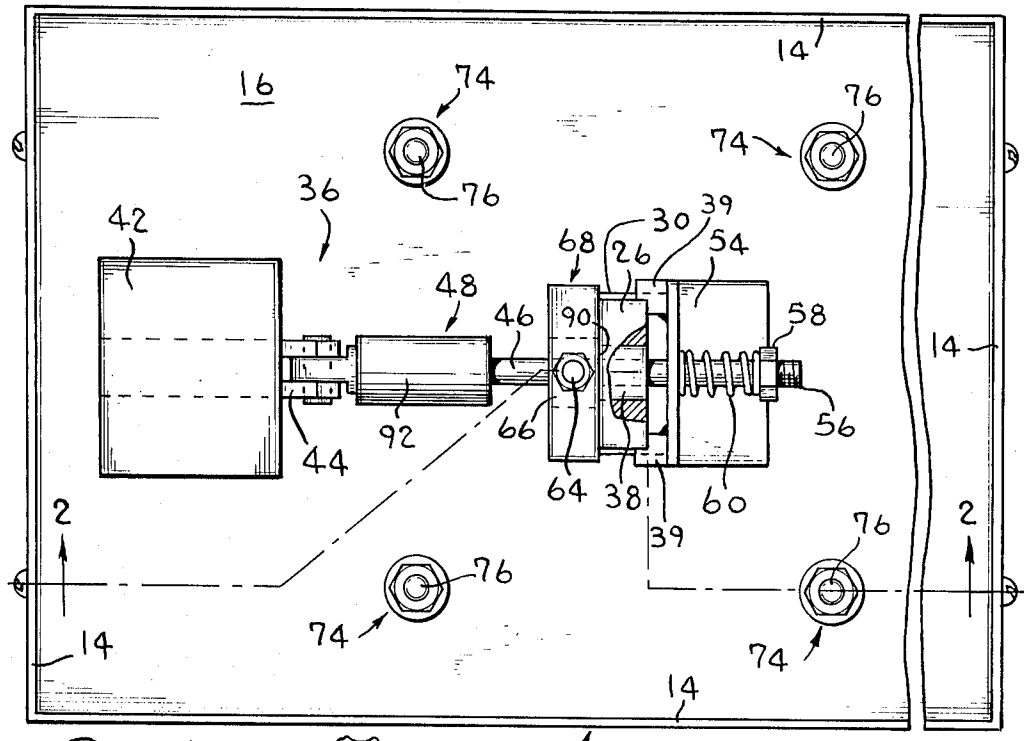


FIG. 1

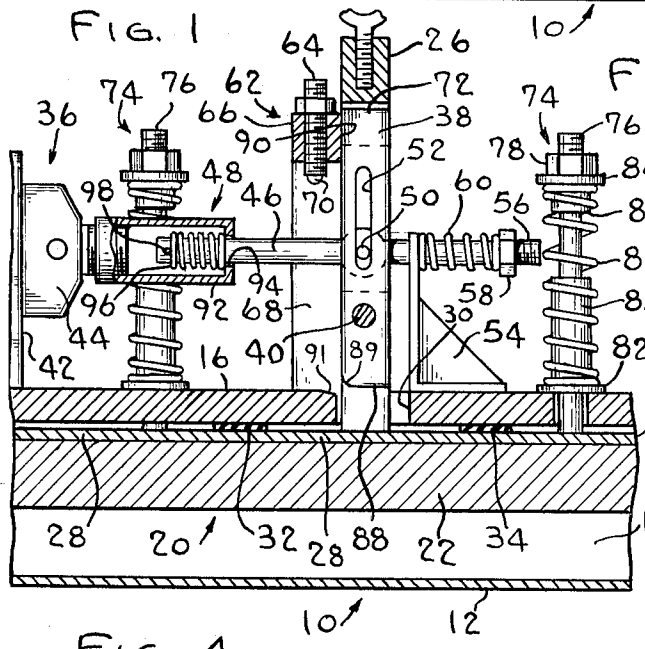


FIG. 4

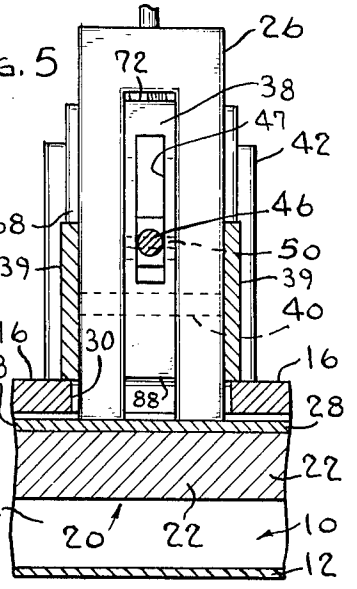


FIG. 5

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PERMANENT MAGNET LIFTING DEVICE

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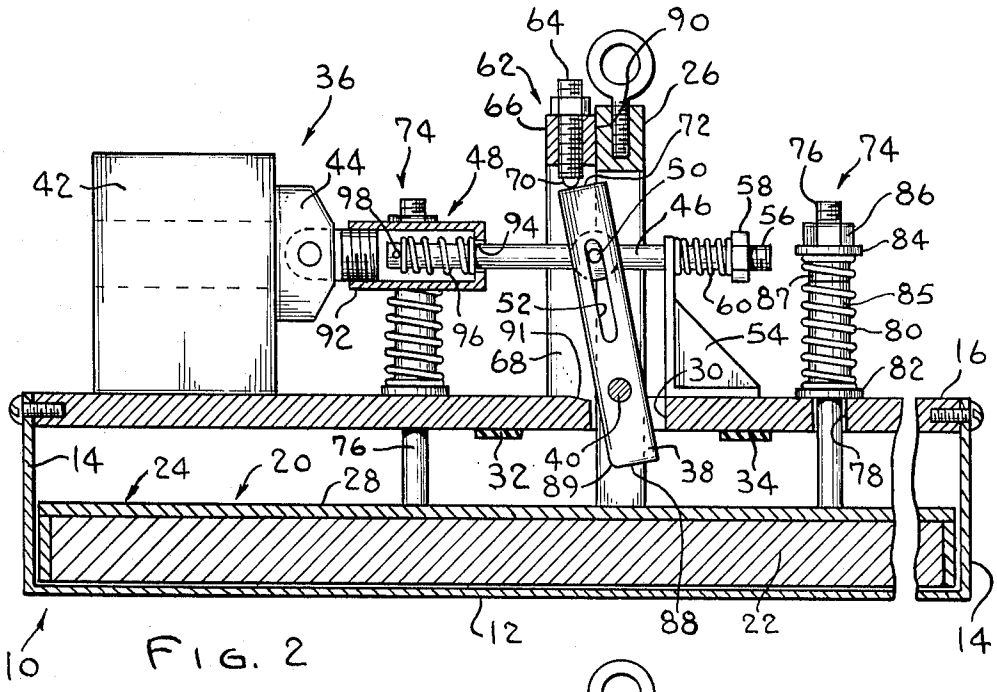


FIG. 2

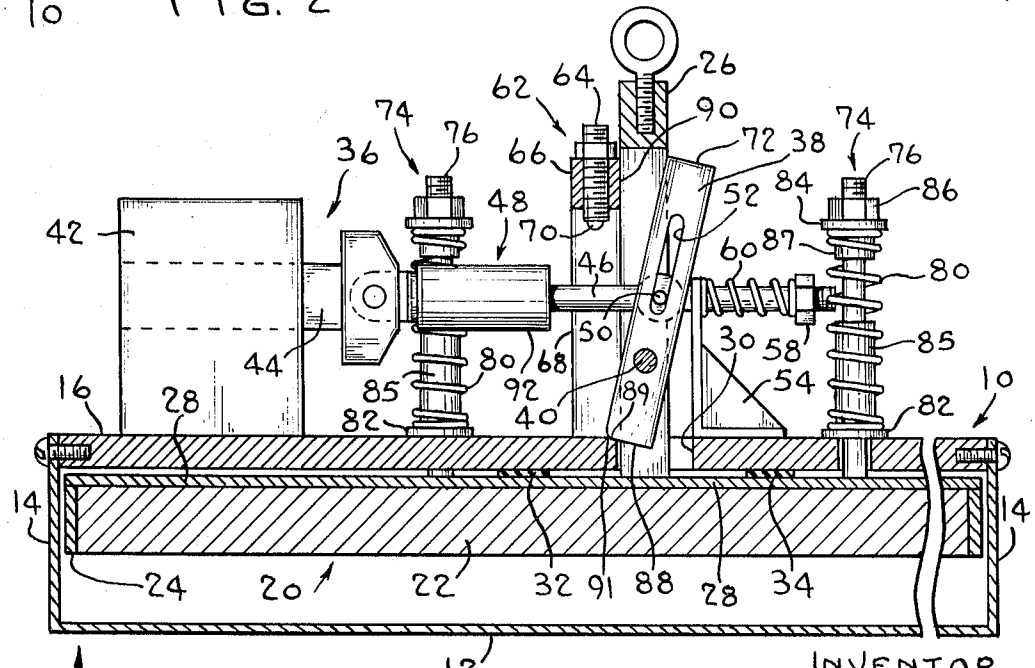


FIG. 3

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PERMANENT MAGNET LIFTING DEVICE

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17 Claims. (Cl. 317—164)

This invention relates to a permanent lifting magnet.

Permanent lifting magnets have certain recognized advantages over electromagnet lifting devices, for example, simplicity of design and economy of operation, both of which result primarily from the fact that permanent lifting magnets do not require a steady flow of relatively high current during operation. Furthermore, permanent lifting magnets have an inherent safety advantage in that a power failure during operating does not effect their holding power whereas with an electromagnet it could result in premature release of the load. However, permanent lefting magnets of heretofore accepted construction do have a disadvantage as compared to electromagnets, namely in that they lack the selectivity and versatility of control available from electromagnets.

A general object of this invention is to provide an improved permanent lifting magnet construction.

Another object of this invention is to provide a permanent lifting magnet which affords the selectivity and versatility of control of an electromagnet while maintaining simplicity and economy of design and without sacrificing the inherent safety of a permanent lifting magnet.

For the achievement of these and other objects, this invention proposes to provide a permanent lifting magnet wherein a magnet is movable relative to a load engaging surface to assume either an operative position adjacent the load engaging surface or an inoperative position spaced from that surface wherein a load adjacent the load engaging surface will be outside of the attractive force of the magnet. The permanent lifting magnet is adapted for connection to an external lifting force and, preferably in such a manner that movement of the magnet between its operative and inoperative positions is in accordance with the applied lifting force. Control means is also provided which is operable selectively to hold the magnet in both its operative and inoperative positions or to release the magnet for movement between those positions.

The novel features of this invention are set forth in the appended claims. The invention itself, together with additional objects and advantages thereof, will be more clearly understood from a reading of the following description in connection with the accompanying drawings wherein a preferred embodiment of this invention is illustrated and in which:

FIG. 1 is a top plan view of a permanent lifting magnet constructed in accordance with the teachings of this invention;

FIG. 2 is a section view taken generally along line 2—2 of FIG. 1 illustrating the magnet in its operative position;

FIG. 3 is a similar section view illustrating the magnet in its inoperative position;

FIG. 4 is another similar section view illustrating an abnormal condition of the lifting magnet wherein the control means is prematurely actuated with the magnet elevated; and

FIG. 5 is a partial section taken along line 5—5 of FIG. 4.

A permanent lifting magnet constructed in accordance with this invention will have many applications and is not necessarily limited to any particular application. For this reason, only broad reference to a load and not a particular application will be made in the following description.

As illustrated in the drawings, a permanent lifting magnet includes a hollow housing 10 comprising a lower load engaging face 12, side walls 14 and a back plate 16 attached to side walls 14 in spaced relation from face 12. A permanent magnet assembly 20 is disposed within the housing and structurally includes magnet portion 22, which can be of any well-known construction such as being made of one or more ceramic or ferro-magnetic members, and support structure 24 which preferably encloses all but the lower face of the magnetic portion for optimum transference of magnetic flux. In FIG. 2, the magnet assembly is in its operative position adjacent lower face 12 of the housing. As illustrated in the drawings, face 12 and side walls 14 are integrally formed, and are preferably made of a suitable non-magnetic material, such as stainless steel, so as not to interfere with the magnetic field. With this construction and with the magnet positioned as illustrated, a load positioned in engagement with face 12 will be within the attractive field of the magnet and will be held in engagement with face 12 for joint movement with the permanent lifting magnet.

The magnet assembly 20 is free for movement within housing 10 and can be moved to assume either the operative position of FIG. 2 or the inoperative position of FIG. 3. More particularly and as will be described more completely hereinafter, magnet assembly 20 is movable away from face 12 to a position adjacent back plate 16 whereupon a load positioned adjacent face 12 will be spaced a sufficient distance from the magnet to be outside of the influence of its magnetic field. Therefore, movement of the magnet to its inoperative position will release the load which had been attracted to face 12 and, with the magnet so positioned, the lifting magnet can be moved as desired without attracting a load.

To effect movement of the magnet assembly, post 26 is attached to upper plate 28 of support structure 24 and extends through opening 30 in back plate 16 of the magnet housing for connection to an external lifting force such as an overhead crane (not shown). Assuming the permanent magnet assembly to be in its operative position, a lifting force applied to post 26 initially moves only permanent magnet assembly 20 relative to housing 10 and from its operative position into its inoperative position. After the permanent magnet assembly engages back plate 16, rubber spacers 32 and 34 being provided to cushion, this engagement, a further lifting force on post 26 will produce vertical movement of the entire permanent lifting magnet assembly. Similarly, when the lifting magnet is subsequently lowered, face 12 will come to rest on a suitable support structure or load and further lowering movement allows the permanent magnet assembly to drop to its operative position.

In order to provide selective control over the operation of the permanent lifting magnet to permit it to pick up, carry and/or release a load as desired, an electromechanical control is provided which includes solenoid actuator 36, lever 38 pivotally mounted on a pin 40 fixed on post 26, and return compression spring 60. The solenoid actuator is fixed on back plate 16 and is of well-known construction including coil assembly 42 and plunger 44. Plunger 44 is connected to operating rod 46 through lost motion coupling 48, the construction and function of which will be described more completely hereinafter. Rod 46 extends through an elongated slot 47 in lever 38. A pin 50 is connected to and movable with rod 46 and is engaged in opposed slots 52 in the lever to establish a driving connection between the lever and rod with slots 47 and 52 permitting vertical movement of the lever while maintaining a driving connection therebetween. Rod 46 extends through support bracket 54, which is fixed on back plate 16, and terminates in a threaded portion 56 for receipt of nut 58. Spring

60 is seated between bracket 54 and nut 58 and is operative, when compressed, to exert a force on the operating rod tending to move plunger 44 out of coil assembly 42, that is a force to the right as viewed in the drawings. With this arrangement, energization of coil 42, through any suitable well-known electrical arrangement (not shown), draws plunger 44 into the coil assembly against the bias of coil spring 60 and when the coil assembly is subsequently de-energized spring 60 moves rod 46 and withdraws plunger 44 from within the coil assembly. This movement of rod 46 is transmitted through the pin and slot connection, 50 and 52, and manifests itself as alternate counterclockwise and clockwise movement of lever 38 in response to energization and deenergization of coil 42, respectively.

With the magnet assembly in either its operative or inoperative positions, the electro-mechanical control is effective to lock the magnet assembly in position and connect the magnet assembly and housing for unitary movement in response to a lifting force on post 26. In the preferred embodiment of this invention, stop means 62 is provided on housing 10 and is spaced vertically from back plate 16 for engagement with lever 38 to hold the magnet assembly in its operative position. More particularly, support bracket 68 is connected to and extends upwardly from plate 16 and stud 64 is threaded through upper end 66 of bracket 68 to provide a stop 70 facing toward the magnet assembly. Stop 70 is arranged to engage upper end 72 of lever 38 when the lever is pivoted counterclockwise by energization of solenoid actuator 36 and, when so engaged, connects the magnet assembly and housing 10 for unitary movement upon application of a lifting force. Furthermore, it will be noted that the magnet assembly will now be held in its operative position so that a load can be attracted to face 12 and will be held on the face as the lifting magnet is moved. Being threadedly engaged in end 66, stud 64 is adjustable to vary the vertical position of stop 70 relative to lever end 72 and thereby vary the angle at which stop 70 engages the lever to permit adjustment of the force which will be necessary to pivot the lever out of engagement with the stop. That is the force which must be provided by spring 60 to release the magnet assembly.

With no lifting force on post 26 and face 12 supported on a suitable support structure or load, lever 38 can be freely moved into and out of engagement with stop 70 through energization and de-energization of solenoid 42. However, when the magnet assembly is in its operative position with a load attracted to face 12 and solenoid 36 is energized to move lever 38 into engagement with stop 70 and a lifting force then applied to raise the lifting magnet and load, the combined weights of the load, housing and the elements of the electro-mechanical actuator are applied to end 72 of lever 38 through stop 70. Spring 60 is selected so that it is characterized by being incapable of exerting a force sufficiently large to overcome the frictional force resulting from this load so that the solenoid can be de-energized without moving of the lever, and correspondingly releasing of the load. This affords the dual advantage that to activate the lifting magnet by locking the magnet assembly in its operative position only a relatively short electrical pulse is necessary and when the lifting magnet is raised the solenoid can be de-energized. Furthermore, the inherent safety of a permanent lifting magnet is maintained as a power failure and will have no effect on a suspended load.

Magnet assembly 20 can also be locked in its inoperative position and connected to the magnet housing for unitary movement in response to the application of a lifting force. More particularly, when the magnet is in its inoperative position and the solenoid is de-energized, spring 60 will move lever 38 clockwise so that lower end 88 of the lever engages the walls of plate 16 defining opening 30. With the lever so positioned, the magnet cannot move downwardly to its operative position and

it is engageable with plate 16 so that application of a lifting force moves the entire assembly as a unit. The permanent lifting magnet can then be moved as desired, held in a suspended position or placed onto a support without the magnet assembly moving within the housing and without attracting any unwanted articles to face 12.

To release the magnet assembly for movement to its operative position, the solenoid is energized to pivot lever 38 out of engagement with plate 16 and allow the magnet assembly to drop, assuming the entire lifting magnet assembly is not suspended. In this regard and to retard or cushion downward movement of the magnet assembly, four spring assemblies 74 are provided. Since the spring assemblies are of identical construction only one will be described in detail. Each spring assembly 74 includes a post 76 attached to upper plate 28 and extending through an aperture 78 in plate 16. Compression spring 80 is positioned on post 76 and is seated between washer 82, in engagement with plate 16, and washer 84, which abuts an adjusting nut 86 threaded on post 76, to bias the magnet assembly upwardly. Downward movement of the magnet assembly is opposed by springs 80 and tubular sleeve 85 is positioned on the post for engagement with tubular portion 87 of washer 84 to serve as a stop and limit the downward movement. The amount of downward movement and the force of springs 80 is readily adjustable by manipulating nut 86, preferably the adjustment is such as to position the magnet assembly so that it is spaced just slightly above face 12. L-shaped block 39, see FIG. 1, is attached to bracket 54 and cooperates in guiding movement of the magnet assembly relative to its housing.

When the solenoid operates to disengage the lever from the back plate it must act somewhat against the weight of the magnet, and it will be appreciated that unless suspended, the magnet assembly will not be held tightly against spacers 32 and 34 and some limited vertical movement is possible. End 88 is provided with a radius 89 and a bevel 91 is provided to reduce the force which the solenoid must overcome. Furthermore, the springs 80 will, even in their extended position of FIG. 2, exert an upward force on the magnet so that the solenoid must only overcome the force resulting from the differential between the weight of the magnet assembly and the combined forces of the springs. For example, if the magnet assembly, and its associated elements, have a combined weight of 50 pounds, springs 50 are selected to exert an upward biasing force on the magnet of approximately 50 pounds so that the solenoid need only overcome a force resulting from a load of approximately two pounds. This permits a relatively small solenoid to be used and furthermore reduces the size of spring 60 which is required.

With the elements arranged as illustrated in FIG. 3, the danger of prematurely energizing the solenoid exists and, with a lifting force applied to post 26, lever 38 will pivot out of engagement with opening 30 but will engage wall 90 of bracket 68 stopping the lever and preventing plunger 44 from being drawn completely into the solenoid coil assembly. This condition could burn out the solenoid. To avoid this problem, lost motion coupling 48 has been provided. This coupling structurally comprises a tubular member 92 connected to the end of plunger 44. Rod 46 extends into member 92 through opening 94 and compression spring 96 is seated between member 92 and a pin 98 fixed on the end of rod 46. Spring 96 has a spring force which is greater than that of spring 60 so that when the rod 46 and lever are moving freely they will move in unison. However, upon premature energization of solenoid 42, as described above, and as shown in FIG. 4, plunger 44 will be drawn into the coil assembly but rod 46 is held by face 90 against further movement to the left and tubular member 92 compresses spring 96 against pin 98. This prevents burn-out of the solenoid and when the lifting magnet is subsequently

placed onto a suitable support structure, magnet **20** will lower to its operative position and as lever **38** frees face **90**, spring **96** will complete movement of the lever to the left to assume its position in engagement with stop **70** and return the lost motion coupling to its normal condition.

In operation and when it is desired to pick up and transport a particular load to a desired location solenoid **36** can be energized to lock magnet assembly **20** in its operative position and connect it and housing **10** for unitary movement upon the application of a lifting force. Or, if the magnet assembly was in its inoperative position, energization of the solenoid would release the magnet assembly for movement from its inoperative to its operative position and again would engage lever **38** with stop **70** to establish the connection between the magnet assembly and its housing for joint movement. With the magnet assembly in its operative position, a load can be attracted to face **12** and a lifting force applied to post **26** to raise and transport the load to any desired location. The solenoid can then be de-energized and when the load is positioned as desired and properly supported, lever **38** is moved by spring **60** out of engagement with stop **70** thereby freeing the magnet assembly for movement within the housing. If the solenoid had not been previously de-energized, de-energization could take place after the load has been properly positioned and supported. When a lifting force is then applied to post **26**, the magnet assembly is moved from its operative position to its inoperative position to remove the load from the magnetic field and lever **38** engages support plate **16** to lock the magnet in its inoperative position. If for any reason it is desired to re-engage the load, the lifting force can be removed and the solenoid energized, whereupon the magnet assembly will drop to its operative position. For most effective operation, i.e. movement of the magnet assembly in the housing, the combined weight of the housing and electromechanical control is greater than the weight of the magnet assembly and its associated elements. Also, the relative weights of the housing and electro-mechanical control and of the magnet assembly are determined by the strength of the magnet **22** so that the attractive force with the load is overcome to insure separation of load and magnet assembly. With this arrangement the permanent lifting magnet can engage and hold a load while it moves the load to a desired location, it can set the load down without releasing it or it can release it if desired and, furthermore, it can be operated to permit movement without attracting any unwanted load.

Although but one embodiment of the present invention has been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

What I claim is:

1. A permanent lifting magnet assembly comprising, in combination,

a permanent magnet,

a support frame for said magnet,

means connecting said permanent magnet and said support frame for free relative movement therebetween in accordance with the application and removal of a lifting force on said permanent lifting magnet assembly with said permanent magnet normally assuming a first position adjacent a first portion of said frame when the lifting force on said lifting magnet assembly is removed to thereby attract a load to said first portion and normally moving to and assuming a second position spaced from said first position a predetermined distance sufficient to remove a load adjacent said first portion from the attractive force of the magnetic field of said magnet when said lifting force is applied to said lifting magnet,

and selectively operable means operative, when said permanent magnet is in both said first and second positions, to interconnect said permanent magnet and said frame for joint movement and against relative movement therebetween due to said lifting force so that said permanent magnet remains in a selected one of said first and second positions regardless of the application or removal of said lifting force.

2. A permanent lifting magnet assembly comprising, in combination,

a support frame including a lower load engaging portion and a second portion spaced vertically above said lower portion,

a permanent magnet disposed in and freely movable vertically relative to said frame,

means for connecting said permanent magnet to a mechanism for applying a lifting force to said permanent lifting magnet assembly,

said permanent magnet normally moving to a first position adjacent said load engaging portion when said lifting force is removed from said permanent magnet and moving in response to application of said lifting force to a second position spaced from said lower portion a predetermined distance sufficient to remove a load adjacent said lower portion from the attractive force of the magnet field of said magnet, said magnet, in said second position, engaging said said second portion for joint upward movement of said frame and magnet upon further application of said lifting force,

and selectively operable means operative, when said magnet is in both said first and second positions, to interconnect said magnet and said frame for joint movement and against relative movement therebetween due to said lifting force so that said permanent magnet remains in a selected one of said first and second positions regardless of the application or removal of said lifting force.

3. A permanent lifting magnet assembly comprising, in combination,

a permanent magnet,

a frame including a load engaging surface,

means for connecting said permanent magnet to a mechanism for applying a lifting force to said permanent lifting magnet assembly,

means supporting said permanent magnet on said frame for movement relative to said load engagaing surface in response to the application and removal of said lifting force with said permanent magnet normally assuming a first position adjacent said load engaging surface when said lifting force is removed and normally moving to a second position spaced from said load engaging surface a predetermined distance sufficient to remove a load adjacent said surface from the attractive force of said magnet when said lifting force is applied to said magnet,

and means operative selectively to connect said magnet in said first position for joint movement with said frame and against movement to said second position and to release said magnet for movement to said second position so that said magnet can be held in said first position regardless of the application and removal of said lifting force.

4. A permanent lifting magnet assembly comprising, in combination,

a permanent magnet,

a frame for said permanent magnet including a load engaging surface,

means for connecting said permanent magnet to a mechanism for applying a lifting force to said permanent lifting magnet assembly,

means supporting said permanent magnet for movement in said frame relative to said load engaging surface in response to the application and removal of said lifting force to said lifting magnet, said per-

manent magnet normally assuming a first position adjacent said load engaging surface when said lifting force is removed and normally moving to a second position spaced from said surface a predetermined distance sufficient to remove a load adjacent said surface from the attractive force of said magnet when said lifting force is applied to said permanent lifting magnet assembly, said magnet in said second position engaging said frame so that said magnet and frame move jointly upon continued application of said lifting force,

connecting means movable to a first position, when said magnet is in said first position, connecting said magnet for joint movement with said frame and against movement to its second position in response to said lifting force and, when said magnet is in its second position, movable to a second position connecting said magnet for joint movement with said frame and holding said magnet in said second position and against movement to its first position in response to removal of said lifting force,

and means for selectively controlling movement of said connecting means to said first and second positions.

5. A permanent lifting magnet comprising, in combination,

frame means including first and second vertically spaced portions,

a permanent magnet disposed intermediate and movable relative to said vertically spaced portions between a first position adjacent the lowermost portion and a second position spaced from said lowermost portion a predetermined distance sufficient to remove a load adjacent said lowermost portion from the attractive force of said magnet, said magnet arranged in said second position for an engagement with the uppermost portion,

means for connecting said magnet for movement in said frame means,

an elongated lever pivotally mounted on said magnet, said lever having a first position, when said magnet is in its first position, in engagement with a downwardly facing surface on said frame rigidly interconnect said magnet and frame and hold said magnet against vertical movement to its second position, said lever having a second position, when said magnet is in its second position, in engagement with an upwardly facing surface on said frame to rigidly interconnect said magnet and said frame and hold said magnet against vertical movement to its first position,

and actuating means for selectively controlling movement of said lever means to its first and second positions.

6. The permanent lifting magnet of claim **5** wherein said actuating means is supported on said frame and is connected to said lever, actuating movement of said actuating means being generally transverse to the direction of movement of said permanent magnet relative to said frame, and wherein the combined weight of said frame and said actuating means is greater than that of said permanent magnet.

7. A permanent lifting magnet comprising, in combination,

a generally hollow support frame including a load engaging member and a second frame member spaced vertically from said load engaging member,

a permanent magnet disposed for movement relative to said frame between said frame members,

means connected with said permanent magnet and extending upwardly therefrom for connecting to an external lifting force to effect vertical movement of said magnet in said frame so that said magnet is movable, in response to said lifting force, between a first position adjacent said load engaging member and a second position spaced from said load engaging member a predeterimned distance sufficient to

remove a load adjacent said load engaging member magnet in said second position arranged for connection with said second frame member so that a lifting force on said magnet produces joint movement of said magnet and support frame,

lever means connected on said magnet for movement generally transversely of the direction of movement of said magnet relative to said enclosure, said lever having a first position, when said magnet is in said first position, connecting said magnet to said frame for joint movement therewith and holding said magnet against vertical movement to its second position and, when said magnet is in its second position, having a second position connecting said magnet to said frame for joint movement therewith and holding said magnet against vertical movement to its first position,

and means for selectively controlling movement of said lever means to said first and second positions.

8. A permanent lifting magnet comprising in combination,

a hollow enclosure having first and second opposed, vertically spaced members,

a permanent magnet positioned for movement in said enclosure between said first and second members,

means connected with and extending from said magnet through said first member for connection to an external lifting force to effect movement of said magnet to a first position adjacent said second member and to a second position spaced from said second member a predetermined distance sufficient to remove a load adjacent said second member from the attractive force of said magnet, said magnet in said position arranged for engagement with said first member for joint vertical movement of said enclosure and magnet with the application of a lifting force,

a lever pivotally supported on said magnet,

means connected on said enclosure and defining a surface spaced vertically from said enclosure and facing toward said magnet,

said lever movable to a first position in engagement with said surface when said magnet is in its first position to connect said magnet and said enclosure for joint movement upon the application of a lifting force and movable to a second position in engagement with said first member when said magnet is in its second position to hold said magnet against movement to its first position and to connect said magnet and said enclosure for joint movement upon the application of a lifting force,

and actuating means for selectively controlling movement of said lever means to its first and second positions.

9. The permanent lifting magnet of claim **8** wherein said actuating means comprises biasing said lever to one of its positions and solenoid means supported on said enclosure and operative, when energized, to move said lever to its other position against said bias.

10. The permanent lifting magnet of claim **9** wherein said solenoid means includes

a coil and core assembly,

an elongated member connected between said core and said lever for transmitting movement of said core to said lever,

and means connected with said elongated member for biasing said elongated member in a direction opposite to the direction of movement thereof when said coil is energized to that said lever means is held in one of its positions and is movable to its other position against said bias when said solenoid means is actuated.

11. The permanent magnet of claim **10** wherein said biasing means biases said lever to its second position and energization of said solenoid means moves said lever toward its first position, and also including a lost motion

connection between said core and elongated member operative, when said permanent lifting magnet is suspended and said permanent magnet is in its second position, to provide relative movement between said core and elongated member so that said core can be drawn into said coil upon energization without movement of said lever to said second position.

12. The permanent lifting magnet of claim **8** wherein said biasing means biases said lever toward its second position and said solenoid means moves said lever toward its first position so that when said lifting magnet is suspended the combined weight of said enclosure actuating means and a load attracted to said second member is applied to said lever through said surface, and wherein said biasing means is characterized by having a force which is not sufficient to overcome the force resulting from said combined weight.

13. The permanent magnet of claim **12** wherein said means defining said surface is adjustable to vary the force necessary to disengage said lever therefrom.

14. A permanent lifting magnet comprising, in combination,

a support frame including upper and lower vertically spaced portions,

a permanent magnet positioned in said frame for movement between said vertically spaced portions so that a lifting force applied to said magnet is operative to move said magnet from a first position adjacent said lower portion of said frame to a second position in engagement with said upper portion and removal of said lifting force frees said magnet for movement from said second position to said position,

means defining a first surface on said frame facing toward said magnet and a second surface on said frame facing away from said magnet,

selectively movable means connected to and movable with said magnet and also connected for movement relative to said magnet and frame to a first position in engagement with said first surface when said magnet is in said first position and to a second position in engagement with said second surface when said magnet is in said second position to interconnect said magnet and frame for joint movement,

and actuating means for selectively controlling movement of said selectively movable means to its first and second positions.

15. The permanent lifting magnet of claim **13** wherein said actuating means comprises control means for moving said selectively operable means to its first position and means biasing said selectively operable means to its second position, and wherein the combined weight of said frame and a suspended load are applied to said selectively operable means through said surface and said biasing means is characterized by having a force which is insufficient to overcome the force resulting from said combined weight.

16. A permanent lifting magnet comprising, in combination,

a support frame including upper and lower vertically spaced portions,

a permanent magnet positioned in said frame for movement between said vertically spaced portions so that a lifting force applied to said magnet is operative to move said magnet from a first position adjacent said lower portion of said frame to a second position in engagement with said upper portion and removal of said lifting force frees said magnet for movement from said second position to said first position,

means one one of said frame and said magnet defining a first surface facing toward said magnet and a second surface facing away from said magnet,

connecting means connected to the other of said frame and magnet and movable relative to said frame and magnet to a first position in engagement with said first surface when said magnet is in its first position and to a second position in engagement with said second surface when said magnet is in said second position to interconnect said magnet and frame for joint movement,

and actuating means for selectively controlling movement of said last mentioned means to its first and second position.

17. A permanent lifting magnet assembly comprising, in combination,

a permanent magnet,

a frame including a load engaging surface,

means supporting said permanent magnet for vertical movement in said frame relative to said load engaging surface between a first position adjacent said surface so that a load at said surface is within the attractive field of said magnet and a second position spaced from said surface so that a load adjacent said surface is positioned outside of said attractive field,

means for connecting said magnet to a mechanism for applying a lifting force to said permanent lifting magnet assembly,

said magnet normally assuming said first position when said lifting force is removed and normally being moved vertically to said second position in response to application of said lifting force.

and means operative selectively, when said magnet is in said first position, to connect said magnet and frame for joint movement and hold said magnet against movement to said second position and to release said magnet for movement to said second position in response to application of said lifting force so that said magnet can be held in said first position regardles of the application and removal of said lifting force.

References Cited by the Examiner

UNITED STATES PATENTS

1,215,682	12/1959	Bower	317—159
3,009,727	11/1961	Jones et al.	294—65.5
3,079,191	2/1963	Engelsted et al.	294—65.5

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