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LATCH ASSEMBLY FOR MATERIAL HANDLING MAGNET

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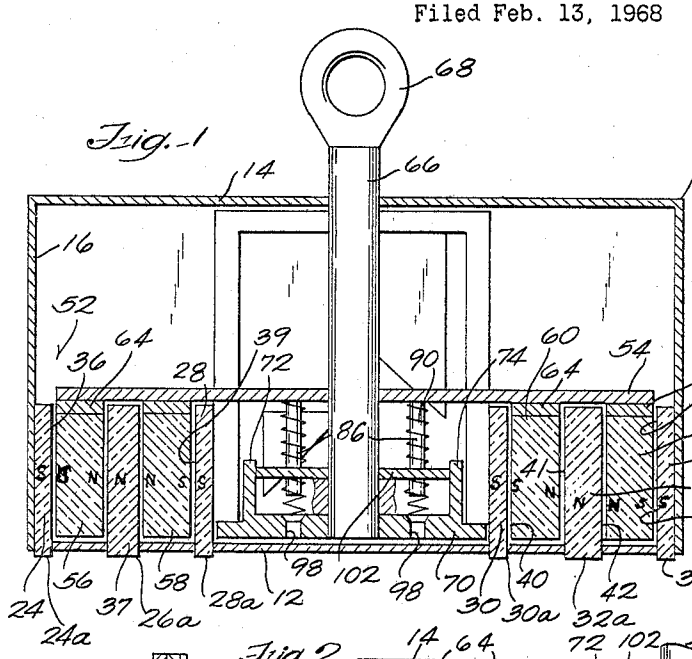

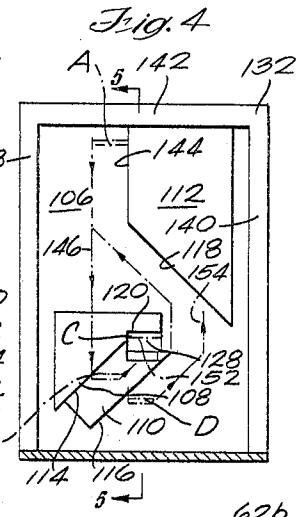

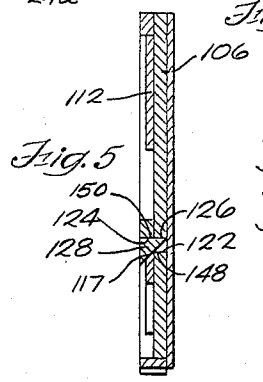

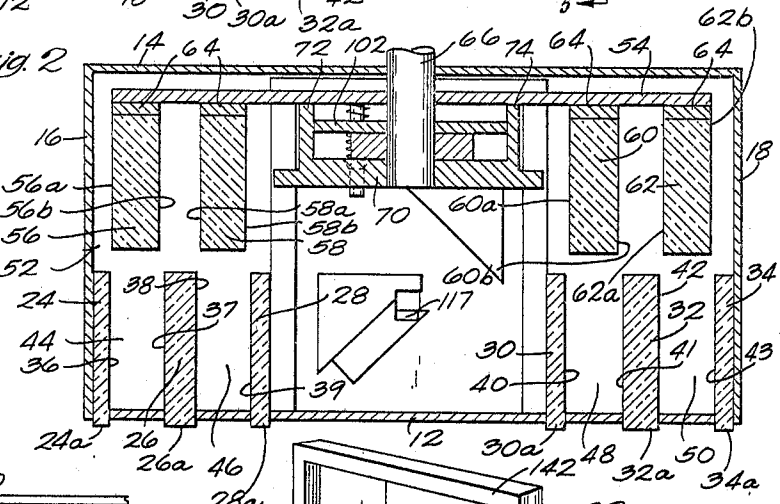

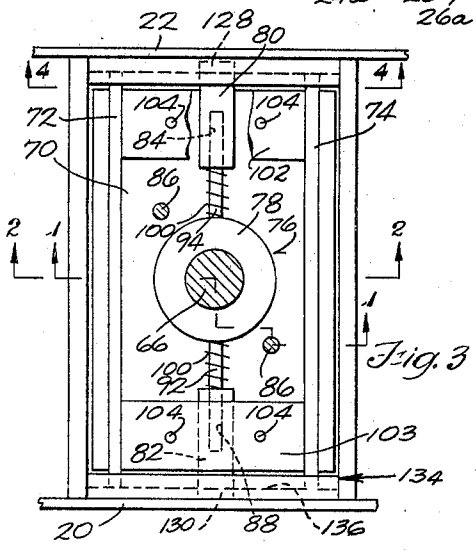

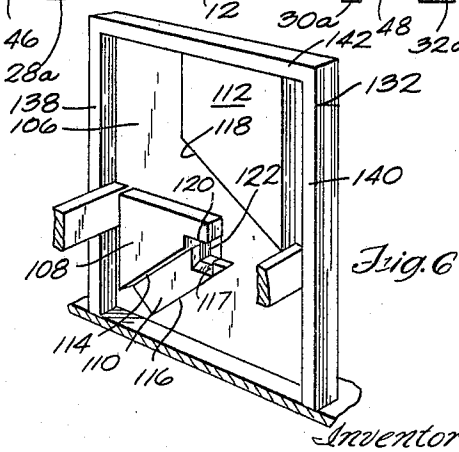

Inventor
William R. Hinger
By Joseph A. Semigrani
Attorney

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LATCH ASSEMBLY FOR MATERIAL HANDLING MAGNET

William R. Hinger, Big Bend, Wis., assignor to Wehr Corporation, Milwaukee, Wis., a corporation of Wisconsin

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ABSTRACT OF THE DISCLOSURE

A material handling magnet is provided wherein a permanent magnet in the form of a rectangular block is magnetized through its thickness dimension to present opposite magnetic polarities at oppositely facing surfaces thereof. The magnet is moved into and out of a position between a pair of pole pieces which are oppositely magnetized when the permanent magnet is positioned between the pole pieces and lose their magnetization as the magnet is withdrawn. The relative movement between the permanent magnet and the pole pieces is perpendicular to the magnet axis of the magnet. A latching arrangement is coordinated with the application of the lifting force to the material handling magnet and is effective to connect the magnet and the pole pieces for joint movement while the magnet is between the pole pieces and generating a working field to hold a load in engagement with the material handling magnet. That connection between the magnet and the pole pieces is adapted to be interrupted, again in coordination with the application of lifting force, to thereby permit positioning the magnet remote from the pole pieces to interrupt the working field and release the load.

BACKGROUND OF INVENTION

Field of invention

This invention relates to material handling magnets and, more particularly, to material handling magnets of the permanent magnet type.

Description of prior art

It has been recognized that an effective magnetic working field can be generated by positioning a permanent magnet between two pole pieces and with the magnet being magnetized to present a different magnetic polarity to each pole piece. More specifically, it has been recognized that a load spanning the two pole pieces is held in engagement with the pole pieces by a large attractive force; however, a relatively small force is required to remove the permanent magnet from between the pole pieces, and thereby interrupt the working field produced as a result of magnetic induction of the pole pieces, if the permanent magnet is moved perpendicular to its magnetic axis or, in other words, in a direction parallel to the confronting surfaces of the pole pieces and magnet. Thus, a relatively strong magnetic field can be generated and interrupted with relatively small actuating forces being involved. In this connection see Patents 3,079,535 and 2,724,075.

Such arrangements require a reliable latching arrangement to position the magnet adjacent the pole pieces or to release the magnet for movement away from the pole pieces. This invention is concerned with the provision of

an effective, practical and reliable latching arrangement for use with this type of magnetic circuit so that the circuit is adaptable to use in a material handling magnet.

SUMMARY OF INVENTION

In accordance with this invention, a material handling magnet is provided with a magnetic circuit wherein a permanent magnet is supported for movement into and out of a position inducing opposite magnetic polarities in a pair of adjacent pole pieces. Relative movement of the pole pieces and magnet is in a direction generally parallel to the confronting surfaces of the magnet and pole pieces and this movement occurs in accordance with the application of the lifting force to the material handling magnet. A latch and detent arrangement is provided to selectively connect the magnet and pole pieces for joint movement in response to the lifting force while the magnet is in the position magnetizing the pole pieces or disconnect the magnet and pole pieces so that the magnet is removed from that position. Engagement between the latch and detent to connect or disconnect the magnet and pole pieces is coordinated with the application of the lifting force, and thus with relative movement between the magnet and pole pieces, and is achieved by relative movement between the latch and detent so that the desired movement between the magnet and pole pieces is not affected.

DESCRIPTION OF DRAWINGS

FIG. 1 is a section view through a material handling magnet illustrating the magnets in an operative position inducing opposite magnetic polarities in adjacent pole pieces;

FIG. 2 is a section view of the material handling magnet of FIG. 1 with the magnets removed from the operative position to interrupt the magnetic induction of the pole pieces;

FIG. 3 is a top plan view of the material handling magnet with the top wall removed;

FIG. 4 is a section view generally along line 4—4 in FIG. 3;

FIG. 5 is a section view generally along line 5—5 in FIG. 4; and

FIG. 6 is a perspective view of the detent arrangement.

DESCRIPTION OF PREFERRED EMBODIMENT

With particular reference to FIGS. 1 and 2, a material handling magnet is illustrated as including a housing or basic support structure **10** defined by bottom wall **12**, top wall **14**, side walls **16** and **18**, and end walls **20** and **22**. The support structure is basically made of non-magnetic material and incorporates a number of elongated magnetic pole pieces **24**, **26**, **28**, **30**, **32** and **34**. The pole pieces are of equal length and the thickness of pole pieces **24**, **28**, **30** and **34** is generally one-half that of pole pieces **26** and **32**. Each pole piece is arranged with an end **24***a*, **26***a*, **28***a*, **30***a*, **32***a* and **34***a* extending through elongated openings defined in bottom wall **12**. The pole pieces are arranged with pairs of confronting surfaces **36–37**, **38–39**, **40–41** and **42–43** defining elongated spaces **44**, **46**, **48** and **50** therebetween. The pole pieces are suitably connected to the support structure.

Magnet assembly **52** is disposed within the support structure. The magnet assembly includes a rigid, backing plate **54** of non-magnetic material. Four generally elongated permanent magnets **56**, **58**, **60** and **62**, each in the

form of a rectangular block, are connected to the underside of plate **54** with spacing block **64** of non-magnetic material positioned between each magnet and the backing plate. The magnets depend from the backing plate in alignment with respective ones of spaces **44–50**.

The position of the magnet assembly with respect to the pole pieces is controlled through a mechanism by means of which a lifting force can be applied to the material handling magnet so that the position of the magnet assembly is controlled in accordance with the application and removal of the lifting force. More particularly, a lifting rod **66**, having an eye **68** at one end, is connected to plate **70**. Plate **70** has a pair of transverse bars **72** and **74** attached to the upper surface thereof. The hook of a hoist mechanism (not shown) can be engaged in eye **68** to apply a lifting force to the material handling magnet. As will be described more completely hereinafter, FIG. 2 illustrates a position of the magnet assembly with a lifting force applied to the lifting rod. The magnet assembly has another position relative to the pole pieces. In FIG. 2, bars **72** and **74** are in engagement with backing plate **54** and hold magnets **56–62** above and out of spaces **44–50**. When the material handling magnet is positioned with its bottom wall (or pole piece ends **24***a*–**34***a*) resting on a support surface, removal of the lifting force allows the magnets to fall by gravity into the spaces between the pole pieces. It will be noted in FIG. 1 that the engagement between bars **72** and **74** and backing plate is broken to allow the magnets to be positioned wholly within the spaces between the pole pieces, plate **70** coming to rest on bottom wall **12**.

The magnets are magnetized as illustrated, namely through their thickness so that one surface of each magnet presents one magnet polarity whereas the oppositely facing surface thereof presents an opposite magnetic polarity. More particularly, surfaces **56***a*, **58***b*, **60***a* and **62***b* present a south magnetic polarity whereas surfaces **56***b*, **58***a*, **60***b* and **62***a* present a north magnetic polarity. Thus, when the magnets are positioned as in FIG. 1, pole pieces **24**, **28**, **30** and **34** are induced with a south magnetic polarity and pole pieces **26** and **32** are induced with a north magnetic polarity and a working flux is generated at bottom wall **12** through the exposed ends of the pole pieces so that articles can be attracted to and lifted by the material handling magnet. When the magnets are withdrawn from between the pole pieces as illustrated in FIG. 2, the magnetic induction of pole pieces **24–34** is interrupted and the working flux is removed so that a load attached to the pole piece ends can be released.

The advantages of a magnetic circuit arrangement of this type, wherein a magnet is disposed between a pair of pole pieces and relative movement between the magnet and pole pieces to vary or completely interrupt the working magnetic field is generally parallel to the confronting surfaces of the magnet and pole piece, or perpendicular to the magnetic axis, is that a relatively small force is required to produce movement between the magnet and pole piece, or pieces. More particularly, a relatively strong magnetic working field can be generated and a relatively small actuating force is required to produce the relative movement required to vary the field. Magnets of ceramic material are particularly adapted for use in this type of circuit as such material is relatively high energy magnetic material and is extremely versatile as to the magnetic orientation which can be induced therein.

This application is concerned with the problem of controlling the position of the magnets with respect to the pole pieces and proposes, as a solution to that problem, an effective and relatively simple latch arrangement which positively positions the magnet relative to the pole pieces. Preferably, the latch arrangement alternatively establishes one of two positions in coordination with the application and removal of the lifting force, in one position the magnet being positioned wholly between the pole pieces and presenting opposite magnetic polarities thereto to produce a maximum strength working field and in the other position the magnet being withdrawn from between the pole pieces to interrupt the working field.

More particularly, a latch mechanism **76** is supported on plate **70** and between bars **72** and **74**. The latch mechanism includes apertured central block **78** disposed on lift bar **66** and also includes latch members **80** and **82**. Each latch member includes a pair of openings, **84** in member **80** and **88** in member **82**. Two support rods **92** and **94** are welded to and extend from block **78**, their opposite ends being engaged in respective latch member openings **88** and **84**. Two compression springs **100** are positioned one on each of the portions of the rods projecting from the central block. Springs **100** are compressed between central block **78** and the latch members, biasing latch member **80** toward vertical wall **22** and latch member **82** toward vertical wall **20**.

Plates **102** and **103** are suitably fixed to bars **72** and **74** and engage latch members **80** and **82** to hold the central block and latch members so that in a vertical direction, they move jointly with plate **70**. For reasons which will become apparent hereinafter, the distance between plate **70** and plates **102** and **103** is such as to permit the latch mechanism to rotate about lift bar **66** and pins **104** are fixed on plate **70** to limit the rotational movement of the latch mechanism.

With the arrangement described to this point, the magnet assembly is biased to a position wherein individual magnets **56–62** are arranged between pole pieces **24–34**. In this connection, the term "bias" is used in its broad sense of urging a member in a given direction, gravity and the weight of the magnet assembly in the illustrated embodiment providing the biasing force but the term being sufficiently broad to include other types of bias producing arrangements such as springs and the like. The magnets can be removed from between the pole pieces by applying a lifting force to bar **66** and are returned to that position upon removal of the lifting force. The latch mechanism moves with the lifting bar and hence its position corresponds to the position of the magnets and the movement of both the magnets and the latch mechanism is coordinated with the lifting force and with each other. The latch mechanism is associated with a detent arrangement which is effective to control the position of the magnet assembly and release of the magnet assembly for movement toward and away from the pole pieces.

Detent arrangements are provided on both vertical walls **20** and **22** where they are associated with latch members **80** and **82**. Since the construction of the detent arrangement is the same at both walls, with the one exception to be explained hereinfater that each is the reverse of the other, only one will be described in detail. With reference to FIGS. 4, 5 and 6 where the detent arrangement associated with vertical wall **22** is illustrated, the detent arrangement includes a back plate **106** and three cam plates **108**, **110** and **112** connected to the back plate. Each cam plate projects outwardly from back plate **106** into the interior of the material handling magnet, and each includes a sloping surface **114**, **116** or **118** facing downwardly or in a direction toward the pole pieces. Plate **108** is notched at **120** and plate **106** is provided with an opening **122**, surface **124** of the notch and surface **126** of opening **122** are in alignment and together form a holding surface facing downwardly or toward the pole pieces.

The holding surface is fixed relative to the pole pieces and when engaged by projection **128** on latch member **80** (an identical projection **130** of latch member **82** being arranged to engage an identically formed holding surface at wall **20**) limits upward movement of the latch mechanism and correspondingly the magnets with respect to the pole pieces.

The arrangement of the holding surfaces and latch projections, relative to each other and the magnets and

pole pieces, is such that when the latch projections engage the holding surfaces the upward movement of the magnets is limited to an amount insufficient to withdraw the magnets from between the pole pieces. This maintains a sufficient field strength to hold a load engaged with the exposed pole piece ends. It is possible to release a load without complete withdrawal of the magnets from between the pole pieces. It should also be pointed out that when the load is released the magnets are urged away from their position between the pole pieces because the poles are saturated and, being of like polarity, repel the magnets. In effect, this repulsion tends to hold the magnets out of the areas between the pole pieces but when a load engages the pole piece ends flux is diverted through the load reducing the repulsion force drawing the magnets into the areas.

The latch members move vertically relative to the holding surfaces and surfaces **114**, **116** and **118** are positioned to rotate the latch mechanism horizontally about lift bar **66** into alternative positions wherein the latch projections are arranged for vertical movement into engagement with the holding surfaces or past the holding surfaces. More particularly, surface **114** slopes upwardly from a point below and horizontally to one side of the holding surface to a point below and generally in vertical alignment with the holding surface. Surface **116** slopes upwardly from a point vertically below the holding surface to a point on an opposite horizontal side of the holding surface, i.e. to a point on a side of the holding surface horizontally opposite to the side from which surface **114** slopes toward the holding surface. Lastly, surface **118** slopes upwardly from a point on the same horizontal side of the holding surface on which surface **116** terminates to a point above the holding surface and on the same horizontal side of the holding surface as that on which surface **114** begins. As stated previously, each of the plates **108**, **110** and **112** project from back plate **106**. As can be seen in FIGS. 5 and 6, plates **110** and **112** have generally the same projection from the back plate so that surfaces **116** and **118** are generally in the same vertical plane but plate **108** extends further from the back plate so that the surface **114** is horizontally offset from surface **118** and, more importantly from surface **116**.

It will also be noted that the detent mechanism is surrounded by a three-sided arch **132** attached to back plate **106**. An identical arch **134** is provided on back plate **136** attached to wall **20**. The vertical sides of the arches, e.g., **138** and **140** of arch **132**, cooperate with bars **72** and **74** to guide vertical movement of the lift assembly and latch mechanism. The horizontal sides, e.g. **142** of arch **132**, provide an upper limit on the vertical movement of the lift assembly and correspondingly the magnets. This limit is achieved by engagement of bars **72** and **74** with the horizontal sides, the horizontal sides being so positioned as to permit complete withdrawal of the magnets from the areas **46–50** and thereby interrupt the working field at the exposed ends of the pole pieces.

With the above structure in mind a complete cycle of load engagement, pick-up and release will be described. Assuming the material handling magnet to be suspended by a suitable lift mechanism engaged in eye **68** and the latch mechanism to be disengaged from the holding surfaces, bars **72** and **74** will be in engagement with horizontal side **142** of arch **132**, and a corresponding side in arch **134**. In this orientation the lifting mechanism, magnets, pole pieces and the basic support structure are movable as a unit so long as the material handling magnet is not supported from below. Also in this orientation, latch member **128** is in its uppermost position and will be located at position A, in engagement with vertical surface **144** of plate **112**. When a load is to be engaged, the material handling magnet is positioned over the load and lowered to engage the exposed ends of the pole pieces with load. The lifting force is then released sufficiently to allow the magnets to lower into spaces **44–50**, the pole pieces are subjected to magnetic induction as illustrated in FIG. 1 and an external working field is generated attaching the load to the exposed pole piece ends. The latch mechanism moves with the magnets and as the magnets move between the pole pieces latch member **128** moves downward along line **146** on one horizontal side of the holding surface to position B below surface **114** and above surface **116**. Structurally, latch member **128** includes an angled face **148** which, together with the latch member being free to move on rods **92** and **94** against the bias of springs **100**, allows the latch member to move toward and away from back plate **106** over projections from the back plate (in this instance plate **108**) without disturbing the horizontal position of the latch member so that the latch member remains on line **146** during the downward movement. To raise the material handling magnet with the load attached, the lifting force is again applied. As the lifting force is applied, latch member **128** is moved into engagement with surface **114**, along that surface and into opening **122** where its upper surface **150** is directly below the holding surface and moves to position C engaging the holding surface in response to continued lifting force.

It will be noted that an amount of lost motion is provided between the lift assembly and the magnet assembly, this lost motion takes the form of the relative movement that is provided in connection between the lift and magnet assemblies after the magnets have assumed their lowermost position between the pole pieces. As the magnets move into the spaces **44–50**, bars **72** and **74** are disengaged from plate **54** insuring that the magnets can move wholly within the spaces between the pole pieces. When the material handling magnet is to be lifted, the lost motion is sufficient to permit the latch member to move from position B into position C without raising the magnets or, if the magnets are raised during this part of the cycle, limiting that movement to an amount insufficient to materially affect the strength of the working field. Compression springs **86** extend between back plate **54** and plate **70** and are disposed on rods **90**. The springs exert a force between plates **54** and **70**. Plate **70** includes two holes **96** and **98** disposed on diametrically opposite sides of the central block. Springs **86** provide an additional force urging the latches over plate **108** and out of hole **122**. Rods **90** position the springs and holes **96** and **98** accommodate the rods during relative movement of the lift mechanism and the magnet assembly.

When the latch member engages the holding surface the entire material handling magnet, with load attached, moves as a unit in response to continued application of lifting force. The load can then be transported to any desired location for release. To release the load, the material handling magnet is lowered onto a support. With the load supported from below, the lifting force is further released relieving the force holding the latch member in engagement with the holding surface. The lifting assembly and latch mechanism move downwardly and the latch member is moved from position C along path **152** to assume position D below surface **116** when the lift mechanism bottoms on lower wall **12**. It will be noted that for position B the lift can bottom and the latch will not engage surface **116**. An angled surface **117** is provided in plate **110** directly below the holding surface. This angled surface engages the lower angled surface of the latch member to insure secure seating of the latch member and preventing the latch catching on downward movement away from the holding surface.

The lifting force is now reapplied moving the lift assembly upward and initially the latch member moves along surface **116** past and to the opposite horizontal side of the holding surface where it is clear of the holidng surface. The latch member being clear of the holding surface, the lifting assembly is free to continue upwardly

and reengaging the magnet assembly carries the magnet assembly out from between the pole pieces. During this movement, latch member **128** follows path **154** into engagement with and along surface **118** to the end of that surface where the latch member continues upwardly along vertical surface **144**. The latch member now moves along the upper portion of path **146** back to position A. Bars **72** and **74** engage horizontal side **142** of the arch after which the entire material handling magnet moves as a unit in response to continued lifting force, the magnets now being the position of FIG. 2 and the working field interrupted so that the load is released.

At this point, it should be noted that the detent mechanisms, although identical in construction on both vertical walls, are oppositely angled. In other words, where surfaces **114** and **116** face generally to the right and surfaces **118** and **144** face generally to the left, as viewed in the direction of section lines **4—4** in FIG. 3, the corresponding surfaces in the detent mechanism on wall **20** would face to the left and right, respectively, when viewed in the same direction. Also the cooperation between latch member **82** and the detent mechanism on wall **20** is the same as that already described. Also, the latch mechanism is illustrated in its latched position in FIG. 3 and in the latched position the latch members and holding surfaces are aligned on one of the center lines of the lifting rod **66**; this positions the latch mechanism most effectively to transmit the lifting force. With this arrangement the primary loading on the latch members is in shear and material handling magnet can more effectively handle larger loads, particularly where the latch members are held between plates **70** and **102** and they, together with the detent arrangements, function in the nature of a door latch.

With the described arrangement, the latch mechanism will be rotated slightly in a counterclockwise direction from the position of FIG. 3 when in its uppermost position, i.e. when latch projections **128** and **130** are in position A. Similarly, the latch mechanism in moving from position D to position A will rotate clockwise (as viewed in FIG. 3) in clearing the holding surface and then counterclockwise as it moves along surface **118** (and the corresponding surface at wall **20**).

The lower angled surface on the latch projections and the freely movable, spring biased latch member allow the latch members to ride over projections as the latch mechanism moves downwardly and without causing rotation of the latch mechanism. On the other hand, the upper surface of the latch projections resists any camming action and causes the latch member and latch mechanism to follow the slope of the surfaces. Moreover, the illustrated embodiment completely coordinates the latching arrangement with movement of the magnets and the application and release of the lifting force, and makes optimum use of gravity as a biasing force to maintain a relatively simplified and yet effective mechanism.

It will be appreciated that although vertical movement of the magnets is the preferred arrangement, other arrangements can be used without departing from the spirit or scope of this invention. Therefore, the terms "vertical" and "horizontal" are used in relative sense and should not be interpreted in a limiting sense.

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.

I claim:

1. A material handling magnet comprising, in combination,

first and second pole pieces having relatively spaced surfaces defining a magnet receiving area therebetween,

a magnet having first and second surface portions and magnetized so that said first magnet surface portion exhibits one magnetic polarity and said second magnet surface portion exhibits an opposite magnetic polarity,

said magnet biased to a first position in said area wherein said first and second surface portions confront said first and second pole piece surfaces to induce opposite magnetic polarities in said pole pieces and being movable against said bias away from said first position,

lifting means for applying a lifting force to said material handling magnet,

means connecting said magnet to said lifting means for movement of said magnet relative to said pole pieces in a direction generally parallel to said confronting surfaces into and out of said first position in accordance with the application of lifting force to said lifting means,

detent means fixed relative to said pole pieces and including a holding surface,

latch means connected to and movable in accordance with movement of said magnet and including a latch member,

means biasing said latch member toward a latching position for engagement with said holding surface and said latch member having at least one other position wherein said latch member is located for movement relative to and without engagement with said holding surface,

and said latch member supported for movement against said bias toward said one other position,

and said holding surface and latch member arranged relative to each other and said magnet and pole pieces to position said magnet in said first position relative to said pole piece surfaces when said holding surface and latch member are in engagement.

2. The material handling magnet of claim **1**

wherein said pole piece surfaces extend vertically and said magnet is movable vertically relative to said pole piece surfaces and said area in response to application and removal of said lifting force,

wherein in said latching position said latch member is below and generally in vertical alignment with said holding surface and in said one other position said latch member is out of vertical alignment with said holding surface,

and means coordinated with said lifting force for alternatively positioning said latch member in said latching position and said one other position.

3. The material handling magnet of claim **2**

wherein said magnet moves into said area in response to removal of said lifting force and moves in a direction away from said area in response to application of said lifting force,

wherein said latch member is supported for horizontal movement as well as vertical movement,

wherein said means for positioning said latch member includes means defining a first surfaec sloping from a point below and offset to one horizontal side of said holding surface to a point corresponding to said latching position of said latch member for guiding said latch member for engagement with said holding surface and means defining a second surface sloping from a point generally aligned with and below said holding surface to a point offset to an opposite horizontal side of said holding surface,

and including means defining a third surface extending from said opposite horizontal side of said holding surface above said holding surface to said one horizontal side of said holding surface,

whereby as said magnet is lowered between said pole pieces said latch member engages said first surface and said latch member is moved along said first surface into engagement with said holding surface when

a lifting force is applied to said lifting means and subsequent removal and application of said lifting force displaces said latch member to said opposite side of and vertically past said holding surface into engagement with said third surface for displacement by said third surface to said one side of said holding surface.

4. The material handling magnet of claim 3 wherein said magnet comprises a ceramic permanent magnet having oppositely facing generally vertical surfaces providing said first and second magnet surface portions and said magnet is magnetized so that its magnetic axis extends generally normal to and between said oppositely facing surface portions.

5. The material handling magnet of claim 1 including means defining a support structure,
wherein said first and second pole pieces extend vertically and are fixed in said structure and each includes a portion extending exteriorly of said support structure with the first and second surface portions disposed within said support structure,
said magnet being movable vertically relative to said pole piece in moving into and out of said first position,
including means connecting said magnet and said lifting means for limited vertical movement away from said pole pieces and at the limit of said limited vertical movement connecting said magnet, lifting means, support structure and pole pieces for joint movement in response to continued upward force on said lift means,
and wherein said holding surface is positioned to limit vertical movement of said magnet to less than said limited vertical movement and so that when engaged by said latch member continued upward movement of said lifting means produces joint movement of said support structure, pole pieces, magnet and lift means with said magnet in said first position.

6. The material handling magnet of claim 5 wherein in said latching position said latch member is below and generally in vertical alignment with said holding surface and in said other position said latch member is out of vertical alignment with said holding surface,
including means defining a surface extending above said holding surface arranged in the path of movement of said latch member toward said limit to engage and position said latch member to one horizontal side of said holding surface at said limit,
wherein said holding surface faces toward said pole pieces,
including means coordinated with said lifting force for alternatively positioning said latch member in said latching position and said one other position,
said means for positioning said latch member including means defining a first surface facing generally toward said pole pieces and sloping from a point to said one horizontal side of said holding surface upwardly to said holding surface,
and means defining a second surface facing generally toward said pole pieces and sloping from a point below and vertically aligned with said holding surface upwardly to a point on the opposite horizontal side of said holding surface below and vertically aligned with said surface above said holding surface,
wherein said latch member is biased toward a position for engagement with said first and second surfaces and said surface extending above said holding surface as well as said holding surface whereby, in sequence, removal of said lifting force moves said magnet and latch member downwardly with said magnet moving between said pole pieces and said latch member moving below said first surface, application of said lifting force engages said latch member with said first surface and moves said latch member along said first surface into engagement with said holding surface, removal of said lifting force moves said latch member below said second surface, and application of said lifting force engages said latch member with said second surface and moves said latch member along said second surface to said other horizontal side of said holding surface past said holding surface to engagement with and movement along said surface extending above said holding surface to a position above and to said one horizontal side of said holding surface.

7. The material handling magnet of claim 6 including a vertical wall extending generally perpendicular to said pole piece surfaces,
wherein said detent means is supported on said vertical wall with said holding surface being generally horizontal and extending generally perpendicular to said vertical wall,
wherein said first surface projects from said vertical wall,
wherein said second surface projects from said vertical wall but terminates short of the projection of said first surface,
wherein said surface extending above said holding surface projects from said vertical wall,
and wherein said latch member includes a cam surface facing generally toward said pole pieces to cam said latch member over projections from said vertical wall as said latch member moves downwardly and a holding surface facing generally away from said pole pieces to engage projections from said vertical wall without camming said latch member against said bias.

8. The material handling magnet of claim 7 wherein siad support structure includes relatively spaced vertically extending walls,
wherein said pole pieces extend between said vertical walls defining an elongated area therebetween providing said magnet receiving area,
wherein said magnet is elongated and is movable vertically into and out of said area,
wherein detent means, first and second surfaces and said surface extending above said holding surface in accordance with claim 7 are supported on each of said vertical walls with the surfaces on one of said vertical walls projecting toward the other vertical wall and the first and second surfaces and the surface extending above said holding surface on one wall sloping oppositely with respect to the corresponding surfaces on the other vertical wall,
wherein latch means in accordance with claim 7 is supported at each of said vertical walls with each latch member biased toward its respective vertical wall,
and wherein said latch means is supported for horizontal as well as vertical movement.

9. The material handling magnet of claim 7 wherein said permanent magnet comprises a ceramic magnet having oppositely facing surfaces providing said first and second magnet surface portions and magnetized so that its magnetic axis extends generally normal to and between said oppositely facing surface portions.

10. The material handling magnet of claim 7 wherein said latch members are supported on support means having a lower support surface engaging said latch members and moved on said support surface in response to and against said bias.

11. The material handling magnet of claim 10 wherein said support means is connected to said lifting means and is engageable with said magnet, said support means transmitting lifting force to said latch means and magnet.

12. The material handling magnet of claim 6 including means defining a lost motion connection between said latch means and said magnets affording relative movement between said latch means and magnets when said magnet is in said first position and means biasing said latch means downwardly relative to said magnets so that a biasing force is provided

assisting vertical movement of said latch means relative to said holding surface.

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