July 20, 1965 J. F. MANTING 3,196,320

MAGNETIC LIFT DEVICE

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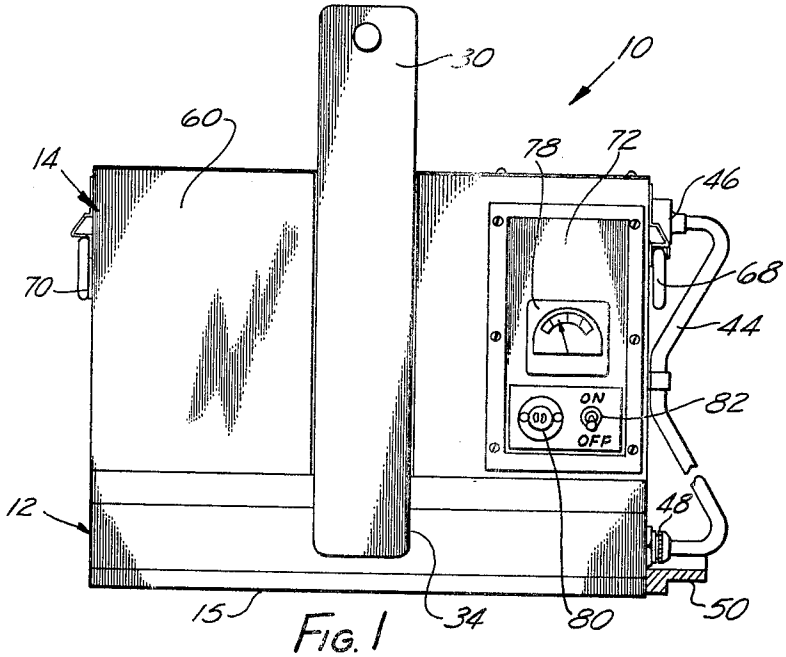


FIG. 1

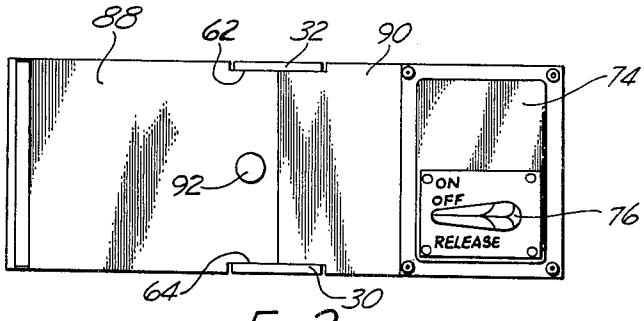


FIG. 2

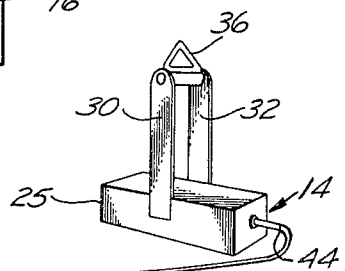


FIG. 5

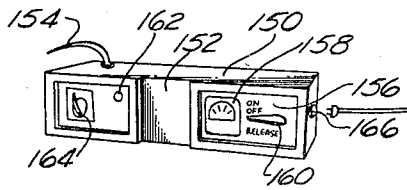


FIG. 9

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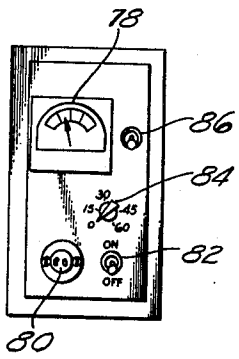


FIG. 4

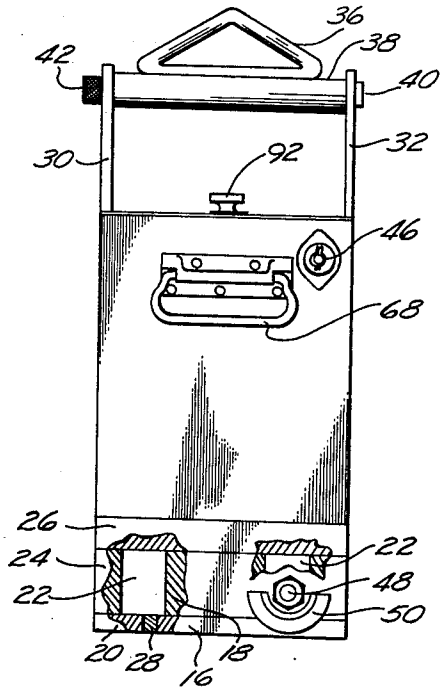


FIG. 3

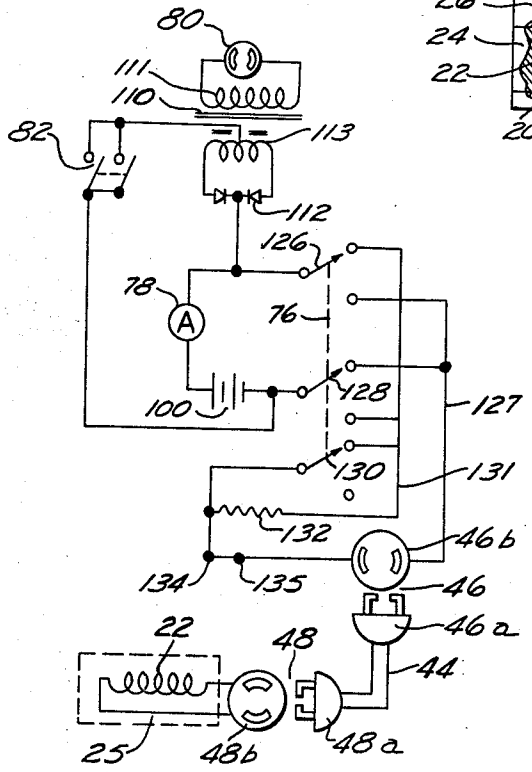


FIG. 7

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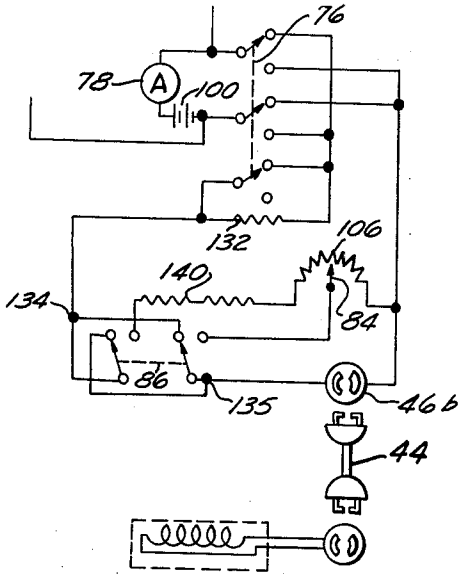


FIG. 8

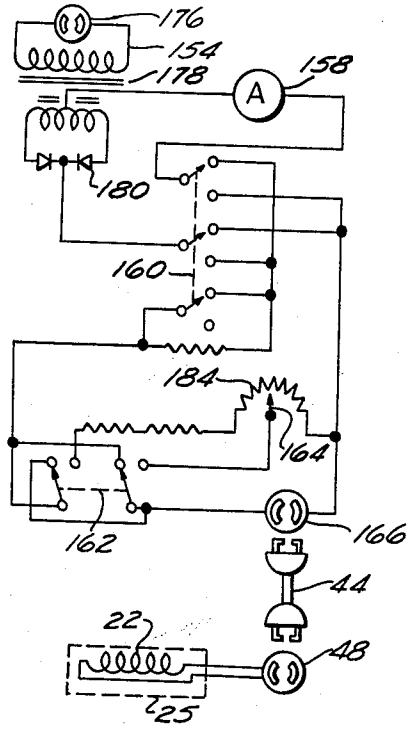


FIG. 10

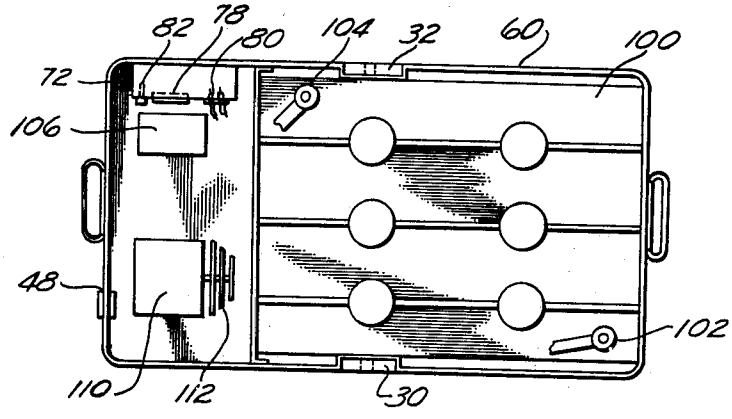


FIG. 6

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3,196,320

MAGNETIC LIFT DEVICE

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Filed Mar. 16, 1961, Ser. No. 96,142
8 Claims. (Cl. 317—123)

This invention relates to conveying apparatus and more particularly to a magnetic lifting and conveying device.

Conventional electromagnets in lifting and conveying equipment are of two main types; namely, the plug-in type for connection with an external conventional alternating current power source (see, e.g., Patent 1,588,447), and the storage battery power source (see, e.g., Patents 2,657,752 and 2,794,941). Each of these types has its particular advantages and disadvantages involving such factors as electrical wiring between the unit and an electrical outlet, battery recharging, relative lifting capacity and holding power, mounting of cumbersome accessories such as battery equipment and transformers, power source failure susceptibility and the resulting injury and hazard potential, adaptability to continuous conveyor chains, and other factors too numerous to mention. Both types possess a common lift-load limiting feature, in that the accessory housing connecting the magnet and the lifting handle ordinarily is the weakest "link" in the structure.

As a consequence of the particular advantages and disadvantages of each type, it is often necessary for industries having a substantial amount of conveying to purchase both types of units, or to supplement one type of magnetic lifting device with mechanical hoist mechanisms.

Even then the known types of magnetic lift devices are limited in weight carrying capacity by the structural limitations incident to the housing of the accessory equipment.

Further, magnetic lifting apparatus has not been flexible in operation by being utilizable both as a compact unit and as a divisible remotely operable assembly.

Accordingly, it is an object of this invention to provide a novel and unique magnetic lifting device capable of lifting increased amounts of metal materials without danger of possible structural failure, by complete elimination of the use of the housing as a connecting link in the lift device.

Another object of this invention is to provide a magnetic lift unit with which both battery source type and external power source type power packs may be readily and interchangeably used.

Another object is to provide a magnetic lift device that is optionally remotely controllable by easily removing the sensitive power pack elements from the lifting magnet, but that is also quickly formable into the compact unitary structure.

Other objects are to provide a magnetic lift device that has a variable lifting power, that is very safe to use by workmen, the power packs and magnet of which may be quickly disassembled and reassembled utilizing no tools, and the interchangeable battery power pack of which has a built-in battery recharger.

Various other objects and advantages will be apparent upon studying the following specification in conjunction with the drawings in which:

FIG. 1 is a front elevation view of the magnetic lift device including a battery type power pack;

FIG. 2 is a plan view of the device in FIG. 1;

FIG. 3 is a partially sectioned end view of the device in FIG. 1;

FIG. 4 is a front elevation view of a control panel used with the device in FIG. 1 including a variable holding power control device;

FIG. 5 is a perspective view of the magnetic lift unit with a power pack (not shown) at a remote position;

FIG. 6 is a plan view of the device shown in FIG. 1 with the top covers removed;

FIG. 7 is an electrical diagram of the circuitry when the battery power pack forms part of the lift device;

FIG. 8 is a fragmentary electrical diagram showing the battery powered device and having a variable holding power;

FIG. 9 is a perspective view of the external power source type power pack; and

FIG. 10 is an electrical diagram of the control circuit used with the power pack of FIG. 9.

Basically, this invention comprises a magnet unit including an electromagnet, an electrical exciter winding adjacent the magnet, lifting bracket means on the magnet, and handle means on the bracket means. This unit combines electrically and, if desired, mechanically with a battery power pack and accessory housing, or interchangeably with an external power source control housing; the electrical connection being preferably a simple plug-in arrangement, and the mechanical connection preferably being a sliding interlock. The unit may be operated remotely through either of the housings, or with either housing mechanically coupled therewith.

Referring to FIG. 1, the composite lifting device 10 includes electromagnet unit subassembly 12, and power pack and accessory housing subassembly 14.

The electromagnet unit 12, shown in more detail in FIGS. 3 and 5, may be of varied construction and may possess a variously configurated lower surface 15 depending upon the shape of the article to be lifted, or other circumstances. The electromagnet is here shown (FIG. 3) to include magnetizable pieces 16, 18 and 20 forming a flat lower surface and adjacent electrical coil forming windings 22, with additional supporting and covering plates 24 and 26 being provided as desired. The lower magnetic pieces 16 and 20 are preferably separated by an insert 28 of non-magnetic material to establish more effective magnetic circuits. These conventional pieces are all very securely fastened together by any suitable means (not shown) to form a solid joined structure hereinafter sometimes designated as magnet 25.

Extending upwardly from both sides of this electromagnet structure are two integral brackets or lifting means 30 and 32, secured directly to the magnet as by welding at 34 so that all of the lifting stresses appear only in the lifting brackets and the magnet. These brackets 30 and 32 are formed of very sturdy material and are secured to the magnet over a substantial area of the bracket to assure an over-all sturdy construction. Removably attached to the upper extremities of these brackets is a handle 36 that is attached to brackets 30 and 32 by collar 38 and pin 40. This assembly allows rapid removal of the handle without tools for removal of housing subassembly 14 in a manner to be explained hereinafter. Electrically linking housing subassembly 14 with magnet 25 is an electrical cord 44 connected to housing 14 by plug 46 and to magnet 25 by another plug 48. A suitable guard 50 may be provided around plug 48 to protect it during operation. These plugs may be of any conventional quickly removable type such as the twist lock type.

The power pack and accessory housing 14 may be of the battery type as shown in FIGS. 1, 2, 3 and 6, or it may be interchanged with the external power source type housing shown in FIG. 9.

The battery housing subassembly includes housing 60 which may be rectangular in cross section and possesses two outwardly facing lateral recesses or slots 62 and 64 to facilitate a sliding interlock with brackets 30 and 32 of the electromagnet subassembly. Thus, with handle

means 36 removed as in FIG. 1, housing 60 may be removed from direct contact with the electromagnet subassembly by simply lifting the housing upwardly with handles 68 and 70. No other connection need exist between these two components other than electrical cord 44 which may be of any length to suit the particular situation. Housing 60 possesses a front control panel 72 and a top control panel 74. Top control panel 74 embodies switch 76 to control the "on," "off" and "release" operations of the electromagnet. The front panel may be of the type depicted in FIG. 1 or in FIG. 4, depending upon whether the variable holding power feature to be described hereinafter is incorporated.

The panel depicted in FIG. 1 embodies ammeter 78, plug 80 for connecting the unit with an external power source to recharge a storage battery, and control switch 82 for the battery charging operation. The panel shown in FIG. 4 also includes ammeter 78, plug 80 for the built-in battery charger, switch 82 for this battery charger, and in addition, control dial 84 for adjusting the variable holding power and switch means 86 for actuating or deactuating the variable holding power electrical apparatus. The top of housing 60 may comprise suitable hinged doors 88 and 90 (FIG. 2) fastenable together by a suitable latch actuated with knob 92 for access to the housing interior.

In FIG. 6 these covers are shown removed to reveal a conventional storage battery 100, preferably of the twelve-volt type and having conventional terminals 102 and 104, rheostat 106 for controlling the adjustable holding power of the unit, a conventional battery charger 110, including a step-down transformer having coils 111 and 113 and a rectifier 112. The means used to mount these elements into the housing, and also their relative positions may be varied as desired. Also seen in FIG. 6 are control panel 72 including plug 80, ammeter 78, and switch 82 described heretofore.

The electrical circuitry for this battery type power pack and control housing is shown in two alternate forms in FIGS. 7 and 8.

Referring now to FIG. 7, the circuit there depicted includes storage battery 100, ammeter 78, plug 46 including male member 46*a* and female member 46*b*, plug 48 including male member 48*a* and female member 48*b*, electrical exciter winding 22, magnet 25, on-off-release switching means 76 including switches 126, 128 and 130, resistor 132 around switch 130, battery charger 110 including conventional transformer coils 111 and 113 and rectifier 112, plug 80 for battery charger 110, and control switch 82 for battery charger 110. The gang switch 76 may be of any desired design to effect the actuation, deactuation and release of the magnet to release the conveyed article by reversal of the current in winding 22. The reverse current is substantially less than the ordinary magnetizing current by virtue of resistor 132 to prevent reactivation of the magnet by this current.

The circuitry shown in FIG. 8 is essentially similar to that shown in FIG. 7 except that inserted between points 134 and 135 in FIG. 7 is the adjustable holding power circuitry including rheostat 106 along with optional resistors 140, and switch means 86 for alternately by-passing or including rheostat 106 and thus the variable holding power in the circuitry.

In FIGS. 9 and 10 is shown the interchangeable power pack operated from an external power source and usable on the electromagnet unit shown in FIG. 5, by merely removing handle 36 and sliding housing 150 over brackets 30 and 32 by virtue of slots 152 formed in the two opposite sides of housing 150. Electrical cord 154 connects the device to a conventional power source. The housing includes a control panel 156 having an ammeter 158, an on-off-release switch means 160, an on-off switch means 162 for actuating or deactuating the variable holding power feature, and control dial 164 for controlling this variable holding power.

The circuitry for the operation and control of this external power source type power pack control unit is depicted in FIG. 10 and includes plug 176 for connection to a conventional outlet, step-down transformer 178, rectifier 180, and on-off release switch 160, variable rheostat 184 with controller 164, and switch means 162 for alternatively allowing variable holding power for magnet 25 or allowing a pre-set holding power. Plug 166, electrical exciter winding 22 and magnet 25 complete the circuitry.

Operation

When it is desired to lift and convey metallic magnetizable articles or stock with the subject device, the magnetic unit shown in FIG. 5 may be coupled with either the battery operated power pack shown in FIG. 1 or the external source type power pack shown in FIG. 10, and may be operated remotely or as a combined assembly. It further may utilize a variable holding power or a constant holding power, depending upon the type of material to be conveyed, the weight thereof, the safety factors involved and other considerations.

When it is desired to convey magnetizable metallic stock with the battery operated device, the electromagnet unit depicted in FIG. 5 is altered by removing nut 42 (FIG. 3), sliding pin 40 out of collar 38, lifting handle 36 from between brackets 30 and 32, sliding housing 60 down over these brackets by means of slots 62 and 64, connecting plugs 48 and 46 of cord 44, replacing handle 36, and attaching this handle to a suitable hoist or boom for operation. Next, the device is lowered to position with lower surface 15 in contact with the article to be lifted, and switch means 76 is moved from the "off" position to the "on" position thereby raising switches 126, 128 and 130 to the position shown in FIG. 7. Thus, current emitted from battery 100 passes to switch 128, through switch 128 to plugs 46 and 48, through coil 22 and back to point 135, through switch 130 to switch 126, through switch 126, ammeter 78, and back to battery 100. The magnet 25 is then actuated and will lift the article. After the article has been conveyed to the desired spot, switch means 76 is placed in the "release" position to lower switches 126, 128 and 130 in FIG. 7, whereby current flowing from battery 100 flows to switch 128 which is now closed to contact by-pass 131, through resistor 132 since switch 130 is now dead, through plugs 46 and 48 to coil 22 and passing therethrough in the reverse direction, through line 127 and lowered switch 126, then through ammeter 122 and back to battery 100. The resistor 132 causes the reverse current to be just large enough to destroy the previously formed magnetic fields and thereby release the article but not large enough to create an oppositely directed holding magnetic field.

When the battery becomes discharged and needs recharging, switch means 76 is opened by placing it in the "off" position (the normal storage position), and plug 80 is connected to a conventional alternating current outlet. Switch 82 is then closed to cause current to flow through battery charger 110 including the transformer and the rectifier 112, ammeter 78, battery 100, and back to the source.

Referring now to the variable holding power circuitry shown in FIG. 8, switch 86 and rheostat 106 are inserted between points 134 and 135 of the circuit in FIG. 7. If it is desired to obtain a variable holding power with the magnet to pick up a light load with the use of a small amount of current, for example, switch means 86 is thrown. Current then flows through rheostat 106 and may be regulated by the position of controller 84.

If it is desired to utilize an external power source control housing shown in FIG. 10 with the magnetic unit of FIG. 5, handle 36 is first removed, the battery type housing is slid from between brackets 30 and 32, and plug 46 is disconnected. Next, housing 150 is slid over the brackets and handle 36 is replaced. Electrical cord 44 is attached to housing 150 at plug 166 and cord 154 is

connected to a conventional alternating current outlet. Next, switch means 160 is thrown so that current passes through inlet plug 176 and electrical cord 154, through transformer 178, rectifier 180, switch means 160, plugs 166 and 48, and through coil 22 to actuate magnet 25, and then back to the source. The release operation is essentially the same as that described with respect to the battery operated type. If it is desired to have a variable holding power, switch means 162 is thrown to put rheostat 184 and controller 164 into the circuit. Current then passes through the rheostat to allow regulation of current to coil 22 for varying the lifting force of magnet 25.

If desired, either of these power packs and control housings may be physically removed from the magnetic unit shown in FIG. 5 and operated at a remote position. This is done, for example, by the cord 44 being connected between the magnetic unit and the power pack through plug 166 as generally shown in the combined FIGS. 5 and 9. The cord connecting the magnet unit with either of the housings may be of the desired length to facilitate control from a truck cab or the like. This removes the workman from the vicinity of the heavy stock, makes the handling thereof more convenient, and allows him to work more efficiently. Obviously a boom or the like will be hooked unto handle 36 to move the magnetic unit as desired.

It is seen that there is provided a magnetic lifting and conveying apparatus which no longer relies on the strength of the accessory housing as a stress-bearing member, which is extremely versatile in operation, which is simple in construction, and which may be operated remotely by removing the powerpack to any desired location.

It will be obvious to those having ordinary skill in the art that various minor modifications may be made in the magnetic lifting device disclosed without departing from the spirit of the invention, such modifications being deemed as part of this invention which is to be limited only by the scope of the appended claims and the reasonable equivalents thereto.

I claim:

1. A magnetic lift device comprising: an electromagnet having a lower surface capable of effectively contacting a magnetizable article to be lifted; an electrical exciter coil adjacent said magnet for energizing and de-energizing said magnet; lifting bracket means mounted directly and securely to said magnet; a separable housing resting on and supported by said magnet and forming a removable fit with said magnet and said lifting bracket means for operation with said magnet as a physically combined device and as a separated, remotely operated device; an electrical control circuit for said magnet in said housing; and an electrical contacting means between said housing and said magnet and forming a part of said circuit.

2. A magentic lift device comprising: an electromagnet having a lower surface capable of effectively contacting a magnetizable article to be lifted; an electrical exciter coil secured to said magnet for energizing and de-energizing said magnet; a plurality of lifting brackets mounted directly to said magnet; a removable housing having means in the side walls thereof for forming a cooperative removable fit with and between said brackets; said housing resting upon said magnet when fitting with said brackets, being substantially free from tensile stress and capable of sliding removal between said brackets for remote operation of said magnet and brackets from the physically removed housing; an electrical control circuit for said magnet in said housing; an electrical connecting means between said housing and said magnet and forming a part of said circuit; and switch means in said circuit for actuation and deactuation of said coil and magnet.

3. A magnetic lift device comprising: an electromagnet having a lower surface capable of effectively contacting a magnetizable article to be lifted; an electrical exciter coil secured to said magnet for energizing and de-energizing said magnet; a plurality of elongated brackets secured rigidly to opposite sides of said magnet; a housing having recesses in the side walls thereof for forming a cooperative sliding, removable fit with said brackets; said housing normally resting upon said magnet and supported thereby when fitting with said brackets, and capable of sliding removal therefrom for remote operation of said magnet and brackets from the physically separated housing; handle means removably secured to the top of said brackets; an electrical control circuit for said magnet in said housing; an exterior electrical cord between said housing and said magnet forming a part of said circuit; and switch means in said circuit for actuation and deactuation of said magnet.

4. A magnetic lift device comprising: an electromagnet having a lower surface capable of effectively contacting a magnetizable article to be lifted; an electrical exciter coil above and secured to said magnet for energizing and de-energizing said magnet; a plurality of elongated brackets secured rigidly and directly to opposite sides of said magnet and extending upwardly therefrom; a housing having recesses in the side walls thereof for forming a cooperative removable sliding fit with and between said brackets; said housing resting upon and supported by said magnet when positioned between said brackets, and capable of sliding removal therefrom for remote operation of said magnet and brackets from the physically separated housing; handle means removably secured to the upper extremities of said brackets; an electrical control circuit for said magnet in said housing; a variable resistance means in said circuit for obtaining the desired amount of current in said winding to vary the magnetic lifting power; an exterior electrical cord between said housing and said magnet forming a part of said circuit and enabling said magnet to be operated from the housing when resting on said magnet or removed therefrom; and switch means in said circuit for actuation and deactuation of said magnet.

5. A magnetic lift device comprising: an electromagnet having a lower surface capable of effectively contacting a magnetizable article to be lifted; an electrical exciter coil secured to said magnet for energizing and de-energizing said magnet; a plurality of elongated lifting brackets secured directly to opposite sides of said magnet and extending upwardly therefrom; a housing having recesses in the side walls thereof for forming a cooperative removable sliding fit with and between said brackets; said housing resting upon and supported by said magnet when positioned between said brackets and capable of sliding removal therefrom for remote operation of said magnet and brackets; an electrical control circuit for said said magnet in said housing; a storage battery in said housing and electrically connected into said circuit for supplying current for said winding; an exterior electrical cord between said housing and said magnet and forming a part of said circuit; and switch means in said circuit for actuation and deactuation of said coil and magnet.

6. A magnetic lift device comprising: an electromagnet having a lower surface capable of effectively contacting a magnetizable article to be lifted; an electrical exciter coil above and secured to said magnet for energizing and de-energizing said magnet; a plurality of elongated lifting brackets secured rigidly to opposite sides of said magnet and extending upwardly therefrom; a housing having recesses in the side walls thereof for forming a cooperative sliding fit with and between said brackets; said housing resting upon and supported by said magnet when positioned between said brackets and capable of sliding removal therefrom for remote operation of said magnet and brackets; an electrical control circuit for said magnet in said housing; an electrical transformer means and rectifier means mounted in said housing and connected to said circuit for operating said electromagnet

from an exterior alternating current power source; an exterior electrical cord between said housing and said magnet and forming a part of said circuit and enabling said magnet to be operated from the housing when resting on said magnet or removed therefrom; and switch means in said circuit for actuation and deactuation of said coil and magnet.

7. A magnetic lift device comprising: an electromagnet having a lower surface capable of effectively contacting a magnetizable article to be lifted; an electrical exciter coil above and secured to said magnet for energizing and de-energizing said magnet; a plurality of elongated lifting brackets secured rigidly to opposite sides of said magnet and extending upwardly therefrom; a housing having recesses in the side walls thereof for forming a cooperative sliding fit with and between said brackets; said housing resting upon and supported by said magnet when positioned between said brackets and capable of sliding removal therefrom for remote operation of said magnet and brackets; an electrical control circuit for said magnet in said housing; battery charging means mounted in said housing and connected into an electrical circuit in parallel with said magnet control circuit; switch means in said parallel circuit for operation of said charging means; and electrical connection means in said parallel circuit and mounted in a wall of said housing for connection to an external power source.

8. A magnetic lift device comprising: an electromagnet having a lower surface capable of effectively contacting a magnetizable article to be lifted; an electrical exciter coil above and secured to said magnet for energizing and de-energizing said magnet; a plurality of elongated lifting brackets and secured to opposite sides of said magnet and extending upwardly therefrom; a housing having recesses in the side walls thereof for forming a cooperative sliding fit with and between said brackets; said housing resting upon and supported by said magnet when positioned between said brackets and capable of sliding removal therefrom for remote operation of said magnet; an electrical control circuit for said magnet in said housing; a storage battery in said housing and electrically connected into said circuit for supplying current for said winding; an exterior electrical cord between said housing and said magnet and forming a part of said circuit; switch means in said circuit for actuation and deactuation of said coil and magnet; said control circuit including an electrical plug connection in a wall of said housing; an electrical plug connection on the exterior of said magnet; and an electrical cord having matching plug connections on its extremities for physical and electrical juncture with said housing and magnet plug connections with said exterior electrical cord, wall connection, magnet connection, and plug connection enabling the alternative operation of said magnet through said housing with said housing resting on said magnet or removed therefrom.

References Cited by the Examiner

UNITED STATES PATENTS

1,402,802	1/22	Simmons	317—163
2,390,377	12/45	Lillquist et al.	317—123
2,794,941	6/57	Anderson	317—123

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