Sept. 1, 1936. B. F. FITCH 2,052,559

LOAD LIFTING CRADLE

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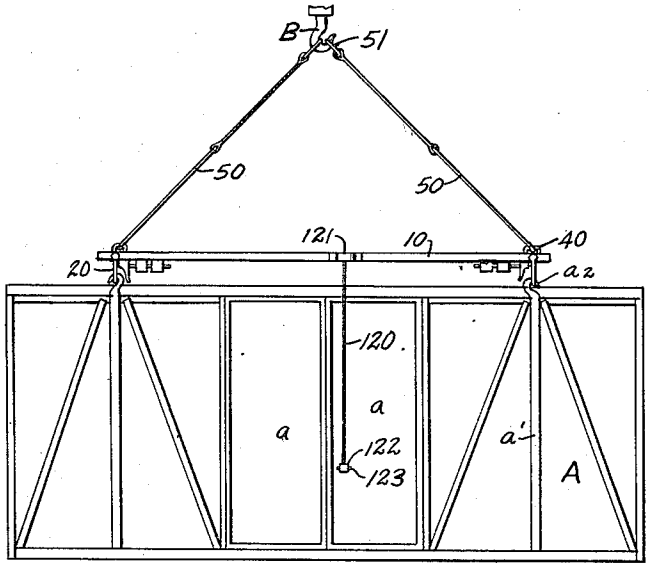


FIG. 1

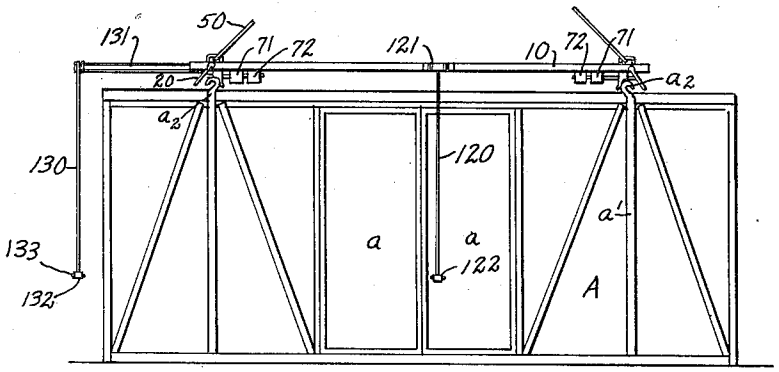


FIG. 2

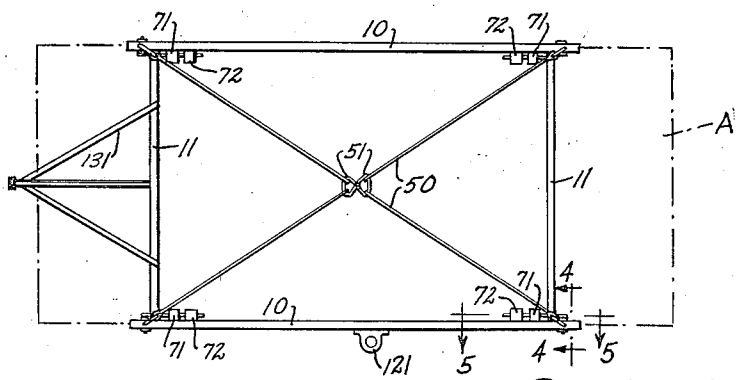


FIG. 3

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FIG. 5

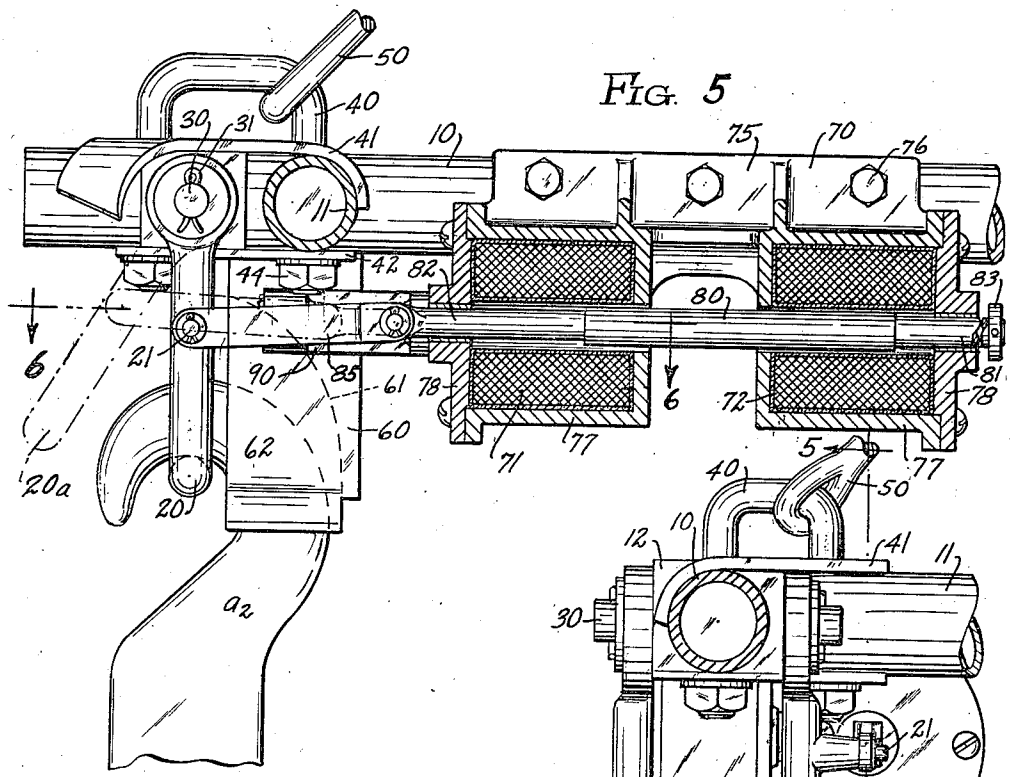
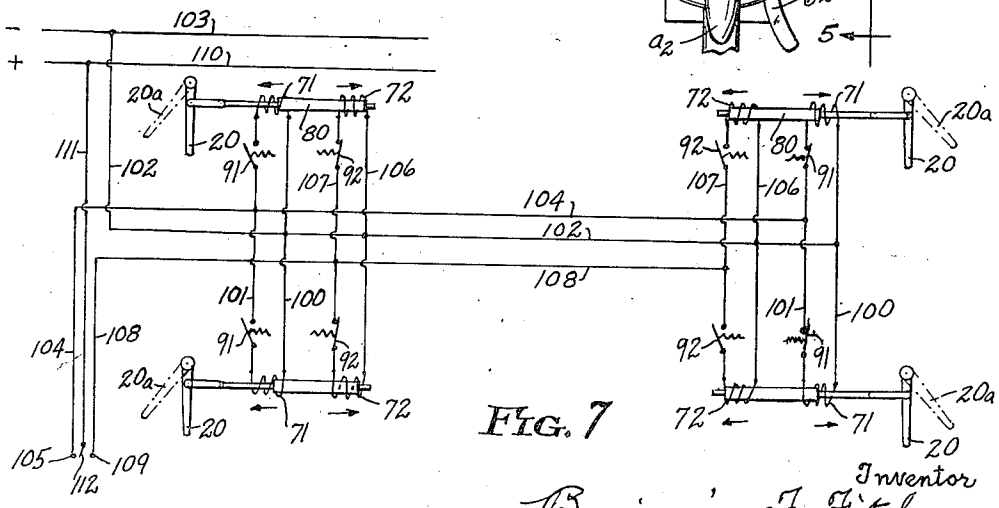


FIG. 4

FIG. 7



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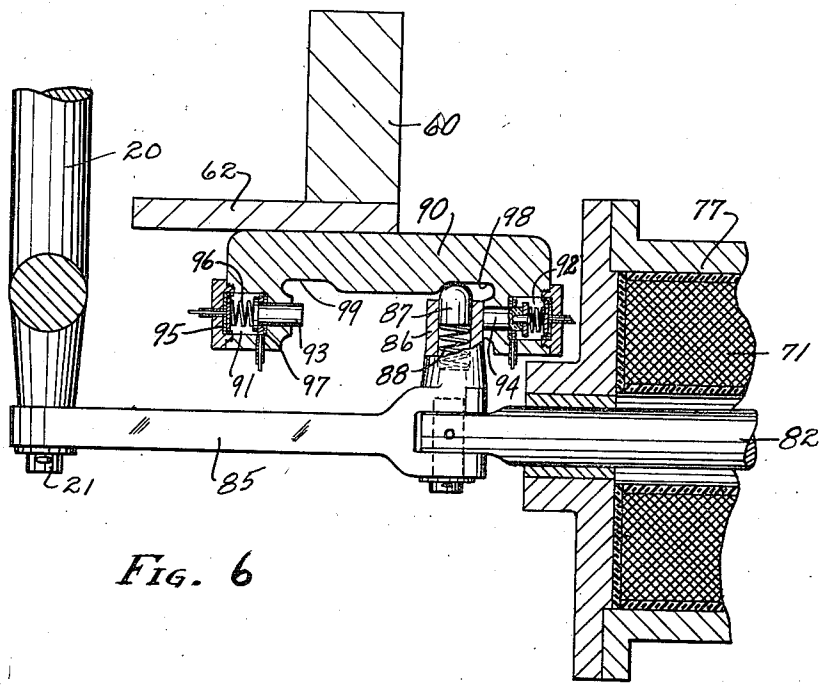


FIG. 6

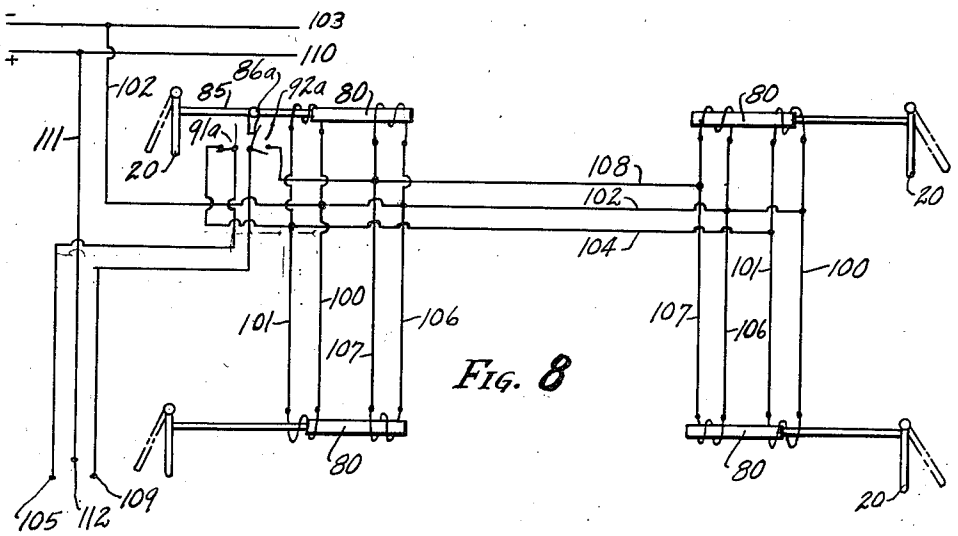


FIG. 8

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UNITED STATES PATENT OFFICE

2,052,559

LOAD LIFTING CRADLE

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Application September 7, 1933, Serial No. 688,479

3 Claims. (Cl. 294—67)

This invention relates to apparatus for connecting a lifting mechanism to a demountable automobile body, which may be loaded with bulk or package freight. This apparatus has a load-engaging means arranged to be connected with the body at four points, two on each side, and is adapted to be suspended in a horizontal position by a suitable depending raising mechanism, whereby the body may be well supported for lifting while maintained in its level position.

More particularly the invention is designed to raise demountable bodies having supporting hooks projecting slightly above their eaves, and to that end employs a cradle comprising a floating rectangular frame having shackles or loops pivoted to the frame and depending therefrom, so that they may be swung into and out of engagement with the hooks.

The object of the present invention is to provide simple and effective means for swinging the shackles in either direction, such means being readily operable from a convenient adjacent or remote location. To this end I have provided double-acting solenoids, one for each shackle, the solenoid being adapted to swing the shackle in either directon according to the energization of the solenoid, and I have so connected the windings of the solenoids with a suitably located reversing switch or push buttons that when the switch is thrown in one direction the shackles are swung inwardly to enter the mouths of the body hooks, and on the other movement of the switch are swung outwardly to clear the hooks. The circuits for operating the various solenoids simultaneously and correspondingly are collected into a suitable cable, which may depend at the side or end of the cradle or in a control cab, and the conductors of which are electrically connected with a readily accessible reversing switch, or push buttons.

The invention above outlined is illustrated in the drawings hereof and is hereafter more fully explained, and the novel characteristics are summarized in the claims.

In the drawings, Fig. 1 is a side elevation of my cradle attached to a demountable truck body which is being lifted by a hoist attached to the cradle, this view showing the electric cable depending at the side of the cradle; Fig. 2 is a side elevation of a demountable body and the cradle detached therefrom but in position to engage the shackles, this view illustrating the operating cable at the end of the body; Fig. 3 is a plan of the cradle over a body indicated in broken lines and illustrates provision for supporting the electric cable at either the end or side of the cradle; Fig. 4 is a vertical cross-section through the cradle on a larger scale, as indicated by the line 4—4 on Fig. 3; Fig. 5 is a vertical section on the inner side of one of the longitudinal bars of the cradle, illustrating the solenoid operating mechanism, the section being on the plane indicated by the line 5—5 on Figs. 3 and 4; Fig. 6 is a horizontal section through the solenoid and limit switches operated thereby, as indicated by the section line 6—6 on Fig. 5; Figs. 7 and 8 are diagrams illustrating two different wiring plans for the solenoids, Fig. 7 showing the wiring when limit switches are carried by each solenoid, and Fig. 8 when master limit switches are operated by one solenoid for the benefit of all of them.

Referring first to Figs. 1 and 2, A indicates a demountable automobile body adapted to rest on and be carried by either an automobile truck, lighter, car float, barge, steamer or railway flat-car or gondola, as desired. This body is preferably of about the maximum size that can be conveniently carried by a highway truck, trailer or semi-trailer, two or three of such bodies being adapted to be mounted end-to-end on or in the railway car. The body is provided with a suitable floor frame, side walls, end walls and roof, and preferably doors in both sides and both ends. Two of such side doors are indicated at "a" in these figures. Each side of the demountable body is provided with two upwardly extending straps a' terminating in hooks a2. These hooks lie substantially in the side plane of the body and are located a short distance above the eaves and face in opposite directions, preferably toward the ends of the body.

The cradle provides a floating rigid rectangular frame and suitable U-shaped shackles pivotally supported thereby and depending therefrom. The frame may be made up of a pair of longitudinal tubular side bars 10 and a pair of tubular end bars joining the side bars and welded or otherwise secured thereto. There may be intermediate cross-bars or other bracing means, not shown in the drawings.

The supporting shackles 20 are pivotally carried by the side bars of the cradle, these side bars being preferably provided with reinforcing blocks 12, rigid with the bars adjacent their ends. These blocks have parallel vertical outer sides, which are substantially engaged by the inner faces of the shackle arms. These arms are supported by horizontal pins 30, extending laterally through the longitudinal bars, reinforcing blocks

and shackle arms, and receiving cotter pins 31 beyond the shackle arms.

To suspend the cradle, I prefer to provide inverted U-shaped bolts 40, positioned diagonally so that one leg may pass downwardly through the longitudinal bar 10, while the other leg passes through the end bar 11. Suitable stiffening plates 41 and 42 are provided above and below the bars and are rigidly connected to them, as by welding, and the bolt legs 40 also pass through these stiffening plates and have nuts 44 on their lower ends. This makes a rigid attaching device adjacent the corner of the clamp.

I have shown articulated hog rods 50 secured to the loops 40 and extending diagonally upward toward a common point. Each pair of hog rods may be connected to a ring 51, which may be hooked over a suitable hoist B, Fig. 1.

Suitable means is preferably provided to guide the cradle as it is lowered to bring the shackles opposite the mouths of the body hooks. Thus, I have shown guide blocks 60 secured to the side bars and depending from them adjacent each shackle. Each guide block 60 presents a curved wall 61 adapted to engage the back of the hook a2 and a side wall 62 adapted to engage the inner side of the hook, so that the lowered cradle is automatically positioned both endwise and sidewise.

The parts so far specifically described are of the general type shown in my pending applications No. 574,743, filed November 13th, 1931, and No. 615,906, filed June 7th, 1932, and reference is made to the patents to be granted on those applications for claims relating to the cradle itself.

As heretofore outlined, the present invention is concerned with the means for swinging the shackles 20 on their pivots 30. Such means will now be described.

Carried by each longitudinal bar 10 adjacent the shackle is a hollow solenoid frame 70 having within it a pair of windings 71, 72, there being accordingly four of these double solenoids. Longitudinally movable within the windings is the core 80, which is connected with the corresponding shackle 20. I have illustrated the solenoids as fixedly carried by the frame and the core as operating on a fixed axis. I have shown a link 85 pivoted at its opposite ends to the core and to the shackle. Thus the axial movement of the core is translated into a swinging movement of the shackle and, as hereinafter described, this movement may be in either direction according to which winding of the solenoid is energized.

Referring more specifically to Fig. 5, the solenoid frame is made up of a supporting portion 75, adapted to engage the bar 10, and be secured thereto by bolts 76, and a pair of oppositely facing metallic cups 77 in which are located the respective windings 71 and 72. The cups may be integral with the body or supporting portion, as shown. Each cup is closed at its outer end by a cap 78, which has a central opening making an effective guide for the core bar 80.

The core bar 80 has a central iron portion adapted to respond to the magnetic influence of the windings and reduced extensions 81 and 82, which may be of non-magnetic material and slide readily through the openings in the end caps 78. A suitable stop in the form of a collar 83 is shown on the extension 81. The extension 82 is provided at its end with an eye by which it is pivotally connected to the link 85, the other end of which has an eye embracing a stud 21 on the side of one of the arms of the shackle 20.

When the shackle is depending vertically, as illustrated in full lines in Fig. 5, the magnetic core 80 is in the position shown in that figure. Now, if the shackle is free to swing, an energization of the winding 71 will pull the core toward the left in that figure, which would swing the shackle 20 into the position shown in dotted lines at 20a. In this latter position the magnetic core 80 will nearly fill the opening in the winding 71 but only partially in the head of the winding 72, and when the latter winding is exclusively energized the core will be drawn toward the right and the shackle swung back into vertical position.

The four windings 71 adjacent the corresponding shackles are connected to one circuit, and the four windings 72 distant from the corresponding shackles to another circuit. Each circuit is connected with one terminal of the power line, while the other terminal of the power line leads to a switch or push buttons which may connect it with either of said circuits. Thus the four windings 71 may be simultaneously energized to the exclusion of the windings 72, or the windings 72 may be energized to the exclusion of the windings 71.

It is desirable to provide means to open the circuits to the solenoids when the shackles reach either limit of movement, to save current and prevent possible injury to the solenoids. The arrangement of switches for this purpose is illustrated in Fig. 6. As there shown, I have secured to the outer wall 62 of the guide block 60 a bracket 90 carrying two electric switches 91 and 92, respectively, operated by plungers 93 and 94. Each switch is shown as comprising a disc 95 connected to one terminal, with a spring 96 engaging the disc, and a washer 97 normally held by the spring in contact with the other terminal. The plunger 93 or 94 referred to may separate its washer 97 from its terminal and thus break the circuit.

The link 85 is shown as having a boss 86 back of the pivotal connection of the core bar, this boss carrying a plunger 87, pressed by a spring 88 toward the body of the bracket 90. In either extreme position this plunger 87 rests in a recess 98 or 99 in the bracket 90, and prevents inadvertent displacement.

When the shackle 20 is in engaging position the solenoid and switches are in the position shown in Fig. 6 and the switch 92 is open. Now if the circuit be closed through the solenoid winding 71, this swings the shackle into the position shown in dotted lines in Fig. 5. At the end of such movement the boss 86 engages the plunger 93 of the switch 91 and opens that switch, and at the same time the plunger 87 enters the bracket recess 99 and the spring 88 has sufficient force to retain the parts in this position, notwithstanding the gravitational tendency of the shackle to swing down to vertical position. The force of the spring 88 is readily overcome by the force of either solenoid winding, which will swing the shackle in the direction desired.

While the limit switches above described are not necessary to the operation of the shackles by the solenoids, and might be dispensed with, if the shackle windings are such that no dangerous overheating would result if the current were inadvertently left on, nevertheless the automatic limit switches are a distinct advantage in saving current and insuring protection for the solenoids. Such limit switches may be provided for each solenoid, as illustrated in the diagram Fig. 7, or a master limit switch operated by one solenoid

might be provided, as hereinafter described with reference to Fig. 8.

In the diagram, Fig. 7, the four windings 71 at each end of the frame have their terminals connected to two lines 100 and 101; the two lines 100 are connected by a line 102 with one of the power lines 103, while the two lines 101 are connected by a line 104 leading to the switch terminal 105. Similarly the terminals of the four windings 72 are connected to two lines 106 and 107. The limit switches 91 for each of the four windings adjacent the two ends of the crane are shown as included in series in line 101, and the corresponding limit switches 92 in series in the line 107. The lines 106 are intermediately connected to the line 102 leading to the power line 103, while the lines 107 are both connected to the line 108 leading to the other switch terminal 109. From the other power line 110, a line 111 leads to the switch arm 112.

If the switch arm 112 is brought into contact with the switch point 105 the four windings 71 are energized and the core bar is moved to swing the four shackles outwardly into the position shown in dotted lines 20a. At this time the winding 72 is unenergized and idle. Now if the switch arm 112 be swung to engage the terminal 109 the windings 71 are deenergized and the four windings 72 become energized, thus pulling the core and swinging the shackles into the vertical or load-engaging position illustrated at 20.

When the master limit switch arrangements is employed, as illustrated in the diagram Fig. 8, the control by the switch 112 and the wiring to the respective windings is the same as already described, except that the switches 91 and 92 are omitted from the lines 101 and 107. In place of the switches in those lines I employ a pair of switches 91a between the line 104 and terminal 105, and a switch 92a between the line 108 and the terminal 109. Otherwise the circuits are as described with reference to Fig. 7.

In Fig. 8 one of the links 85 carries adjacent its pivotal connection with the core bar an extension 86a which coacts with the respective switches 91a and 92a at the opposite limit of the movement. This arrangement is also substantially that illustrated in Fig. 6, but employs only one of the solenoids instead of all four of them. In either arrangement the power to the four solenoids is shut off as soon as they have performed the work of swinging the shackles in one direction or the other to engage or disengage the load, as desired.

It will be understood that when the cradle is ready for lowering to engage a load, or as it is being lowered, the switch 112 would be set to engage the contact 105 and the windings 71 would be energized and the shackles spread. Then after the cradle has come into the position shown in Fig. 2 with its guides 60 engaging the hooks and the shackles opposite the mouths of the hooks, the switch 112 is thrown into engagement with the contact 109 and this swings the shackles into vertical position within the mouths of the hooks. Thereafter when the hoist raises the cradle, the shackles are raised above the hook openings and effectively engage the hooks as shown in Figs. 1 and 5.

When it is desired to release the load, it is lowered onto a suitable support, which may be a truck, vessel or car or stationary support, and then the cradle is lowered still further so that the guides rest on the body hooks and the shackles are opposite the mouths of the hooks. Then an actuation of the switch arm 112 into engagement with the terminal 105 swings the freed shackles into the position 20a to clear the hooks, allowing the cradle to be elevated.

The electric lines 102 and 111 leading from the power lines may readily depend by flexible cables or cable reel from some point on the hoist structure to a suitable point on the cradle. The line 111 and the two lines 104 and 108 from the two sets of solenoid windings are preferably grouped into a three-strand cable which depends from the cradle and carries the switch at its lower end.

In Fig. 1 I have shown the three-strand cable 120 depending at the side of the cradle beyond the automobile body, being carried by a laterally extending bracket 121 on one of the side bars 10. The cable carries a suitable insulating casing 122, which supports the terminals of the three conductors, one of these terminals being the movable switch arm 112 adapted to contact with either the terminals 105 or 109. As indicated in Fig. 1, the insulating block 122 carries a laterally sliding push-pin 123, which may swing the switch arm in either direction.

Instead of the cable 120 depending at the side I may, if desired, employ a cable 130, depending at the end of the frame, being supported by a longitudinal extension 131, the cable in this case carrying the insulating casing 132, containing the terminals and the switch arm and carrying the double acting push-button 133. Or, if desired, the pendant control may be in cluster with other pendant controls of the hoisting mechanism, or in the cab of a traveling crane or gantry if such be employed.

It will be seen from the description given that the common actuator for the four solenoids may be at whatever point is most convenient, or if desired, there could be several points of actuation arranged by branch lines from the three control lines described. Thus, each hoisting mechanism and cradle may be readily arranged most conveniently for the work it is to perform.

With my double acting solenoid it is not necessary to rely on counterweights or springs to swing the shackles in one direction or the other, but the movements are positive both into active and idle positions. The solenoids are comparatively inexpensive and may be readily mounted on the cradle structure, and are so arranged as to be weather-proof. These solenoids, together with their accessible common actuator, provide an engaging and disengaging system which may be operated with the maximum speed, so that the cradle may drop into position and immediately engage the body and the hoist lift it, or the cradle may be immediately freed from a deposited body, and its shackles are thus automatically in position for re-engagement.

I claim:

1. In a hoisting mechanism for demountable bodies, said mechanism comprising a suspensible cradle, having parallel interconnected side bars, load-engaging members pivotally depending from the bars near their ends, and rigid guiding devices depending from the bars longitudinally inwardly toward the center of the frame from the load-engaging members, and adapted to substantially operatively align the load-engaging members with cooperating means on the body to be lifted, the combination of electrically operable units, operatively connected with the load-engaging members to position them with reference to respective ones of said means on the

bodies, said units being carried by the cradle laterally inwardly from the said bars so as to be laterally guarded thereby and inwardly longitudinally from the guiding devices so as to be longitudinally guarded by the latter.

2. In a hoist having a suspensible rectangular frame and four load-engaging members pivotally carried by the frame in rectangular arrangement, the combination of four solenoids mounted on the frame, each having its core connected with a corresponding load-engaging member, circuits leading from the solenoids and connected with a source of power, and with a depending electric cable, said frame having a lateral extension thereon for supporting the cable so that it depends beyond the region of the body to be engaged, and switch mechanism on the depending portion of the cable to energize the solenoid.

3. In a hoist having a suspensible frame and a plurality of load-engaging members pivoted thereto, each adapted to operatively engage a complementary member on a load to be lifted, when in one position of the pivoted member, and to operatively disengage the same when in another position; the combination of a pair of solenoids associated with one of the pivoted members, core means therefor connected with said member to move the same into said two positions consequent upon energization of respective ones of said pair, means to supply electric energy to the respective solenoids, switch means therefor, operatively connected with the core means for operation thereby to cut off such energy to the acting solenoid when said means has moved the pivoted member to respective ones of said positions, and detent means operatively associated with the said pivoted member to hold it in one of said positions when said energy is cut off.

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