May 29, 1934. W. T. WALKER 1,960,283

STOP MECHANISM FOR HOISTS

Filed Jan. 12, 1934 4 Sheets-Sheet 1

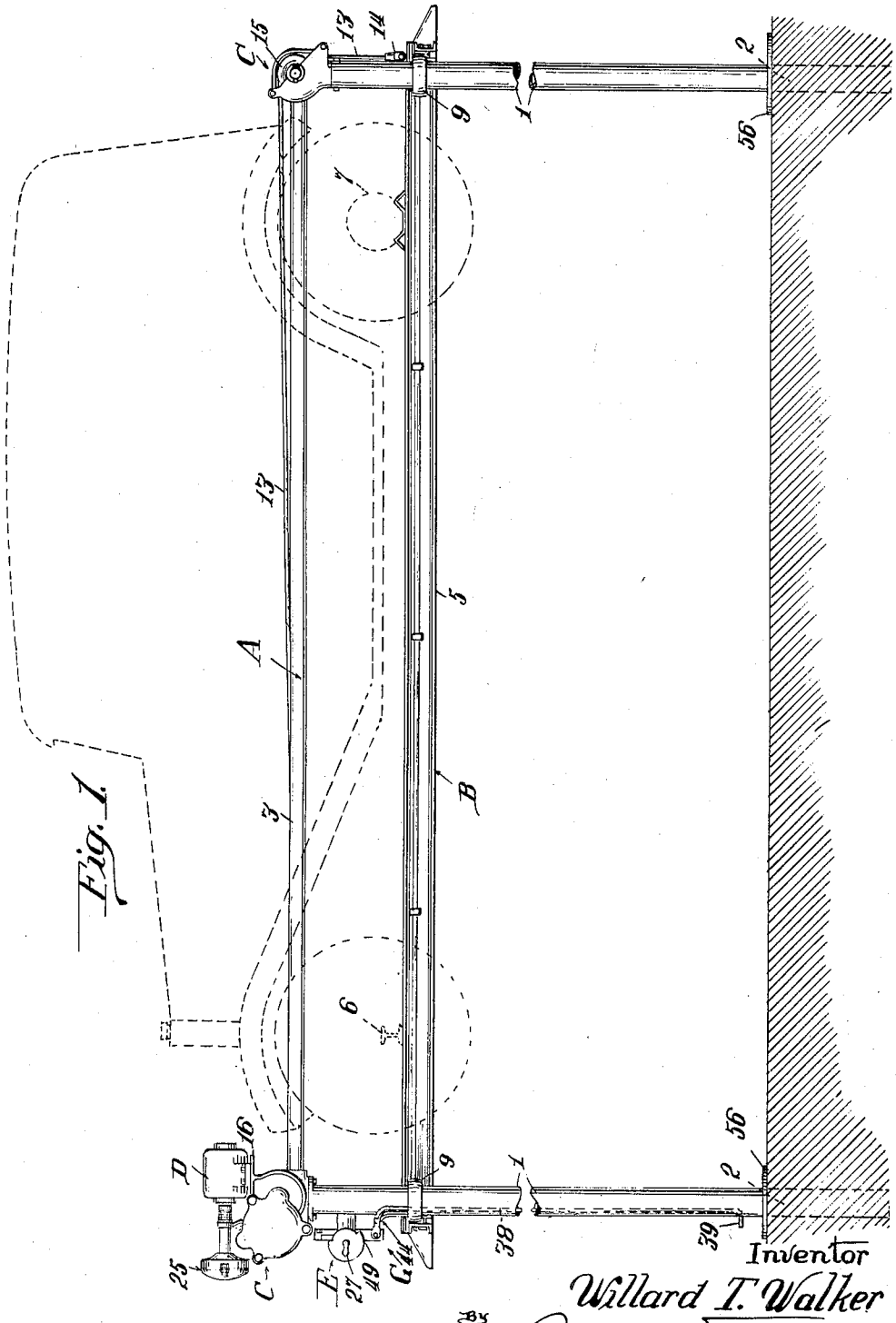


Fig. 1.

Inventor
Willard T. Walker
By Barnett & Truman
Attorneys.

May 29, 1934. W. T. WALKER 1,960,283

STOP MECHANISM FOR HOISTS

Filed Jan. 12, 1934 4 Sheets-Sheet 2

Fig. 6.

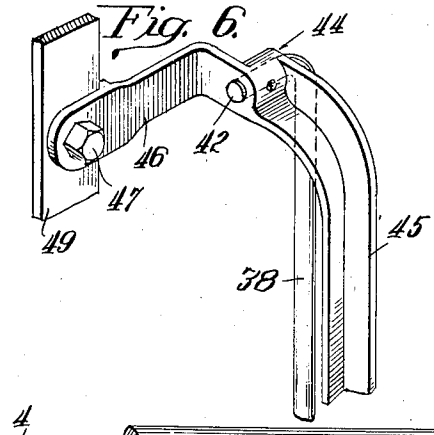


Fig. 2.

Fig. 5.

Inventor
Willard T. Walker
By Barnett & Truman
Attorneys

May 29, 1934. W. T. WALKER 1,960,283

STOP MECHANISM FOR HOISTS

Filed Jan. 12, 1934 4 Sheets-Sheet 3

Fig. 3.

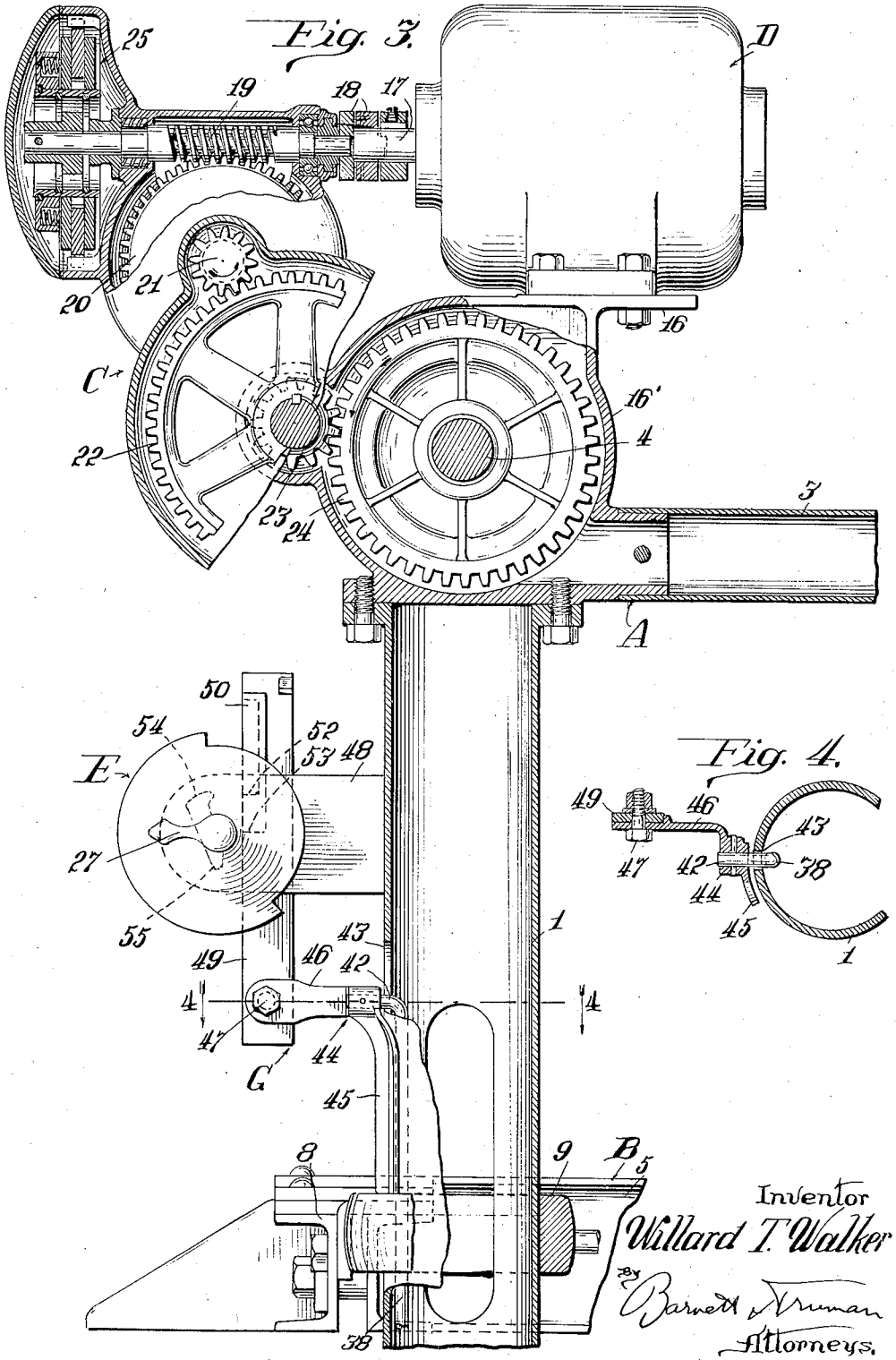


Fig. 4.

Inventor
Willard T. Walker
By Barnett & Truman
Attorneys.

May 29, 1934. W. T. WALKER 1,960,283

STOP MECHANISM FOR HOISTS

Filed Jan. 12, 1934 4 Sheets-Sheet 4

Fig. 8.

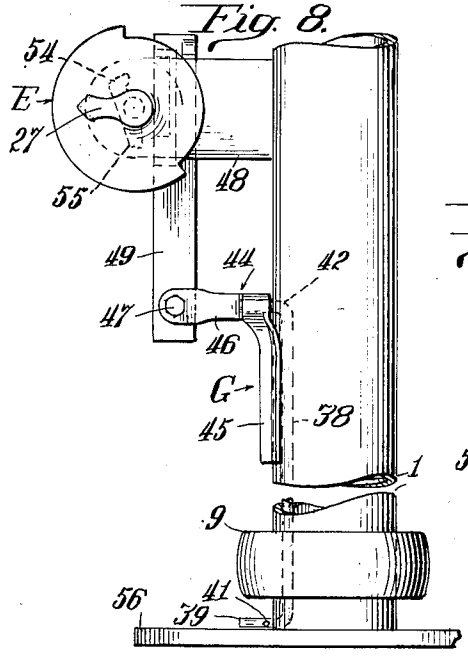


Fig. 7.

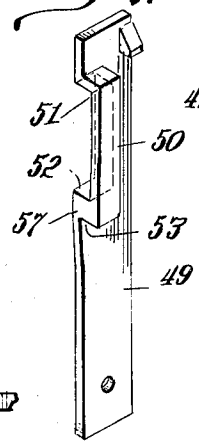


Fig. 9.

Fig. 10.

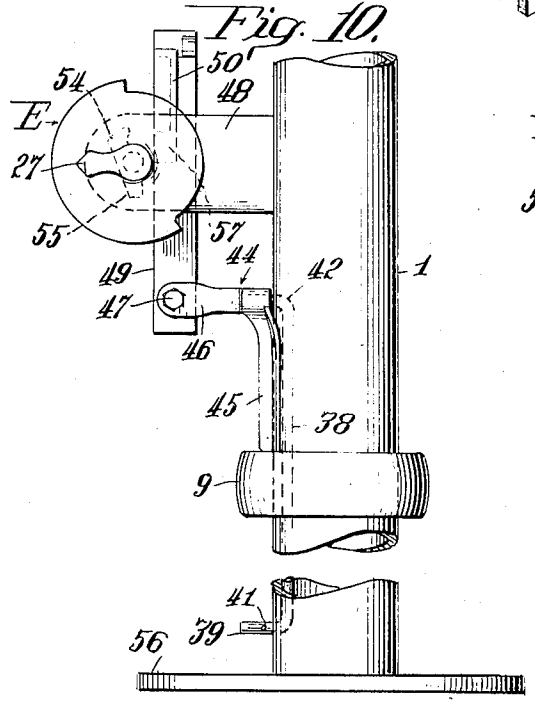
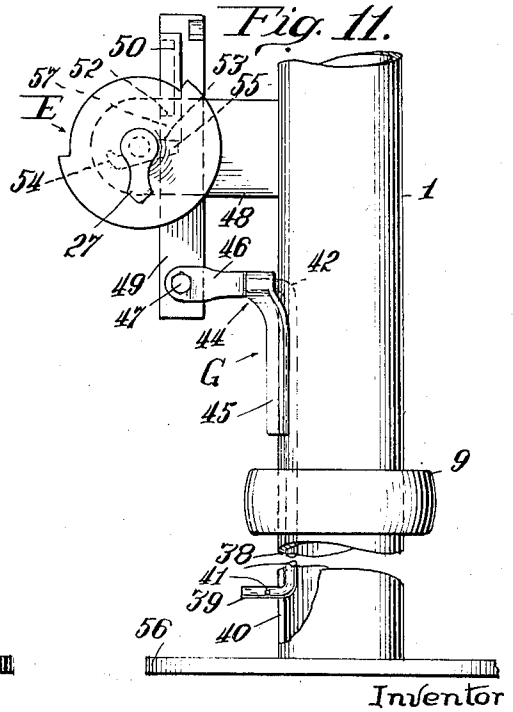


Fig. 11.



Inventor

Willard T. Walker

By Barnett and Truman

Attorneys

Patented May 29, 1934 1,960,283

UNITED STATES PATENT OFFICE

1,960,283

STOP MECHANISM FOR HOISTS

Willard T. Walker, Racine, Wis., assignor to Walker Manufacturing Company, Racine, Wis., a corporation of Wisconsin

Application January 12, 1934, Serial No. 706,338

14 Claims. (Cl. 254—89)

This invention relates to certain new and useful improvements in hoisting mechanism of the type adapted to bodily elevate an automobile so as to permit easy access to the under portions of the chassis, and more particularly to an improved form of limit stop mechanism for automatically stopping the car-supporting carriage when it has reached either its upper or lower limit of vertical travel.

Briefly described, the hoisting mechanism to which this invention is preferably applied, embodies a plurality of separate upright posts positioned adjacent the corners of a clear space into which the automobile may be run. An open carriage structure adapted to support the automobile is guided for vertical movement between the posts, the carriage being provided with guides engaging the several posts. Suitable cable mechanism for supporting and raising and lowering the carriage is operated by means of a reversible electric motor supported adjacent the upper end of one of the posts. The motor is controlled by means of a switch mechanism, preferably supported adjacent the upper end of one of the posts, the switch comprising a member which is swung through a certain arc in one direction from a neutral position to cause the motor to elevate the carriage, the member being swung through a similar arc in the opposite direction from neutral position to reverse the motor and cause the carriage to be lowered. A hoisting mechanism of this general type provided with numerous detailed improvements and safety devices not herein referred to, is disclosed more in detail and claimed in my copending application Serial No. 651,977, filed January 16, 1933.

The present invention is concerned more particularly with a stop mechanism adapted to automatically throw the control switch to neutral position and thus stop the motor and carriage when the carriage reaches either of its upper or lower limits of vertical travel. A vertical actuating rod, preferably positioned within the hollow guide post on which the switch is mounted, has its upper and lower end portions projecting outwardly through vertical slots in the post so that the rod is permitted a limited amount of vertical movement. Stop members carried by these projecting end portions of the rod are so positioned as to be engaged and moved by the adjacent guide member on the carriage as the carriage nears one limit or the other of its vertical travel. A device carried by and movable with the upper end of this rod is adapted to engage cooperating members on the switch mechanism for automatically throwing the switch to neutral position. A device which yieldably holds the switch member in each of its operative positions also serves to yieldably support the vertically movable actuating members in their elevated positions while the carriage is being lowered.

The principal object of this invention is to provide an improved automatic stop mechanism of the type briefly described hereinabove and disclosed more in detail in the specification which follow.

Another object is to provide a stop mechanism having its lower portions substantially housed and concealed within one of the posts or frame members so as to provide a minimum of obstruction to the clear space beneath and around the automobile and hoisting mechanism.

Another object is to provide means for preventing starting the hoisting motor in the wrong direction when the carriage is at either limit of its vertical travel.

Other objects and advantages of this invention will be more apparent from the following detailed description of one approved form of device constructed and operating according to the principles of this invention.

In the accompanying drawings:

Fig. 1 is a side elevation of the hoisting apparatus in elevated position, the corner-posts being partially broken away intermediate their ends.

Fig. 2 is an enlarged end elevation of one upper end of the hoist, the view being taken looking from the left at the near upper corner of Fig. 1 and showing the motor assembly, the control switch and the upper portion of the automatic stop mechanism.

Fig. 3 is a partial side elevation and partial vertical section, taken substantially on the line 3—3 of Fig. 2.

Fig. 4 is a detail horizontal section taken substantially on the line 4—4 of Fig. 3.

Fig. 5 is a detail vertical section taken substantially on the line 5—5 of Fig. 2.

Fig. 6 is a perspective view of the upper end portion of the actuating rod and the bracket connecting this rod with the lower end of the switch-actuating plate.

Fig. 7 is a perspective view of the switch-actuating plate or flat cam.

Figs. 8, 9, 10 and 11 are similar side elevations showing successive positions of the stop mechanism.

The apparatus may be described in general as comprising a fixed supporting frame indicated at A, a vertically movable carriage B movable

within frame A for supporting the automobile, a cable hoisting mechanism indicated generally at C which is mounted on the frame A and from which the carriage B is suspended, a driving motor D, the switch mechanism E for controlling the motor, the mechanism F (see Fig. 5) for yieldably holding the switch mechanism in each of its operative positions, and incidentally for supporting the stop mechanism in one of its operative positions, and the improved automatic limit stop mechanism indicated generally at G.

The frame A comprises four similar upright posts or standards 1, preferably in the form of hollow metallic pipe sections, which are mounted outside of but adjacent four corners of a rectangular clear space suitable for receiving the automobile or other vehicle to be hoisted. These posts are fixedly supported in any suitable manner, preferably by embedding the lower end portions thereof in the ground or other supporting foundation, indicated at 2. The upper ends of the pair of posts at each side of the frame are connected by a horizontal brace member 3, and the upper end portions of the two posts at one end of the frame (the left hand end in Fig. 1) are connected by a non-rotatable shaft 4 (see Figs. 2 and 3).

The carriage B may be of any suitable construction for supporting the automobile so as to permit as free access as possible to the under portions of the car. In the example here shown, the carriage comprises a pair of longitudinally extending beams 5 adapted to engage beneath the front axle 6 and some portion 7 of the rear axle assembly so as to support the automobile. Alternatively, a pair of runways may be used spaced apart so as to receive the four wheels of the automobile. These longitudinal carriage members are connected adjacent the posts 1 by transversely extending beams 8 provided at their ends with guide members engaging the respective posts. As here shown, these guides are in the form of loops 9 which engage loosely about the posts while the carriage is in normal horizontal position, but which will bind against the posts to support the carriage should some portion of the cable-hoisting mechanism fail so as to permit the carriage to cant in any direction from its normal horizontal position.

The winding mechanism C comprises a pair of similar winding drums 10, one positioned adjacent the upper ends of each of the posts 1 at one end of the frame, the drums being connected by the torque tube 11 mounted around the fixed shaft 4 so that the drums will be supported to rotate in unison. A pair of cables 12 and 13 are each fixedly secured at one end to a drum 10, the other end of cable 12 extending downwardly from the drum and being anchored by some suitable means, such as 14, to one corner portion of the carriage. The other cable 13 extends substantially horizontally from the drum 10, adjacent the brace beam 3, to and over a direction sheave 15 supported at the upper end of the post 1 at the other end of the frame, and thence downwardly and is secured to the adjacent corner portion of carriage B. A similar pair of cables 12 and 13 extend from the other drum 10 and are secured to and support the other two corners of the carriage structure.

The reversible electric motor D is supported on the bracket extension 16 of gear casing 16' adjacent the upper end of one of the posts 1. The motor shaft 17 is connected through coupling 18 with the driving worm shaft 19 which meshes with worm wheel 20 and thence through the train of gearing 21, 22, 23 and 24 drives one end of the winding drum assembly. The automatic friction brake mechanism indicated generally at 25 and described more in detail in my copending application hereinabove referred to, serves as a safety brake for the winding mechanism and motor when the load is being lowered.

The switch mechanism indicated generally at E controls the reversible motor D. The switch mechanism is controlled by the rock-shaft 26 on the outer end of which is secured the pointer and operating handle 27. When the switch is in stop or neutral position, this member 27 will be positioned as shown in Figs. 2, 3, 8 and 10. To start the motor D for elevating the carriage, the member 27 is swung in a clockwise direction through an angle of 90°, to the position shown in Fig. 9. To lower the carriage this member is swung through an angle of 90° in the opposite direction, as shown in Fig. 11.

All of the hoisting mechanism as thus far briefly described is substantially the same as has been disclosed more in detail in my copending application Serial No. 651,977, hereinabove referred to. While the improved automatic stop mechanism hereinafter described is designed particularly for use with a hoisting mechanism of this type, it will be apparent as the disclosure proceeds, that the structure of the hoisting mechanism can be varied considerably from the type herein disclosed by way of example, without affecting the operation of the improved stop mechanism.

The mechanism F shown in Fig. 5 is for the purpose of locking the switch mechanism yieldably in its neutral position or in either of its operating positions, and for automatically throwing the switch mechanism to "off" or neutral position whenever a movement from either of its operative positions has been sufficiently started.

The mechanism F will be positioned as shown in solid lines, Fig. 5, when the switch is in "off" or neutral position, and will be positioned as shown in dotted lines (Fig. 5) when the switch is moved to either of its operating positions by causing the carriage to move either up or down. The cam member 28 fixed to the switch shaft 26 is formed in one side with an arcuate notch 29, and in its two ends with similar notches 30 spaced further from the axis of the shaft than the central notch 29. The ends of notch 29 are connected with the respective notches 30 by the inclined cam surfaces 31. The lever 32 pivoted at one end 33 to some convenient fixed member (preferably within the switch housing 34) carries a roller 35 which is adapted to engage alternatively with one or another of the notches 29 and 30 and with the cam surfaces 31. The lever 32 is continuously urged in one direction so as to hold the roller 35 against cam member 28 by means of spring 36, anchored at one end 37 within housing 34 and secured at its other end to the free end of lever 32. When the switch is in "off" or neutral position, spring 36 will hold roller 35 within notch 29 and thus yieldably hold the switch mechanism in this position. If switch member 27 is manually swung in one direction or the other (that is to either of the positions shown in Figs. 9 and 11) the roller 35 will be forced out of notch 29 and along one of the cam surfaces 31 into one or the other of the end notches 30, whereupon spring 36 will snap the roller 35 into this notch 30 so as to yieldably hold the switch mechanism in the selected operative position. Now if the switch shaft 26 is

moved, either manually or automatically from this operative position sufficient to move roller 35 out of notch 30, the spring 36 will force the roller along the cam surface 31 so as to automatically throw the switch completely to its "off" or neutral position and hold it in this position. As will be hereinafter apparent, this mechanism F also functions to yieldably support the automatic stop mechanism G in its elevated position.

The automatic stop mechanism G comprises a vertically shiftable rod or bar 38 which is preferably housed within the hollow post 1 on which the switch E is supported. The lower outwardly turned end portion 39 of this rod projects through a vertical slot 40 in the lower portion of the post so as to be in the path of movement of the carriage guide 9. A transverse pin 41 holds this end of the rod in its outwardly projected position. The outwardly turned upper end portion 42 of this rod 38 (see particularly Figs. 2, 3, 4 and 6) projects outwardly through a vertical slot 43 in the upper portion of post 1 and is anchored in a bracket member 44 having an arm 45 which projects downwardly along the outer side of the post to be engaged by the upper surface of the carriage guide 9, as it nears its upper limit of travel. A second arm 46 on this bracket member 44 projects outwardly and is secured at 47 to the lower end portion of the switch-actuating plate 49 which moves vertically with the actuating rod 38, and which is suitably guided for vertical sliding movement in the switch supporting member 48. The upper portion of this plate 49 is offset at 50 (see Fig. 7) so as to provide a vertically extending socket 51 at the bottom of which is an upwardly facing shoulder 52, and below which is a downwardly facing shoulder 53. Secured on the rock-shaft 26 of the switch are an upwardly projecting arm or finger 54 and a downwardly projecting arm or finger 55. When the switch is in "off" or neutral position, these fingers will be out of engagement with the operating plate 49, as shown in Figs. 3, 8 and 10. When the switch is rocked upwardly to cause the motor B to elevate the load, the finger 54 will be swung into the socket 51 of plate 49 so as to be within the path of upward movement of the shoulder 52. This position is shown in Fig. 9 of the drawings. When the switch member is swung downwardly to lower the load, the finger 55 will be swung beneath the shoulder 53 of plate 49, as shown in Fig. 11.

The operation of this automatic limit stop mechanism G will best be understood by referring to Figs. 8 to 11 inclusive. As shown in Fig. 8, the hoist has been completely lowered, the operating parts are all at rest, and the switch is in the neutral position. At this time the lower end portion 39 of rod 38 rests upon the supporting base 2 or upon the base-plate 56 at the lower end of post 1, so as to support the rod 38 and switch-actuating plate 49 in this lowermost position. In order to elevate the load, the switch member is swung upwardly, or in a clockwise direction, through an angle of 90° to the position shown in Fig. 9. This brings the operating finger 54 into the socket 51 of the plate 49 above the shoulder 52. As shown in Fig. 9, the carriage is traveling upwardly, but the guide 9 has not yet engaged with the arm 45 of the stop mechanism. As the carriage nears its upper limit of travel, the guide 9 will engage the lower end of arm 45 and lift the rod 38 and plate 49 so as to bring the shoulder 52 of the plate into engagement with the finger 54 and swing the switch shaft 26 back toward neutral position. When this movement has progressed far enough to move the roller 35 of the mechanism F out of notch 30 and onto the cam surface 31, the switch will be snapped completely to "off" or neutral position. The parts will now be positioned as shown in Fig. 10. The operating parts are now all at rest with the carriage at its upper limit of travel. The switch is in neutral position, and the switch actuating assembly consisting of rod 38, bracket 44 and plate 49 is held in its uppermost position by the carriage guide 9 which supports the downwardly projecting arm 45 of bracket 44. This position of the parts is also shown in Figs. 1, 2 and 3 of the drawings.

When the carriage is to be lowered, the switch member is swung through an arc of 90° in a counter-clockwise direction so that the pointer 27 will project downwardly, as shown in Fig. 11. This will bring the finger 55 on the switch shaft underneath the shoulder 53 on the operating plate 49. As the carriage guide 9 moves downwardly, it will no longer support the bracket 44, but the operating members of the stop mechanism will now be supported by the finger 55 on the switch-shaft, and the mechanism F which now yieldably holds the switch mechanism in this position. Consequently the rod 38 will still be held in its elevated position as the carriage guide 9 moves downwardly, all as shown in Fig. 11. As the carriage nears its lower limit of travel, this guide 9 will engage the outwardly projecting lower end portion 39 of rod 38 and pull the rod 38 and actuating plate 49 downwardly so as to swing the finger 55 and switch shaft 26 back in a clockwise direction toward neutral position, and as soon as this movement has progressed sufficiently to move the roller 35 onto cam surface 31 the switch will be snapped completely to its neutral position by the mechanism F. The carriage will be stopped with the guide 9 in the position shown in Fig. 8 and the rod 38 will drop still further until it is supported by its lower end 39 on the base plate 56.

It will be noted that when the parts are at rest with the carriage in completely elevated position (see Fig. 10) the offset portion 57 of plate 49, intermediate the shoulder 52 and 53, is positioned in the path of swinging movement of finger 54 so that it will be impossible to swing the switch shaft 26 far enough in a clockwise direction to start the motor for elevating the carriage. Similarly, when the carriage is completely lowered, this portion 57 of the plate 49 is positioned within the path of swinging movement of the lower finger 55 so that it will be impossible to effectively turn the switch in a direction for further lowering the carriage. In other words, the switch is locked against starting the motor in the wrong direction when the carriage is at either limit of its movement. However, it is possible by manual manipulation of the switch to stop the carriage at any intermediate position during its elevating or lowering movement. If this is done, the shiftable parts of the stop mechanism will remain in such positions (see Figs. 9 and 11) that the switch can again be manually thrown to a position for continuing the travel of the carriage in the direction in which it was previously moving.

It will be observed that all of the hoisting mechanism, including the driving motor and control switch, is positioned at the upper end of the supporting frame so as to be above the carriage when it is elevated, thus leaving the space beneath the automobile as unobstructed as possible. The only portion of the stop mechanism which projects downwardly below the carriage is the op-

erating rod 38 which is entirely housed, except for the small projecting end portion 39, within the post 1. Consequently the four posts 1 are practically the only obstructions remaining beneath and around the hoist when the carriage is elevated, as shown in Fig. 1.

I claim:

1. In combination with a hoist comprising a plurality of upright posts, a carriage vertically movable between the posts and provided with guides engaging the posts, means comprising a motor for raising and lowering the carriage, and a control mechanism for the motor, an automatic limit stop mechanism adapted to actuate the control mechanism to stop the motor, said stop mechanism comprising a vertically shiftable member positioned within one of the posts and having portions projecting outside the post to be engaged by one of the guides as the carriage nears either limit of its vertical travel.

2. In combination with a hoist comprising a plurality of upright posts, a carriage vertically movable between the posts and provided with guides engaging the posts, means comprising a motor for raising and lowering the carriage, and a control mechanism for the motor, an automatic limit stop mechanism adapted to actuate the control mechanism to stop the motor, said stop mechanism comprising a vertically shiftable rod positioned within one of the posts, and means projecting outside the post from the end portions of the rod and adapted to be engaged by one of the guides as the carriage nears either limit of its vertical travel.

3. In combination with a hoist comprising a plurality of upright posts, a carriage vertically movable between the posts and provided with guides engaging the posts, means comprising a motor for raising and lowering the carriage, and a control mechanism for the motor, an automatic limit stop mechanism adapted to actuate the control mechanism to stop the motor, said stop mechanism comprising a vertically shiftable rod positioned within one of the posts, means projecting outside the post from the end portions of the rod and adapted to be engaged by one of the guides as the carriage nears either limit of its vertical travel and means for yieldably supporting the rod in its elevated position.

4. In combination with a hoist comprising a plurality of upright posts, a carriage vertically movable between the posts and comprising guides engaging the posts, means comprising a reversible electric motor for raising and lowering the carriage, and a switch mechanism controlling the motor, said switch comprising a member adapted to be swung in opposite directions from a neutral position to initiate a raising or lowering movement of the carriage, an automatic limit stop mechanism comprising a vertically shiftable member positioned adjacent one of the posts and adapted to be engaged and moved by a portion of the carriage as the carriage nears either the upper or lower limit of its travel, an actuating member having an offset portion and positioned adjacent the switch member, said actuating member being connected with the shiftable member so as to be moved thereby, and a pair of fingers on the switch member movable alternatively into the path of the offset portion of the actuating member as the switch member is swung in one direction or the other from neutral position.

5. In combination with a hoist comprising a plurality of upright posts, a carriage vertically movable between the posts and comprising guides engaging the posts, means comprising a reversible electric motor for raising and lowering the carriage, and a switch mechanism controlling the motor, said switch comprising a member adapted to be swung in opposite directions from a neutral position to initiate a raising or lowering movement of the carriage, an automatic limit stop mechanism comprising a vertically shiftable member positioned adjacent one of the posts and adapted to be engaged and moved by a portion of the carriage as the carriage nears either the upper or lower limit of its travel, an actuating member having an offset portion and positioned adjacent the switch member, said actuating member being connected with the shiftable member so as to be moved thereby, a pair of fingers on the switch member movable alternatively into the path of the offset portion of the actuating member as the switch member is swung in one direction or the other from neutral position, and means for yieldably holding the switch member in its neutral or either of its motor actuating positions.

6. In combination with a hoist comprising a plurality of upright posts, a carriage vertically movable between the posts and comprising guides engaging the posts, means comprising a reversible electric motor for raising and lowering the carriage, and a switch mechanism controlling the motor, said switch comprising a member adapted to be swung in opposite directions from a neutral position to initiate a raising or lowering movement of the carriage, an automatic limit stop mechanism comprising a vertically shiftable member positioned adjacent one of the posts and adapted to be engaged and moved by a portion of the carriage as the carriage nears either the upper or lower limit of its travel, an actuating member having an offset portion and positioned adjacent the switch member, said actuating member being connected with the shiftable member so as to be moved thereby, and a pair of fingers on the switch member movable alternatively into the path of the offset portion of the actuating member as the switch member is swung in one direction or the other from neutral position, the plate being so positioned when the carriage is stopped at either limit of its vertical travel that a portion of the plate obstructs the swinging movement of one of the fingers so that the switch cannot be turned to continue movement of the carriage beyond this limit.

7. In combination with a hoist comprising a plurality of upright posts, a carriage vertically movable between the posts and comprising guides engaging the posts, means comprising a reversible electric motor for raising and lowering the carriage, and a switch mechanism controlling the motor, said switch comprising a member adapted to be swung in opposite directions from a neutral position to initiate a raising or lowering movement of the carriage, an automatic limit stop mechanism comprising a vertically shiftable member positioned adjacent one of the posts and adapted to be engaged and moved by a portion of the carriage as the carriage nears either the upper or lower limit of its travel, an actuating member having an offset portion and positioned adjacent the switch member, said actuating member being supported by one end of the shiftable member so as to be reciprocated thereby and a pair of fingers on the switch member movable alternatively into the path of the offset portion of

the actuating member as it is swung in one direction or the other from neutral position.

8. In combination with a hoist comprising a plurality of upright posts, a carriage vertically movable between the posts and comprising guides engaging the posts, means comprising a reversible electric motor for raising and lowering the carriage, and a switch mechanism controlling the motor, said switch comprising a member adapted to be swung in opposite directions from a neutral position to initiate a raising or lowering movement of the carriage, an automatic limit stop mechanism comprising a vertically shiftable member positioned adjacent one of the posts and adapted to be engaged and moved by a portion of the carriage as the carriage nears either the upper or lower limit of its travel, an actuating member having an offset portion and positioned adjacent the switch member, said actuating member being supported by one end of the shiftable member so as to be reciprocated thereby, and a pair of fingers on the switch member movable alternatively into the path of the offset portion of the actuating member as it is swung in one direction or the other from neutral position, and means for yieldably holding the switch member in each of its operating positions.

9. In combination with a hoist comprising a plurality of upright posts, a carriage vertically movable between the posts and provided with guides engaging the posts, means comprising a reversible electric motor for raising and lowering the carriage, and a switch mechanism controlling the motor, said switch comprising a member adapted to be swung in opposite directions from a neutral position to initiate a raising or lowering movement of the carriage, an automatic limit stop mechanism comprising a vertically shiftable rod positioned within one of the posts and having portions projecting outside of the post and into the path of the adjacent carriage guide so as to be moved thereby as the carriage nears either its upper or lower limit of travel, an actuating member having an offset portion and supported by one end portion of the rod so as to be shiftable adjacent the switch member, and a pair of fingers on the switch member movable alternatively into the path of the offset portion of the actuating member as it is swung in one direction or the other from neutral position.

10. In combination with a hoist comprising a plurality of upright posts, a carriage vertically movable between the posts and provided with guides engaging the posts, means comprising a reversible electric motor for raising and lowering the carriage, and a switch mechanism controlling the motor, said switch comprising a member adapted to be swung in opposite directions from a neutral position to initiate a raising or lowering movement of the carriage, an automatic limit stop mechanism comprising a vertically shiftable rod positioned within one of the posts and having portions projecting outside of the post and into the path of the adjacent carriage guide so as to be moved thereby as the carriage nears either its upper or lower limit of travel, an actuating member having an offset portion and supported by one end portion of the rod so as to be shiftable adjacent the switch member, a pair of fingers on the switch member movable alternatively into the path of the offset portion of the actuating member as it is swung in one direction or the other from neutral position, and means for yieldably supporting the rod and actuating member in their elevated position.

11. In combination with a hoist comprising a plurality of upright posts, a carriage vertically movable between the posts and provided with guides engaging the posts, means comprising a reversible electric motor for raising and lowering the carriage, and a switch mechanism controlling the motor, said switch comprising a member adapted to be swung in opposite directions from a netural position to initiate a raising or lowering movement of the carriage, an automatic limit stop mechanism comprising a vertically shiftable rod positioned within one of the posts and having portions projecting outside of the post and into the path of the adjacent carriage guide so as to be moved thereby as the carriage nears either its upper or lower limit of travel, an actuating member having an offset portion and supported by one end portion of the rod so as to be shiftable adjacent the switch member, a pair of fingers on the switch member movable alternatively into the path of the offset portion of the actuating member as it is swung in one direction or the other from neutral position, and means for yieldably holding the switch member in each of its operating positions.

12. In combination with a hoist comprising a plurality of upright posts, a carriage vertically movable between the posts and provided with guides engaging the posts, means comprising a reversible motor for raising and lowering the carriage, and a switch mechanism supported by the upper portion of one of the posts for controlling the motor, the switch comprising a member adapted to be swung in opposite directions from a neutral position to start the motor for raising or lowering the carriage, an automatic limit stop mechanism comprising a vertically movable plate positioned adjacent the switch member and having an offset portion, a finger on the switch member that is swung above and into the path of the offset portion when the switch is actuated to raise the carriage, a second finger on the switch member that is swung below the offset portion so as to support the plate in its raised position when the switch is actuated to lower the carriage, means for yieldably holding the switch member in each of its operative positions, and an actuating member depending from the plate and positioned adjacent the post and having portions adapted to be engaged and moved by a carriage guide as the carriage nears either of its limits of vertical travel.

13. In combination with a hoist comprising a plurality of upright posts, a carriage vertically movable between the posts and provided with guides engaging the posts, means comprising a reversible motor for raising and lowering the carriage, and a switch mechanism supported by the upper portion of one of the posts for controlling the motor, the switch comprising a member adapted to be swung in opposite directions from a neutral position to start the motor for raising or lowering the carriage, an automatic limit stop mechanism comprising a vertically movable plate positioned adjacent the switch member and having an offset portion, a finger on the switch member that is swung above and into the path of the offset portion when the switch is actuated to raise the carriage, a second finger on the switch member that is swung below the offset portion so as to support the plate in its raised position when the switch is actuated to lower the carriage, means for yieldably holding the switch member

in each of its operative positions, and a vertically shiftable rod positioned within the post and having portions projecting outside the post and engaged by a carriage guide as the carriage nears either its upper or lower limit of travel, the upper end of the rod being connected with and at times supported by the movable plate.

14. In combination with a hoist comprising a plurality of upright posts, a carriage vertically movable between the posts and provided with guides engaging the posts, means comprising a reversible motor for raising and lowering the carriage and a switch mechanism supported by the upper portion of one of the posts for controlling the motor, the switch comprising a member adapted to be swung in opposite directions from a neutral position to start the motor for raising or lowering the carriage, an automatic limit stop mechanism comprising a vertically movable plate positioned adjacent the switch member and having an offset portion, a finger on the switch member that is swung above and into the path of the offset portion when the switch is actuated to raise the carriage, a second finger on the switch member that is swung below the offset portion so as to support the plate in its raised position when the switch is actuated to lower the carriage, means for yieldably holding the switch member in each of its operative positions, and an actuating member depending from the plate and positioned adjacent the post and having portions adapted to be enaged and moved by a carriage guide as the carriage nears either of its limits of vertical travel, a portion of the plate being positioned in the path of one of the fingers when the carriage is stopped at either limit of its vertical movement to prevent throwing the switch in a direction to cause continued movement beyond this limit.

WILLARD T. WALKER.