US006695289B1

(12) **United States Patent**
Mickael

(10) **Patent No.: US 6,695,289 B1**
(45) **Date of Patent: Feb. 24, 2004**

(54) **MOTOR DRIVEN SCISSOR JACK WITH LIMIT SWITCHES**

(76) Inventor: **Emil Mickael**, 620 McCully St., Apt. 508, Honolulu, HI (US) 96826

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/356,856**

(22) Filed: **Feb. 3, 2003**

(51) **Int. Cl.**[7] **B66F 3/22**
(52) **U.S. Cl.** **254/122**; 254/126; 187/211
(58) **Field of Search** ..... 254/122, 124, 254/126, 7 R, 7 B, 9 R, 9 B; 182/141, 63, 69; 187/211, 18, 8.5, 8.71, 8.72

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,218,733 A		10/1940	Watts	
3,451,655 A		6/1969	Scott	
3,997,143 A		12/1976	Rose	
4,653,727 A	*	3/1987	Chang et al.	254/1
4,749,169 A		6/1988	Pickles	
4,872,230 A	*	10/1989	Levine	7/100
4,941,797 A	*	7/1990	Smillie, III	414/462
4,943,034 A	*	7/1990	Wagnon	254/122
5,085,407 A		2/1992	Lonon	
5,366,203 A	*	11/1994	Huffman	254/362
5,707,043 A		1/1998	Yoshida	
6,029,950 A		2/2000	Yeh	
6,237,953 B1	*	5/2001	Farmer	280/763.1
6,299,138 B1		10/2001	Huang et al.	

* cited by examiner

Primary Examiner—Joseph J. Hail, III
Assistant Examiner—Daniel Shanley
(74) *Attorney, Agent, or Firm*—Michael I Kroll

(57) **ABSTRACT**

A motorized scissor jack is provided including upper and lower limit switches. The motor is connected with a drive assembly that extends and retracts the jack through a displacement screw. The motor has two speeds. The jack is connectable to a vehicular or standard alternating current power source. The upper and lower limit switches limit the extension and retraction of the jack to defined peak and bottom points. The jack is configured for operation in inclement weather.

20 Claims, 8 Drawing Sheets

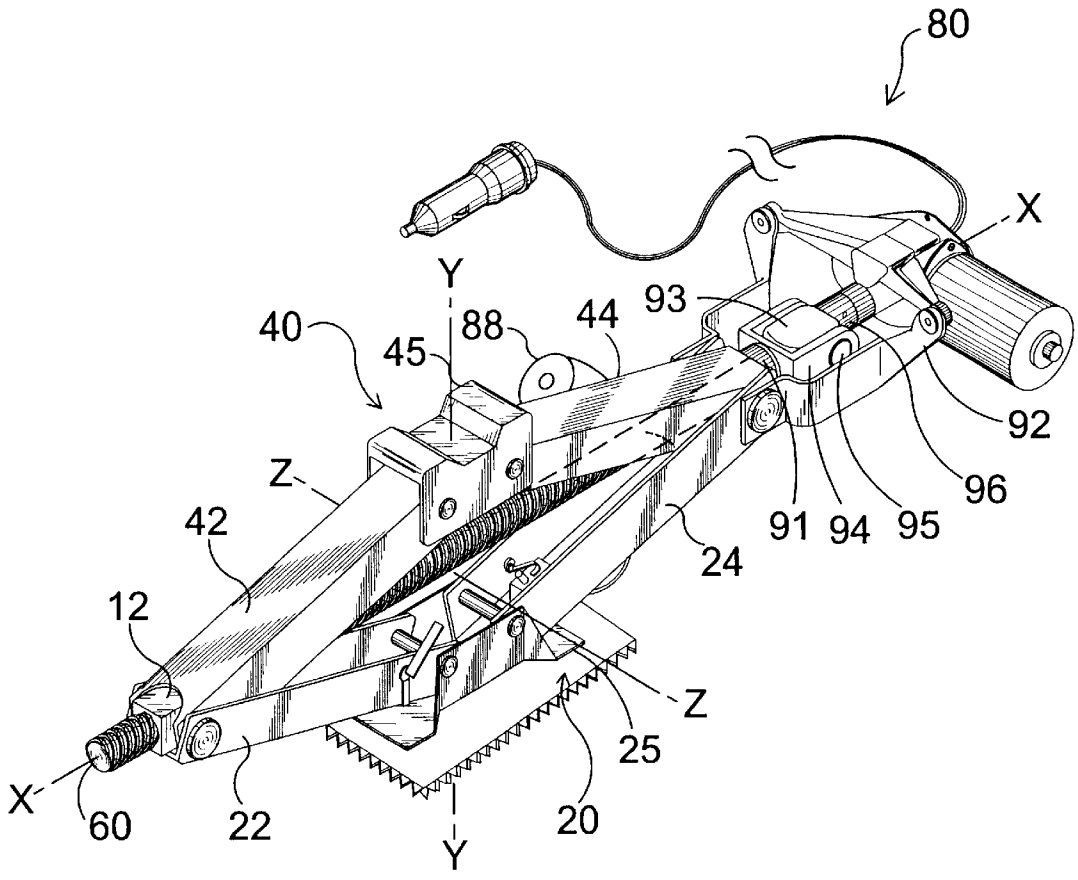

FIG. 1

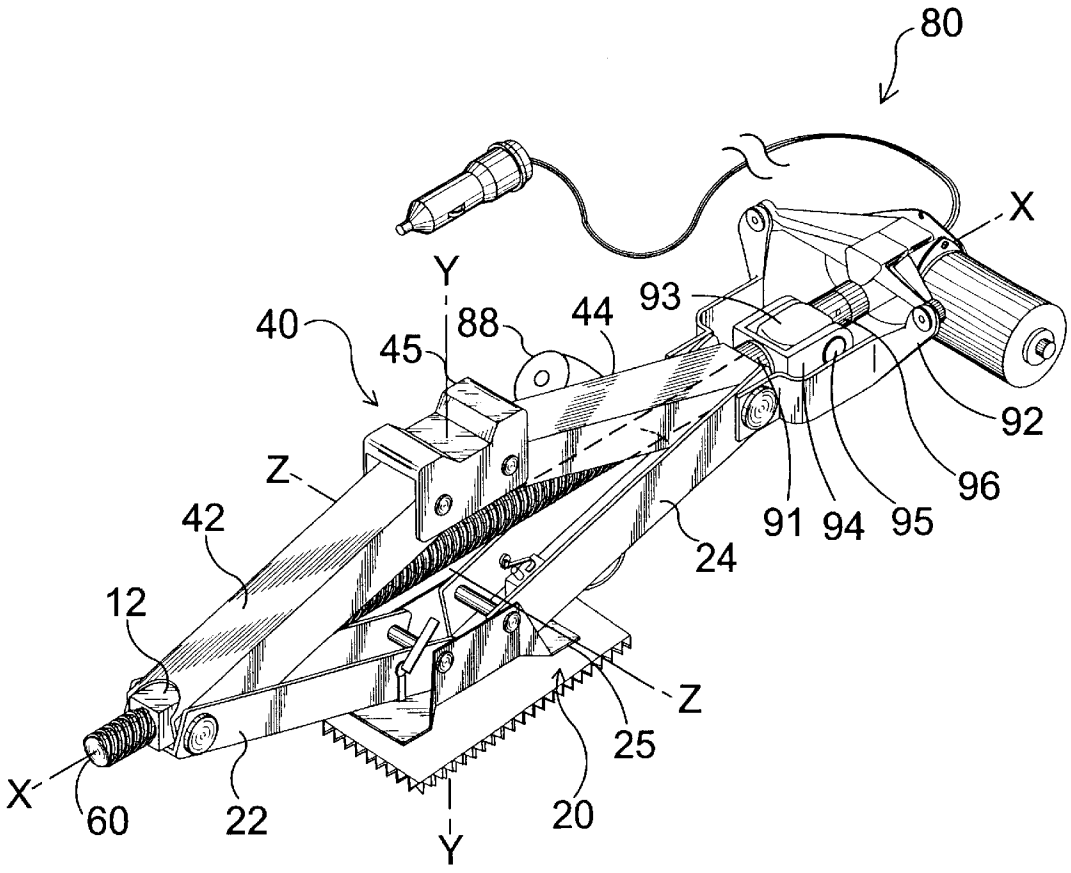

FIG. 2

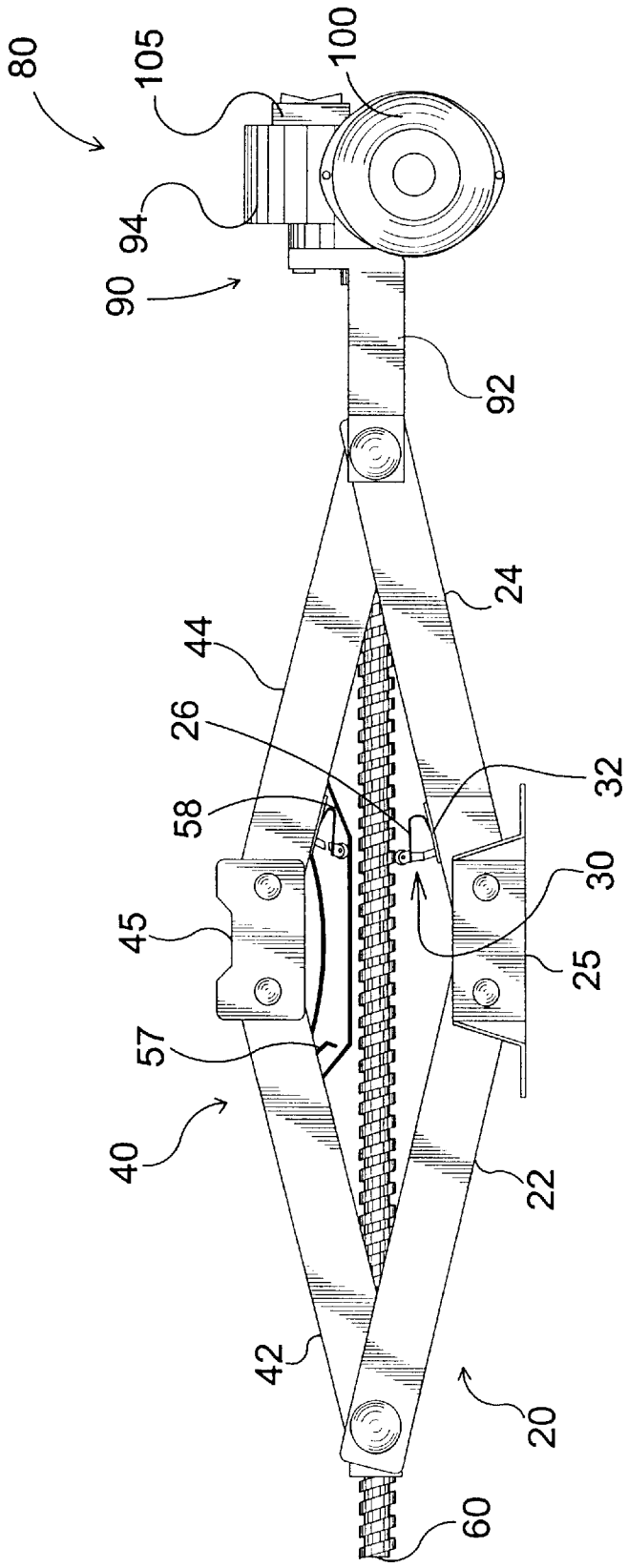

FIG. 3

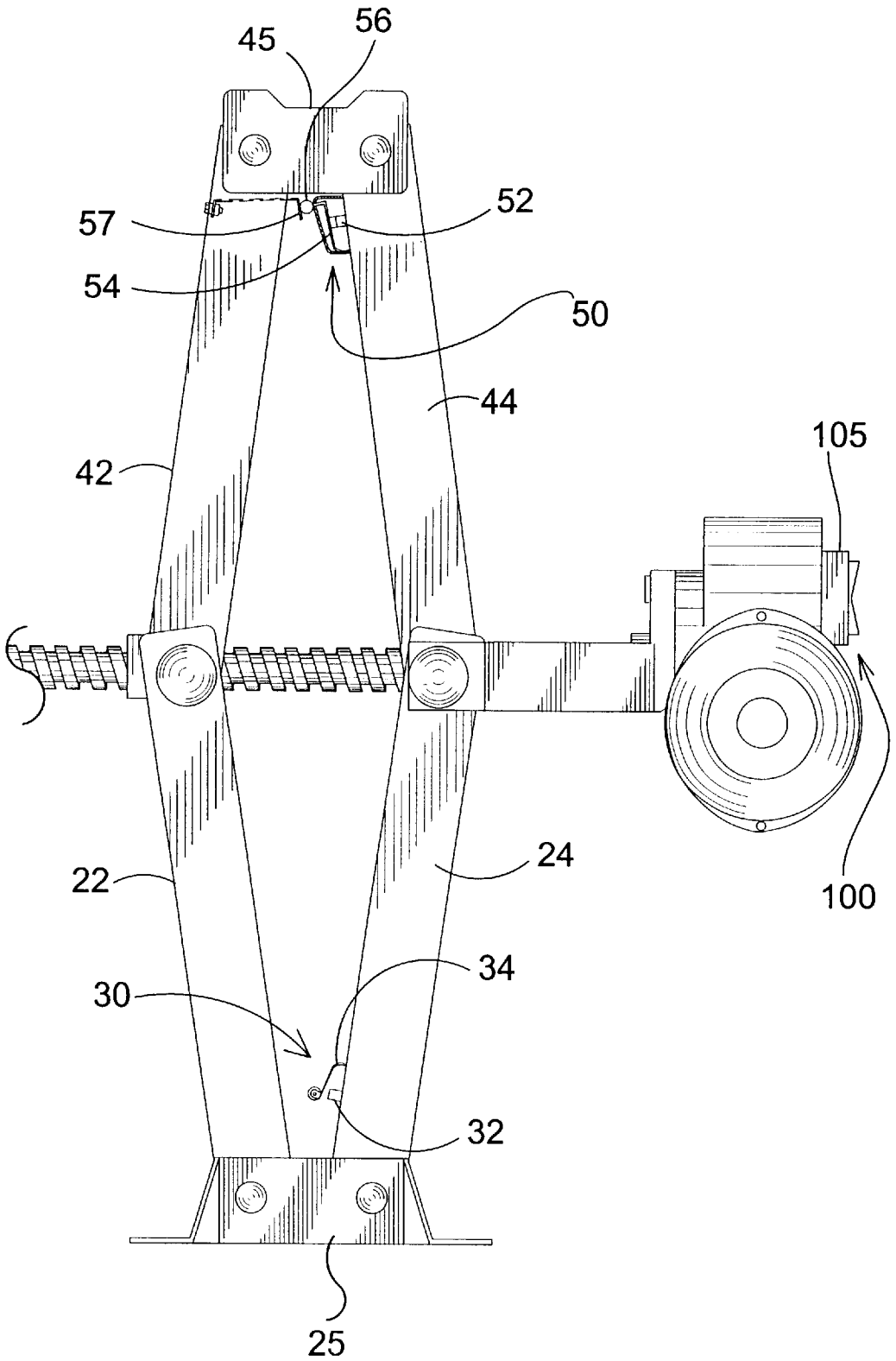

FIG. 4

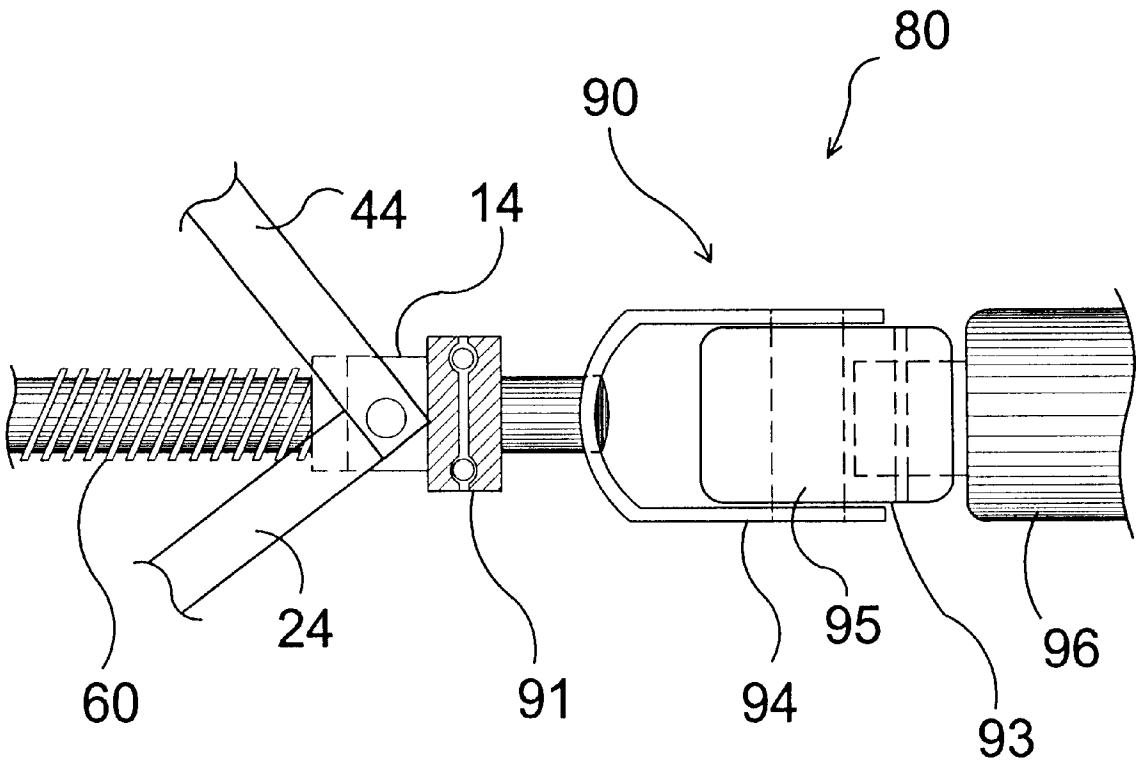

FIG. 5

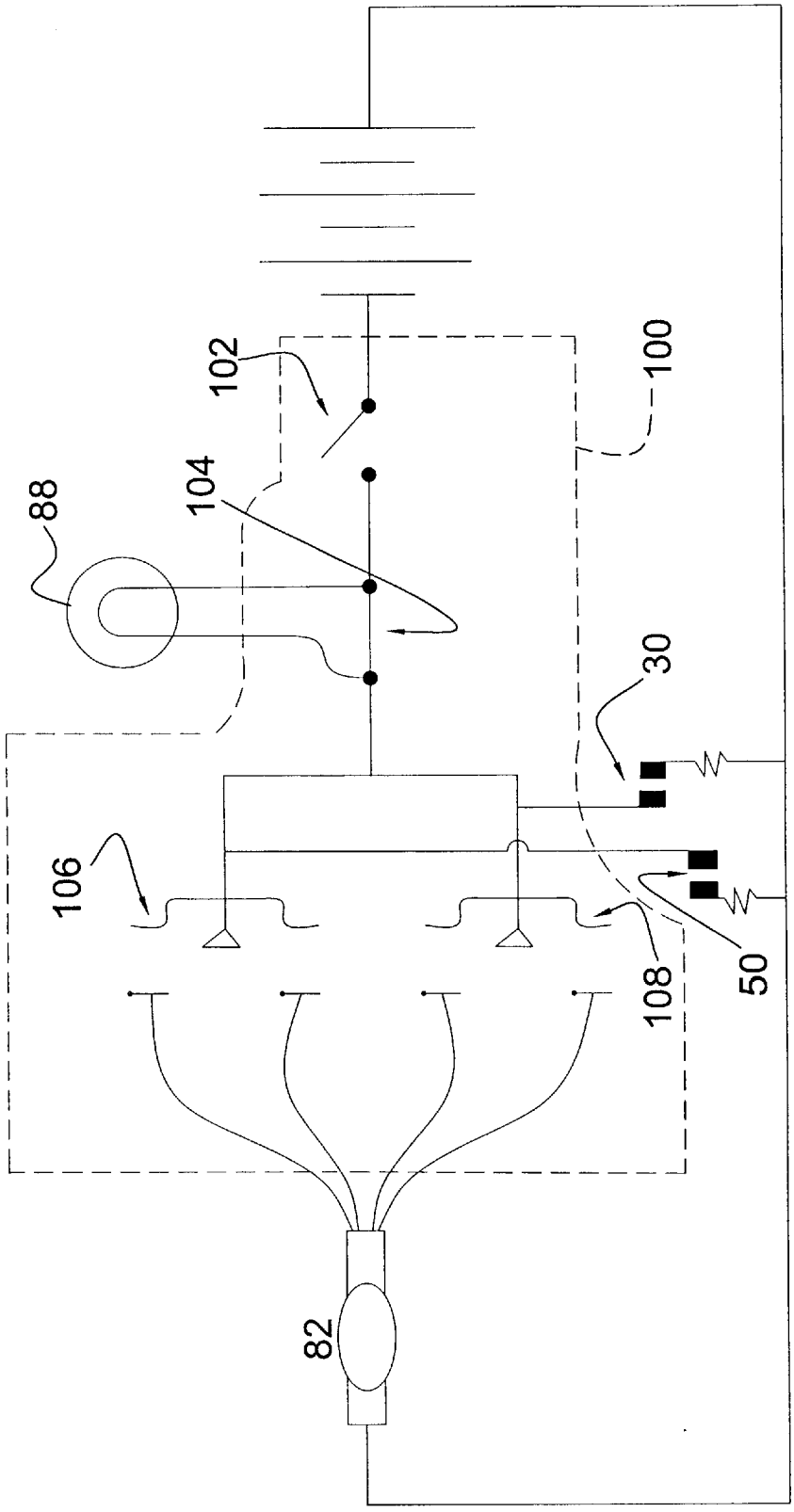

FIG. 6

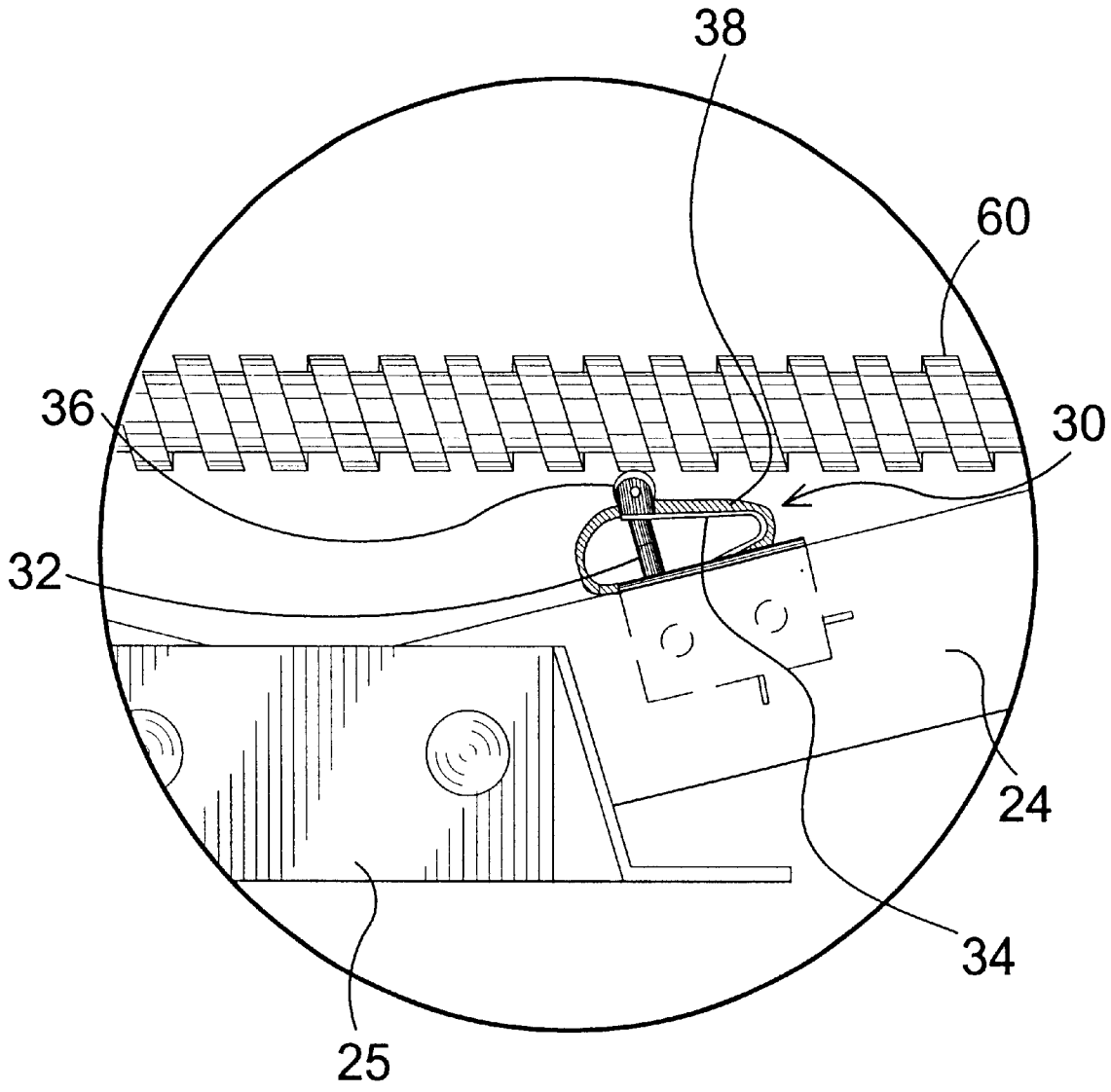

FIG. 7

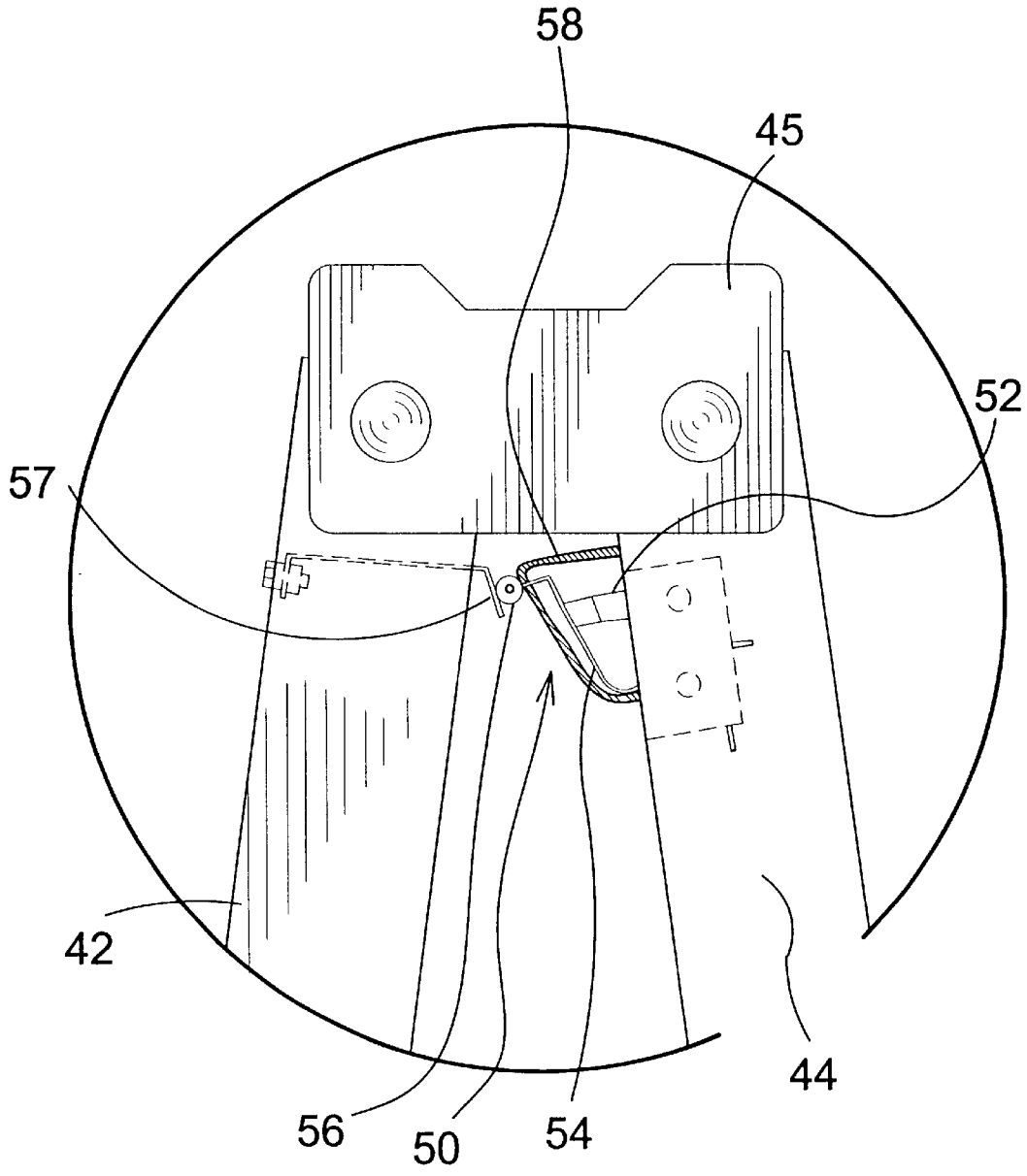

FIG. 8

MOTOR DRIVEN SCISSOR JACK WITH LIMIT SWITCHES

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to scissor type jacks and, more specifically, to motor driven scissor jacks for vehicular applications.

2. Description of the Prior Art

There are other scissor jack devices designed for lifting and lowering an automobile. Typical of these is U.S. Pat. No. 2,218,733 issued to Watts on Oct. 22, 1940.

Another patent was issued to Scott on Jun. 24, 1969 as U.S. Pat. No. 3,451,655. Yet another U.S. Pat. No. 3,997,143 was issued to Rose on Dec. 14, 1976 and still yet another was issued on Mar. 31, 1987 to Chang et al. as U.S. Pat. No. 4,653,727.

Another patent was issued to Pickles on Jun. 7, 1988 as U.S. Pat. No. 4,749,169. Yet another U.S. Pat. No. 4,872,230 was issued to Levine on Oct. 10, 1989. Another was issued to Wagnon on Jul. 24, 1990 as U.S. Pat. No. 4,943,034 and still yet another was issued on Feb. 4, 1992 to Lonon as U.S. Pat. No. 5,085,407.

Another patent was issued to Yoshida on Jan. 13, 1998 as U.S. Pat. No. 5,707,043. Yet another U.S. Pat. No. 6,029,950 was issued to Yeh on Feb. 29, 2000. Another was issued to Farmer on May 29, 2001 as U.S. Pat. No. 6,237,953 and still yet another was issued on Oct. 9, 2001 to Huang et al. as U.S. Pat. No. 6,299,138.

U.S. Pat. No. 2,218,733

Inventor: Roy T. Watts

Issued: Oct. 22, 1940

This invention relates to a jacking arrangement for automobiles whereby a lifting jack is secured on the lower part of the chassis of a vehicle. The jack has a scissors configuration with a motor positioned between scissor arm elements. The extension of the jack is limited by a switch handle which is configured for cutting off the current flow as the switch is closed by the action of a jack arm approximately reaching a maximum extension position. Simultaneously, a switch handle is depressed changing the polarity of the current flow through the motor thereby positioning the motor for the retraction of the jack. At the instant prior to the jack reaching a maximum retracted position, polarity switch handle is depressed again reversing the polarity of the motor.

U.S. Pat. No. 3,451,655

Inventor: Lawrence P. Scott

Issued: Jun. 24, 1969

The present invention is a vehicular scale jack positioned on a wheeled trailer with an electric motor drive arrangement for the operation of lifting and descending of the vehicle to its position for operation. The jack has gear configured for a high speed and a low speed of operation. Switches and are used to control the direction of movement of the jack. Releasing the switches during operation stops the jack in the present position.

U.S. Pat. No. 3,997,143

Inventor: Frank P. Rose

Issued: Dec. 14, 1976

In-place vehicle jack assemblies of the pivoted lever type configured for being permanently mounted at the front and rear of the vehicle frame structure are described. Each of the jack assemblies comprise a unitary device which is independently operable by an electrical motor, and independently selectively controlled at the jack or remotely from the control compartment of the vehicle, control circuits for the jacking assemblies are interlocked with the ignition system of the engine, so that the jacks are operable only when the ignition switch is in an off position. Solenoid actuated relays mounted to the motor housing control the direction of rotation of the motor. The threads of the screw are disengaged from the nut in the fully retracted position. The screw then reengages the nut for extension.

U.S. Pat. No. 4,653,727

Inventor: Shoei D. Chang et al.

Issued: Mar. 31, 1987

The invention relates to motor driven scissors jacks for automobiles driven by an electric power source from the cigarette lighting socket of any automobile. The scissors jack includes a DC motor driven through a deceleration gear box for rotating a screw rod clockwise or counter-clockwise for the raising of the frames of scissors jacks. The jack provides the ability for the automatic raising of vehicles as well as the higher raising and lower collapsing functions and a more powerful raising capability. The jack also includes one ultimate switch for peak and low bottom points. The power supply is automatically cut off when a lower raising rod pushes snapping rod of an ultimate switch.

U.S. Pat. No. 4,749,169

Inventor: Joseph Pickles

Issued: Jun. 7, 1988

A motorized user applied actuator for automobile and like jacks having rotatable operating members for raising and lowering the jack platform. The jack comprises a casing having a drive member detachably cooperable with the jack operating member, an electric motor, and a lightweight step-down transmission connecting the motor with the drive member. The transmission comprises a plurality of staged planetary assemblages which effect a great reduction in speed and advantageous conversion of power. In several illustrated embodiments of the invention one or more handles are attached to the motor casing to provide a convenient hand grip for the manual extension and retraction of the jack. In one embodiment the drive member of the actuator has back-to-back elements alternately engageable with the jack operating member to effect a reversal of the jack movement without reversing the motor. A handle includes start and stop buttons conveniently positioned for application by a user.

U.S. Pat. No. 4,872,230

Inventor: Anthony Levine

Issued: Oct. 10, 1989

A portable automatic automobile scissor jack is described including an electrically powered automobile tire nut remover. The jack is powered through a cigarette lighter type plug by the automobile battery, and has an outlet for powering of a tire nut remover or other equipment. In another embodiment, the nut remover, powered by the auto battery, drives the jack.

U.S. Pat. No. 4,943,034

Inventor: Gerald E. Wagnon

Issued: Jul. 24, 1990

An adapter for a jack is described having a threadable jack shaft and a support platform that rises or lowers when the threadable jack shaft turns. The adapter has a housing containing a drive motor that is coupled to a drive shaft. The adapter has an engagement bracket for releasing and engaging the adapter to the jack. Spring loaded bolts bias the engagement bracket against the face of the housing. To stop the jack a switch can be positioned in a neutral position. In addition, at a lower limit the engagement bracket is disconnected from the support-alignment bar to disengage the drive shaft from the threaded jack shaft. A jack and adapter in combination and a method for operating a jack having support aligning bars wherethrough a threadable jack shaft rotatably passes to raise or lower a support platform of the jack upon rotation.

U.S. Pat. No. 5,085,407

Inventor: Edward M. Lonon

Issued: Feb. 4, 1992

A motorized jack assemblage for vehicles in the form of a kit is described containing a motor and reduction gear linkage adapted to be energized from the cigarette lighter or other source of electrical power in the vehicle. The gear linkage is adapted to drive mechanical coupling means, which keys into and operates a screw type lift jack, which in one case is part of the standard equipment for the vehicle, and in another case is a jack with a specialized base which is part of the kit. A toggle switch is used to control the movement of the jack and includes a right, left, and neutral position.

U.S. Pat. No. 5,707,043

Inventor: Kazuhiko Yoshida

Issued: Jan. 13, 1998

A driving joint for jacks is described including a joint block secured to an output shaft of an electric driving unit. A U-shaped connection plate connected at its opposite ends to the joint block and provides an elongated connection hole in its front wall. The connection plate can be engaged within the U-shaped driven joint, and the elongated connection hole can be fitted to a connection plate of a T-shaped driven joint. With this arrangement, various types of jacks having different types of driven joints can be driven using the forward and reverse controls of a single electric tool.

U.S. Pat. No. 6,029,950

Inventor: Neng-Chen Yeh

Issued: Feb. 29, 2000

A scissor jack assembly is described having two lower arms each having an upper end portion and a lower end portion pivotally attached to a base. The two upper arms each have an upper end portion pivotally mounted to a support bracket and a lower end portion pivotally mounted to the upper end portion of one of the two respective lower arms. A drive shaft rotatingly extends through the connection of the lower end portion of one of the two respective upper arms and the upper end portion of one of the two respective lower arms. A drive device including a motor connected to a drive gear train rotates the drive shaft electrically. A drive nut is exposed for driving by a tool such as a socket for the manual rotation of the drive shaft. Thus, the jack assembly can be operated manually or electrically.

U.S. Pat. No. 6,237,953

Inventor: Dennis E. Farmer

Issued: May 29, 2001

An automatic jack and wheel change system having at least one inverted jack driven by an electric motor permanently attached to the vehicle. The system may employ a jack disposed between the front and rear wheel on each side of the vehicle, or it may be equipped with a jack at each of the four wheels. The system also includes a novel wheel and hub-axle assembly featuring a split axle whose length may be adjusted by operation of an electric motor. The hub has a plurality of arms extending from the hub in a star-shape, each arm having a finger at its free end. The system requires the user to be careful to only lift the vehicle enough to relieve the load from the wheels in order for the axle to be moved linearly. Both the motor for raising the jack and the motor for adjusting the length of the axle may be operated by remote control.

U.S. Pat. No. 6,299,138

Inventor: Chen-Ti Huang et al.

Issued: Oct. 9, 2001

A direct drive electromotive jack device for releasing a torsional force is described and comprises a jack with a driving screw rod, an electromotive motor arranged with a deceleration gearbox, a torsional force releasing means directly connected to a positioning plate, and a power supply directly switch operable by an operator. The torsional force releasing means serves to connect the electromotive motor with the jack. The torsional force releasing means comprises a positioning plate for fixing the electromotive motor; two or more than two symmetric arms of torsional force; a bearing for being passed through the electromotive motor; and a switch connected to the driving screw rod. When the rotary shaft of the electromotive motor rotates, the torsional force can be cancelled by the torsional force releasing means for preventing the jack from generating a strain or being tilt; moreover, by a switch of a power source to control the direction of the current flow, the jack can be lifted or descended.

While these automobile jacks may be suitable for the purposes for which they were designed, they would not be as suitable for the purposes of the present invention, as hereinafter described. The present invention, a motor driven scissor jacks for automobiles configured for application during inclement weather and/or at night is driven by the electric power source from the cigarette lighter socket or 12 volt socket of any automobile. A motor is configured to drive a displacement screw, clockwise, and counter clockwise in order to provide for the raising and lowering of the frame portion of the scissor jack. Upper and lower limit switches positioned in sealed housings are provided for peak to preclude damaging the motor or drive system during the raising and lowering operations of the scissor jack of the present invention.

SUMMARY OF THE PRESENT INVENTION

A primary object of the present invention is to provide a motorized scissor jack for automobiles that can be used during inclement weather.

Another object of the present invention is to provide a motorized scissor jack that is driven by the electric power source from the cigarette lighter socket or 12 volt socket of any automobile.

Yet another object of the present invention is to provide a motorized scissor jack that a motor is provided for the rotation of a displacement screw, clockwise and counter clockwise in order to provide for the raising and lowering of the frame portion of the scissor jack.

Still yet another object of the present invention is to provide a motorized scissor jack for automobiles that provides an upper limit switch positioned in a sealed housing that as the jack moves in an upward direction a driving element on one portion of the upper structure makes contact with a biased displacement element on the opposing portion of the upper structure driving a contact of the biased element into a contact of a fixed contact to complete the limiting circuit.

Another object of the present invention is to provide a motorized scissor jack for automobiles that provides a lower limit switch that as the jack moves in a downward direction the displacement screw comes in direct contact with a limit switch roller and drives a contact of a bias displacement element into a fixed contact to complete the limiting circuit.

Yet another object of the present invention is a two speed motor configured for providing a slow and a rapid lift capability.

Still, yet another object of the present invention is to provide a motor to turn a drive assembly that causes a displacement screw to turn in a rotation that either grabs or pushes the distal end of the displacement screw.

Additional objects of the present invention will appear as the description proceeds.

The present invention overcomes the shortcomings of the prior art by providing a motor driven scissor jacks for automobiles driven by the electric power source from the cigarette lighter socket or 12 volt socket of any automobile configured for use during inclement weather and/or at night. A motor is provided for the rotation of a displacement screw, clockwise and counter clockwise in order to provide for the raising and lowering of the frame portion of the scissor jack. An upper and lower limit switch are positioned in sealed housings and provide for peak and low bottom point electrical cut-offs in order to limit its raising and lowering operations of the scissor jack.

The foregoing and other objects and advantages will appear from the description to follow. In the description reference is made to the accompanying drawing, which forms a part hereof, and in which is shown by way of illustration specific embodiments in which the invention may be practiced. These embodiments will be described in sufficient detail to enable those skilled in the art to practice the invention, and it is to be understood that other embodiments may be utilized and that structural changes may be made without departing from the scope of the invention. In the accompanying drawing, like reference characters designate the same or similar parts throughout the several views.

The following detailed description is, therefore, not to be taken in a limiting sense, and the scope of the present invention is best defined by the appended claims.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

In order that the invention may be more fully understood, it will now be described, by way of example, with reference to the accompanying drawing in which:

FIG. **1** is a perspective side view of a motor driven scissors jack with limit switches being positioned for use with a vehicle constructed in accordance with the present disclosure;

FIG. **2** is a perspective side view of the jack of FIG. **1** constructed in accordance with the present disclosure;

FIG. **3** is a side view of the jack of FIG. **1** in a first position constructed in accordance with the present disclosure;

FIG. **4** is a side view of the jack of FIG. **1** in a second position constructed in accordance with the present disclosure;

FIG. **5** is a close-up of the side view of the jack of FIG. **3** constructed in accordance with the present disclosure;

FIG. **6** is a simplified wiring diagram of the jack of FIG. **1** constructed in accordance with the present disclosure;

FIG. **7** is a close-up view of a lower limit switch of the jack of FIG. **1** constructed in accordance with the present disclosure; and

FIG. **8** is a close-up view of an upper limit switch of the jack of FIG. **1** constructed in accordance with the present disclosure.

DESCRIPTION OF THE REFERENCED NUMERALS

Turning now descriptively to the drawings, in which similar reference characters denote similar elements throughout the several views, the figures illustrate the present invention. With regard to the reference numerals used, the following numbering is used throughout the various drawing figures.

10 motor driven scissors jack with limit switches
20 lower structure
22 first member of lower structure
24 second member of lower structure
25 base plate
26 base plate adapter
27 teeth on base plate adapter
30 lower limit switch
32 fixed connector
34 biased connector
36 roller assembly positioned on bias connector
38 sealed housing for lower limit switch
40 upper structure
42 first member of upper structure
44 second member of upper structure
45 lifting block
50 upper limit switch
52 fixed connector
54 biased connector
56 receiving element
57 displacing element
58 sealed housing for upper limit switch
60 displacement screw
62 displacement screw distal end
64 displacement screw proximal end
80 drive system
82 electrical motor
84 connector adapted for a vehicle or vehicular connector
86 wire
88 light
90 drive assembly
91 bearing
92 support bracket
93 drive adapter
94 U-shaped bracket
95 pin

96 output shaft
98 gear assembly
100 switch assembly
102 on/off switch
104 light switch
105 switch assembly housing
106 switch for selecting the upward direction at a slow or fast speed
108 switch for selecting the downward direction at a slow or fast speed

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The following discussion describes in detail preferred embodiments of the invention. This discussion should not be construed, however, as limiting the invention to those particular embodiments, practitioners skilled in the art will recognize numerous other embodiments as well. For definition of the complete scope of the invention, the reader is directed to appended claims.

Referring now in specific detail to the drawings in which like referenced numerals identify similar or identical elements throughout the several views, and initially to FIG. **1**, a novel motor driven scissor jack with limit switches or jack **10** is shown. Jack **10** is adapted for use with vehicles and uses a battery from the vehicle as a source of power. In addition, jack **10** is configured for use during inclement or adverse weather conditions.

Referring now to FIGS. **2** and **5**, jack **10** includes a lower structure **20**, an upper structure **40**, an adapter **50**, a displacement screw **60**, and a drive system **80**. Displacement screw **60** defines a longitudinal axis-X. An axis-Y is perpendicular to axis-X and is aligned with the upward and downward movement of jack **10**. An axis-Z is perpendicular to axes X and Y.

Lower structure **20** includes a base **25**, a first member **22**, and a second member **24**. Upper structure **40** includes a first member **42**, a second member **44**, and a lifting plate **45**.

Base **25** includes two flat legs and a pair of longitudinally aligned flanges. The legs are preferably configured for receiving a removably positioned base plate adapter **26** defining a larger supporting surface area and including teeth **27** positioned around the perimeter of plate **26** and configured for gripping into ice. The larger supporting surface area of base plate adapter **26** advantageously provides distributes the load borne by jack **10** over a greater surface area. Having a lower ground pressure can reduce the likelihood of jack **10** sinking excessively into soft soils or mud, for example.

One end of members **22** and **24** are rotatingly connected to base **25** by pins. The opposing end of member **22** is rotatingly connected with one end of member **42** and a first or distal nut block **12**. Similarly, the opposing end of member **24** is rotatingly connected with one end of member **44** and a second or proximal nut block **14** (see FIG. **5**). The opposing ends of members **42** and **44** are rotatingly connected to lifting plate **45** by pins. Lifting plate **45** defines a channel parallel to the axis-Y and adapted for receiving a vehicle. Members **22**, **24**, **42**, and **44** have an elongate channel structure with the open side facing inward towards the other members.

Displacement screw **60** has a distal end **62** and a proximal end **64**. Distal end **62** extends along longitudinal axis-X through first nut **12** and proximal end **64** is connected with drive system **80**. Displacement screw **60** is rotatingly connected with first nut **12** and second nut **14** such that the rotation of displacement screw **60** about the longitudinal axis drives lower structure **20** and upper structure **40** between a first or minimum height position and a second maximum height position.

Drive system **80** is fixedly connected to second nut **14** and includes a motor **82** and a drive assembly **90**. Proximal end **64** rotates within bearings **91** and is fixedly connected with a bifurcated or U-shaped bracket **94**. U-shaped bracket **94** has a pin **95** positioned in the vicinity of the tips of its bifurcated legs through which a drive adapter **93** is positioned. Drive adapter **93** is connected by an output shaft or rod **96** with a gear assembly **98**. Gear assembly **98** includes gearing means, such as bevel gears, configured to turn the drive output of motor **82** ninety degrees and connect it with drive output shaft **96**. Gear assembly **98** is fixedly connected with a support bracket **92**. The combination of U-shaped bracket **94**, adapter **93**, and pin **95** is a flexible rotating connection between displacement screw **60** and the gear assembly **98**.

Motor **82** is a two speed electrical motor configured for lifting a load at a first speed and a second speed, wherein the second speed is faster than the first speed. Motor **82** is positioned parallel to axis-Z in order to minimize the length of jack **10** along longitudinal axis-X. Motor **82** is fixedly connected with support bracket **92** and gear assembly **98**.

It should also be pointed out that the length of drive system **80** relative to structures **20** and **40** in the FIGURES is not considered to be proportional, but is increased for purposes of clarification of the description of the structure of the differing elements. The size of drive system **80** is intended to be minimized for safety reasons in order to minimize the amount of exposure of jack **10** and user during operational employment.

A vehicular connector **84** is adapted for coupling with a source of power or power means, such as a 12 volt automotive battery using a cigarette lighter. It is understood that the methods of coupling as well as the standard for vehicular electrical systems will evolve in time and vehicular connector **84** is intended to encompass future changes in coupling as well as voltage. A wire **86** connects connector **84** to drive assembly **80**. Vehicular connector **84** can also include a standard outlet connector for residential or commercial sources of alternating current and a transformer that can be connected with vehicular connector **84**. This can advantageously accommodate using an alternate source of power when in a garage or driveway situation when it is not desired to drive jack **10** off the automobile battery.

Jack **10** can also include a directionally adjustable light **88** having an in-line switch positioned on upper structure **40** proximal to lifting plate **45** and is connected with switch system **100** (see FIG. **6**). Adjustable light **88** is configured to provide critical lighting for aligning lifting plate **45** with the chassis of the vehicle at night or during inclement weather. In one preferred embodiment, light **88** is a separately battery powered removably positionable assembly.

As shown in FIGS. **3** and **7**, jack is in a first position wherein the height of jack **10** in the direction of axis-Y is minimized and elongate members **22**, **42**, **24**, and **44** are extended in proximity with longitudinal axis-X.

A lower limit switch **30** is positioned, in this one preferred embodiment, on member **24** and is aligned for contact with displacement screw **60**. Limit switch **30** includes a fixedly positioned connector **32** and a biased connector **34**. Biased connector **34** includes a connector positioned on an inner side of connector **34** aligned with fixed connector **32**. A roller assembly **36**, including a bracket and a roller, is positioned on an outer side of connector **34** facing towards

displacement screw **60**. The roller is rotatingly positioned on an axle and connected to the bracket. It is recognized, however, that lower limit switch **30** can be positioned on any of the members, for example, and at any point within lower structure **20**, upper structure **40**, or support bracket **92** that provides suitable direct contact with displacement screw **60**.

Roller **36** is suitably configured and dimensioned to engage displacement screw **60**. For example, roller **36** can have at least partially concave outer cylindrical surface or define a channel suitable for the positioning of at least a portion of displacement screw **60**. Roller **36** is configured to roll or spin about an axis parallel with the axis-Z.

A sealed flexible housing **38** is positioned around lower limit switch **30** with the bracket and roller assembly **36** extending there from. Sealed flexible housing **38** is configured to displace longitudinally with the displacement of roller assembly **36** and to not come in direct contact with displacement screw **60** while keeping out rain, dirt, snow, as well as any other potentially intrusive material that can disrupt the performance of switch **30**.

When connectors **32** and **34** of lower limit switch **30** are in direct contact, as a result of the displacement by displacement screw **60**, the electrical connection for retracting or lowering jack **10** is effectively disconnected between drive system **80** and the source of power (see FIG. **6**). This defines the shortest displacement of jack **10** in the direction of axis-Y and the first position.

Referring now to FIGS. **4** and **8**, jack **10** in a second position wherein the height of jack **10** in the direction of axis-Y is maximized and elongate members **22**, **42**, **24**, and **44** are extended in the general direction of axis-Y.

An upper limit switch **50** is positioned on members **42** and **44** and provides an upper limit on the extension of jack **10** in the direction of axis-Y. Upper limit switch **50** includes a fixed connector **52**, a biased connector **54**, a receiving element **56**, and a displacing element **57**. In this one preferred embodiment, fixed connector **52** and biased connector **54** are positioned on member **44** and displacing element **57** is positioned on member **42**.

Biased connector **54** includes a connector element aligned with fixed connector **52** on an inner side and receiving element **56** positioned on an outer side towards displacing element **57**. Biased connector **54** is biased to an open position.

A sealed flexible housing **58** is positioned around upper limit switch **50** with receiving element **56** extending there from. Sealed flexible housing **58** is configured in one preferred embodiment to displace with receiving element **56** and to not come in direct contact with displacing element **57** or member **42** while keeping out rain, dirt, snow, as well as any other potentially intrusive material that can disrupt the performance of switch **50**. In another preferred embodiment, sealed flexible housing **58** also encompasses all of the components of upper limit switch **50** including displacing element **57** and receiving element **56**. Upper limit switch **50** and lower limit switch **30** can also include protective and/or guiding flanges positioned to protect the moveable elements from being damaged and ensure their alignment.

Displacing element **57** is suitably positioned on member **42** such that when jack is positioned at its maximum desired displacement, receiving element **56** drives the connector element positioned on biased connector **54** into direct contact with connector **52**. The direct contact of connectors **54** and **52** provides an electrical coupling which effectively disconnects the electrical connection for raising jack **10** between drive system **80** and the source of power. This defines the maximum displacement of jack **10** in the direction of axis-Z and the second position.

As shown in FIGS. **4–6**, motor **82** drives jack **10** between the first and second positions through switch assembly **100**. Switch assembly **100** includes a waterproof housing **105** on which is positioned an on/off switch **102** for powering jack **10**, light switch **104**, separate up and down directional switches **106** and **108**, respectively, which selectively power a slow or fast motor speed. Switch assembly **100** is positioned on the proximal end of jack **10**.

Switch assembly **100** is configured to simplify the operational use of jack **10** including switches for on/off or power to jack **10** using switch **102**, light **88** using switch **104**, and movement of jack **10** between first and second positions using motor **82** speeds for up/down directions of movement using switches **106** and **108**, respectively. A direction and speed of movement of jack **10** is thus selected simultaneously and activated only as long as the respective switch is held in the depressed position or until a limit switch is contacted. In one preferred embodiment, an interlock prevents the simultaneous activation of switches **106** and **108**.

In operation, as shown in FIGS. **2–8**, the user first assess the ground surface in which the car is presently positioned to determine whether to use base plate adapter **26** to disperse the ground pressure of the load jack **10** will be lifting. Jack **10** is removed from storage, base plate adapter **26** is positioned on lower structure **20** as required, and jack **10** is positioned on the ground surface in the approximate position of use with the proximal end of jack **10** pointing out or away from the vehicle. This enables easy access to switch assembly **100** and enables lift plate **45** to be aligned with the underside of the vehicle. Jack **10** is connected with a power source such as a car cigarette lighter using wire **86** and connector **84**.

Power to jack **10** is turned on using switch **102**. Light **88** is powered on using switch **104** as required. Light **88** can be directionally adjusted to align lift plate **45** with a lift point on the vehicle. Jack **10** can be actuated from any position, but preferably jack **10** is initially in the first position wherein jack **10** has a reduced or minimal height in the direction of axis-Y. Jack **10** can then readily fit between the ground surface and vehicle. Jack **10** can be selectively raised to the second position or upper limit of travel position wherein limit switch **50** is engaged or the position wherein jack **10** is extended sufficiently in the direction of axis-Y to lift the vehicle the desired distance from the ground. When jack **10** is in the first position or lower limit of travel position, limit switch **30** is engaged to preclude attempting to reduce the height in the direction of the axis-Y less than the first position.

After the required maintenance is performed, the height of jack **10** is reduced in the direction of axis-Y from the second position to the first position. Jack **10** can then be turned off, removed from under the car, and then disconnected from the power source. Base plate adapter **26** is removed as required.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims:

1. A motor driven scissors jack assembly comprising:

a scissors jack including a lower structure connected to an upper structure, a displacement screw connected to the upper structure, lower structure, and a drive system, the drive system including a motor for extending and retracting the jack, the jack being adapted for use with a vehicular electrical system;

a lower limit switch positioned on the lower structure, the lower limit switch including a roller assembly config-

ured for being in direct contact with the displacement screw as the jack approaches a lower limit of travel, the limit switch being configured such that the position of the displacement screw at the lower limit of travel engages the roller assembly and connects the lower limit switch, the lower limit switch being configured to limit the retracting of the jack; and

an upper limit switch positioned on the members of the upper structure, the position of the members of the upper structure at an upper limit of travel position being configured to connect the upper limit switch, the connecting of the upper limit switch being configured to limit the extending of the jack.

2. The jack of claim **1**, wherein the motor has two speeds.

3. The jack of claim **1**, wherein the lower limit switch further includes a housing, a biased connector, and a fixed connector, the housing being configured for sealing the biased connector and fixed connector of the lower limit switch.

4. The jack of claim **3**, wherein the roller assembly of the lower limit switch is positioned outside the housing and is aligned for rolling engagement with the displacement screw.

5. The jack of claim **1**, wherein the upper limit switch includes a housing, the housing being configured for sealing at least a portion of the upper limit switch.

6. The jack of claim **5**, wherein the upper limit switch includes a displacement element positioned on one member of the upper structure and a receiving element positioned on the opposing member of the upper structure, the direct contact of the displacing element with the receiving element at the upper limit position connecting the upper limit switch.

7. The jack of claim **5**, wherein the displacing element and receiving element are positioned outside the housing and aligned for direct contact.

8. A motor driven scissors jack assembly comprising:

a scissors jack including a lower structure connected to an upper structure, a displacement screw connected to the upper structure, lower structure, and a drive system, the drive system including a motor, the motor drive jack being adapted for use with a vehicular electrical system;

a lower limit switch positioned in a sealed housing on the lower structure, the lower limit switch including a roller assembly positioned outside of the housing and configured for being in direct contact with the displacement screw as the jack approaches a lower limit of travel, the limit switch being configured such that the position of the displacement screw at the lower limit of travel engages the roller assembly and connects the lower limit switch, the lower limit switch being configured to limit the retracting of the jack; and

an upper limit switch positioned in a sealed housing, the position of the members of the upper structure at an upper limit of travel position being configured to connect the upper limit switch, the connecting of the upper limit switch being configured to limit the extending of the jack.

9. The jack of claim **8**, wherein the motor has two speeds for extending the jack and two speeds for retracting the jack.

10. The jack of claim **8**, wherein the upper limit switch includes a displacement element positioned on one member of the upper structure and a receiving element positioned on the opposing member of the upper structure.

11. The jack of claim **8**, wherein the displacement element and the receiving element are positioned outside the sealed housing of the upper limit switch.

12. The jack of claim **8**, wherein the displacing element and the receiving element are positioned inside the sealed housing of the upper limit switch.

13. The jack of claim **8**, wherein the displacing element is aligned and configured for direct contact with the receiving element.

14. The jack of claim **8**, wherein the jack includes a vehicular connector configured for connecting the jack with a power source.

15. The jack of claim **8**, wherein the lower structure includes a base plate, the base plate being configured for connecting with an adapter plate.

16. The jack of claim **8**, wherein the jack includes a light.

17. A motor driven scissors jack assembly comprising:

a scissors jack including a lower structure connected to an upper structure, a displacement screw connected to the upper structure, lower structure, and a drive system, the drive system including a motor having two speeds for extending the jack and two speeds for retracting the jack, the motor drive jack being adapted for use with an external source of power;

a lower limit switch positioned in a sealed housing on the lower structure, the lower limit switch including a roller assembly positioned outside of the housing and configured for being in direct contact with the displacement screw as the jack approaches a lower limit of travel, the limit switch being configured such that the position of the displacement screw at the lower limit of travel engages the roller assembly and connects the lower limit switch, the lower limit switch being configured to limit the retracting of the jack; and

an upper limit switch positioned in a sealed housing, the upper limit switch including a displacement element positioned on one member of the upper structure and a receiving element positioned outside the sealed housing of the upper limit switch on the opposing member of the upper structure, the displacing element being aligned and configured for direct contact with the receiving element, the position of the members of the upper structure at an upper limit of travel position being configured to connect the upper limit switch, the connecting of the upper limit switch being configured to limit the extending of the jack.

18. The jack of claim **17**, wherein the source of power is a battery of a vehicular electrical system.

19. The jack of claim **17**, wherein the lower structure includes a base plate, the base plate being configured for connecting with an adapter plate.

20. The jack of claim **17**, wherein the jack includes a light.

* * * * *