

May 17, 1960

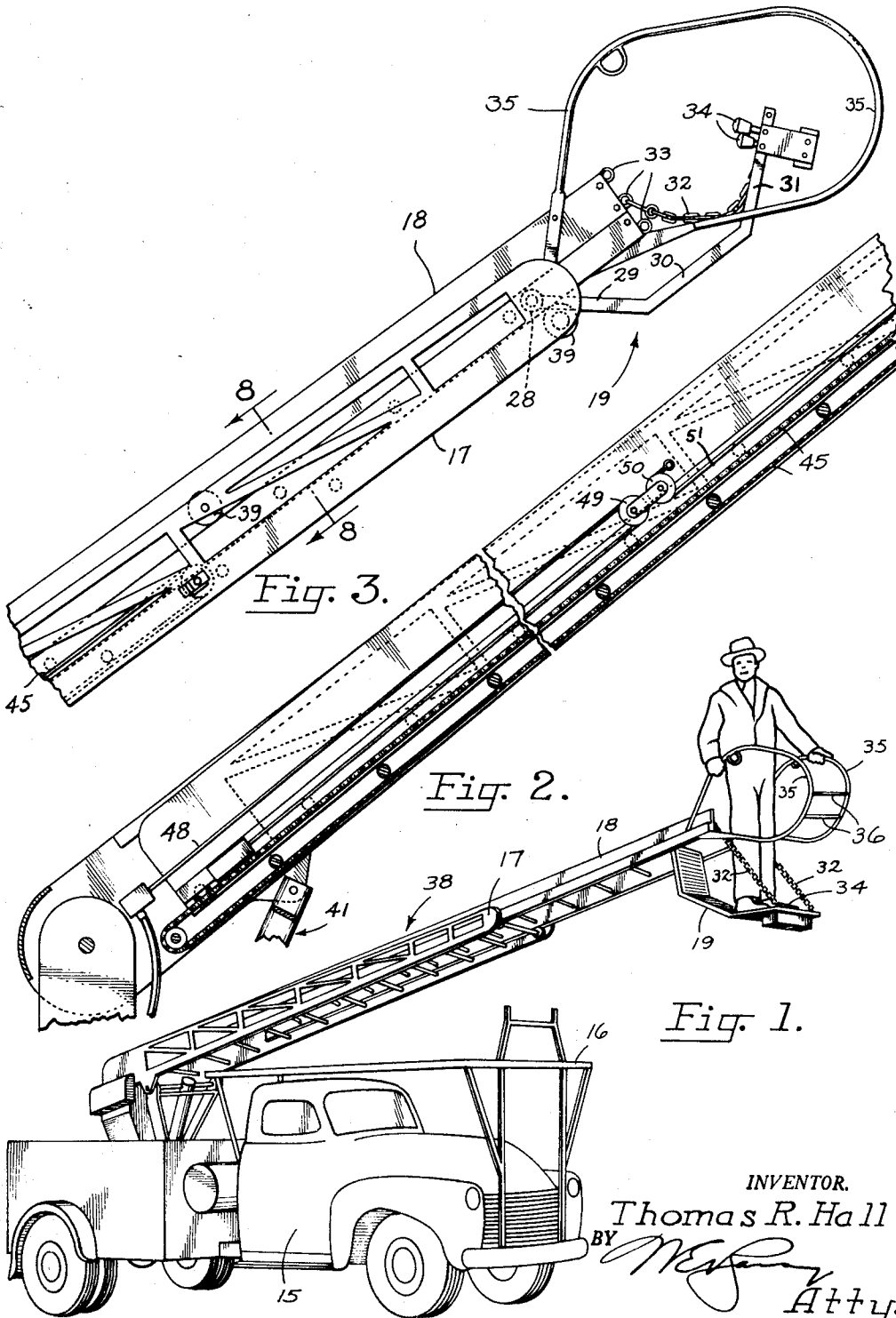
T. R. HALL

2,936,848

ARTICULATED AERIAL LADDER

Filed April 15, 1955

4 Sheets-Sheet 1



INVENTOR.
Thomas R. Hall
BY *[Signature]*
Att'y.

May 17, 1960

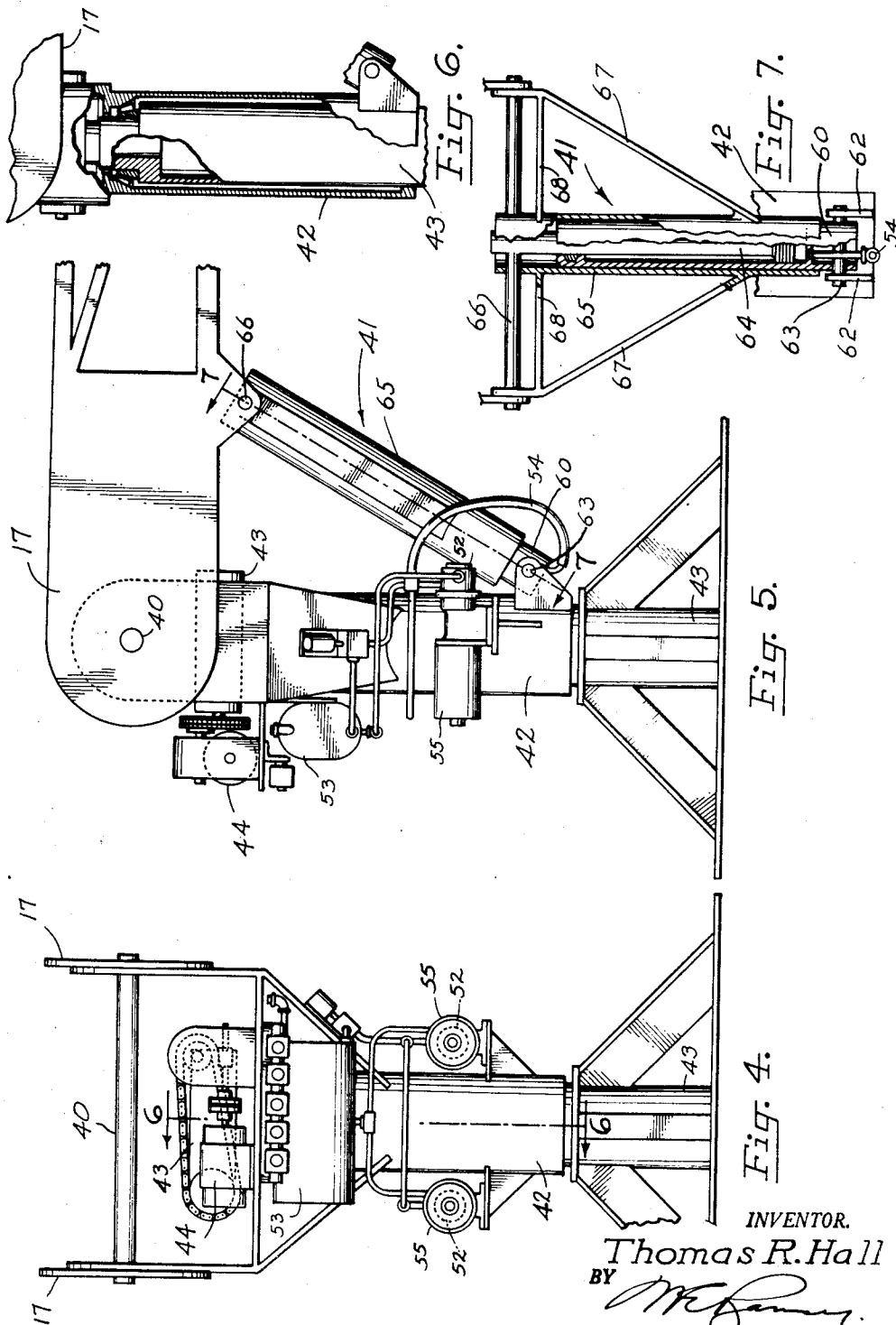
T. R. HALL

2,936,848

ARTICULATED AERIAL LADDER

Filed April 15, 1955

4 Sheets-Sheet 2



INVENTOR.
Thomas R. Hall
BY *McFarland*
Att'y.

May 17, 1960

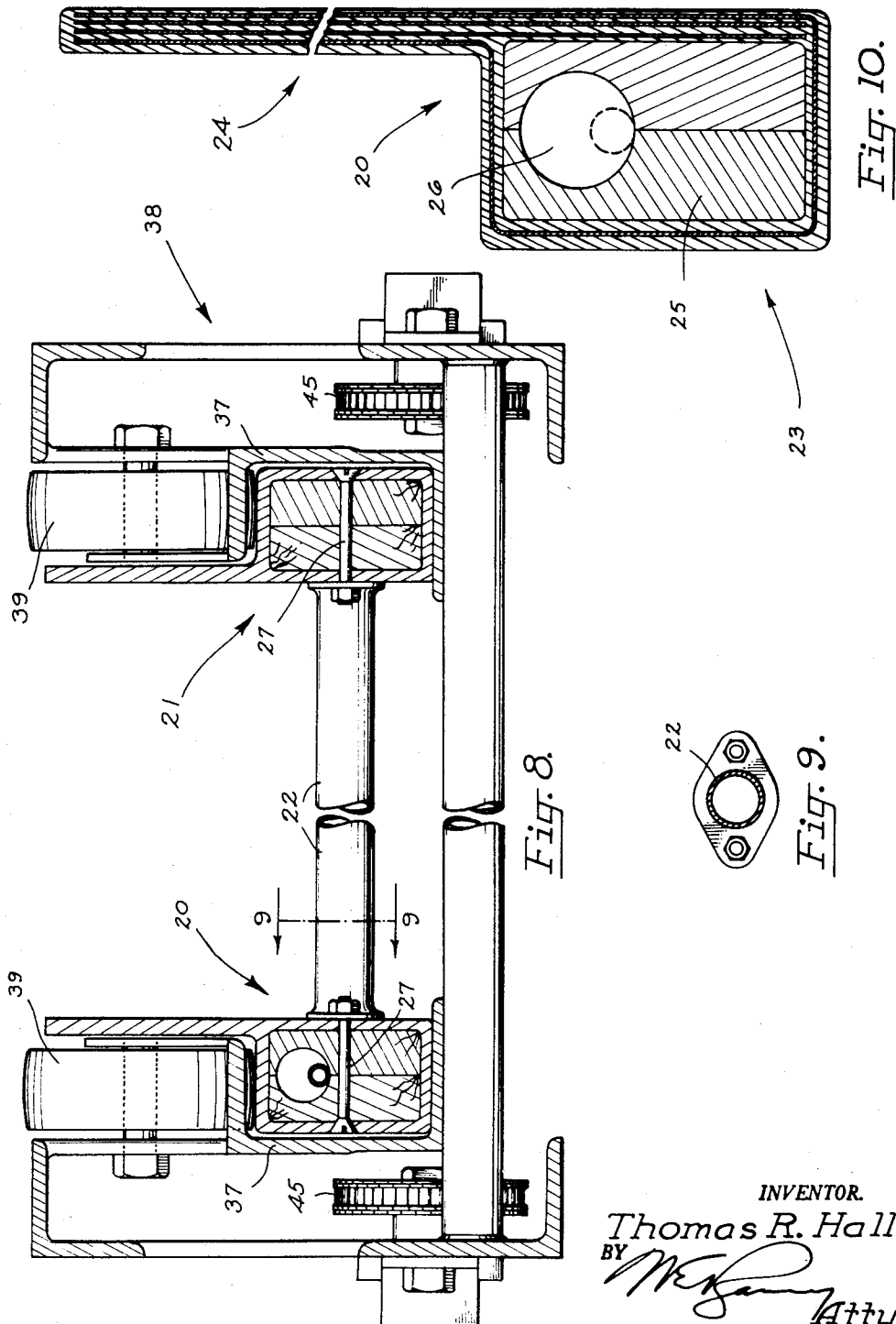
T. R. HALL

2,936,848

ARTICULATED AERIAL LADDER

Filed April 15. 1955

4 Sheets-Sheet 3



May 17, 1960

T. R. HALL

2,936,848

ARTICULATED AERIAL LADDER

Filed April 15, 1955

4 Sheets-Sheet 4

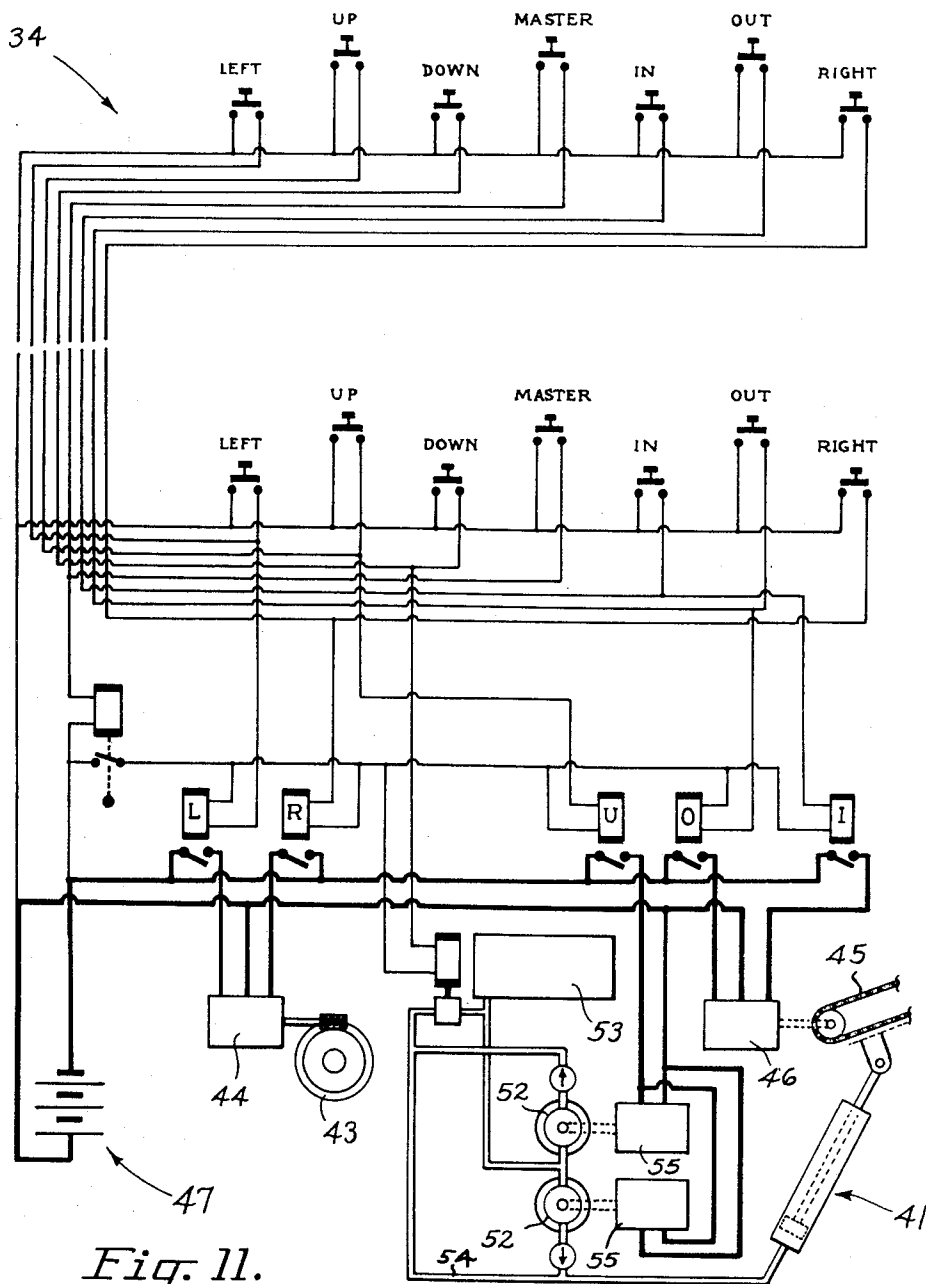


Fig. 11.

INVENTOR.
Thomas R. Hall
BY *McFarley* Atty.

1

2,936,848

ARTICULATED AERIAL LADDER

Thomas R. Hall, Portland, Oreg., assignor, by mesne assignments, to McCabe-Powers Body Company, a corporation of California

Application April 15, 1955, Serial No. 501,554

12 Claims. (Cl. 182—46)

This invention relates to a truck mounted aerial ladder useful to utility crews for street light maintenance, general line work, and tree trimming.

One object of my invention is to provide an aerial ladder of moderate cost utilizing a laminar construction of woven glass cloth and glass fiber matting with a thermosetting polyester casting resin as a binder so as to yield a ladder of high electrical insulating value, long life, and superior structural strength.

Another object of my invention is to provide the terminal end of a movable, powered aerial ladder with a work platform having electrical controls so a workman standing upon the platform selectively may cause the ladder to move in any of three degrees of movement, up or down, in or out, and to and fro. A correlated objective is the provision of ladder side rails which protect and insulate the electric cable which leads to the above mentioned platform controls from the base of the ladder.

The aerial ladder of the instant invention is particularly adapted for use by utility maintenance crews in work upon street lights, electric and telephone transmission lines, tree trimming operations, and the like. The ladder itself is mounted upon a truck chassis and is articulated and powered so as to provide three degrees of movement. The end of the extensible section of the ladder may reach 35 feet or more above the truck chassis. This end carries a novel three section work platform upon which a workman can stand while he works. In addition, electric foot control switches are located upon the outermost edge of the work platform sections for actuation by one foot of the workman while he stands with the other foot upon a level surface. In accord with one object of my invention, the extensible section of the ladder which carries the platform is built up in a mold and cured to provide a laminar construction of woven glass cloth and glass fiber matting with a thermosetting polyester casting resin as a binder. This is an effective insulating material which thus isolates the workmen from the ground and serves as a protection should the ladder or platform inadvertently come into contact with a high voltage line. As an additional safety factor, the work platform is bounded on the side by a pair of looped hand rails. With or without a safety belt, the workman thus can free his hands to repair telephone, power, or light wires, trim trees, or service street lights while located 35 feet or more above the street level. At the same time, his fellow workman can climb the ladder should additional tools or the like be needed on the job.

The primary requisites for an aerial ladder of the type above described, include safety devices to protect the workman, adequate insulation, structural strength, mobility and an actuation mechanism which is trouble free yet inexpensive. These requirements have been satisfied in the instant invention with structures which are an improvement upon prior aerial ladders and which form the subject matter of my inventive objects. Firstly, the ladder itself is formed with a lower section mounted upon a base or stand and an upper section which is

2

formed of insulating material and is extensible with respect to the lower section. In fabricating the insulated upper section, a wood center core is completely encased in a glass and plastic coating having a high tensile strength. At the same time, a flange is formed of the same glass and plastic material so as to define a stringer or side rail for the ladder having the approximate form of a structural steel bulb bar member. Utilizing a pair of these high tensile strength stringers, I can support more than 750 pounds of weight at the end of a ladder having an overall length of 35 feet without employing any supplementary truss or cable reinforcing members. At the same time, a stringer formed in this manner is impervious to moisture and weather, is possessed of an almost indefinite useful life, and the material itself exhibits exceptionally good electrical insulation qualities.

As another feature of my invention, the truck mounted base of the ladder carries electric actuation means which are operable from the battery of the truck itself. These electric actuation means are operable from the work platform through an electric cable which interconnects the base and terminal end by novel structure. This novel structure takes the form of a hollow longitudinal tunnel which pierces one of the side rail stringers of the ladder. The electric control cable to interconnect the control means on the work platform and electric actuated means adjacent the base is carried in this tunnel. Thus, the cable is protected from wear and from inadvertent contact with the high voltage lines about which the ladder may be worked. The provision of this structure is one object of my invention.

Another feature of my invention resides in the provision of a high tensile strength in a ladder side rail of minimal overall size. This strength is provided by plural layers of woven glass cloth encased in the flange of each side rail stringer such that the glass cloth is continuous the full length of the side rail. The cloth is held in place by the use of a casting resin so as to provide a high tensile strength and the provision of this structure is another of my inventive objects.

Another of my inventive objects is to provide an articulated aerial ladder with electric actuation means which are operable from the battery of the truck upon which the ladder is mounted in order that the ladder can be installed at minimal cost upon existing trucks.

These and other objects and advantages of my invention will become apparent during consideration of the following detailed description, taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a perspective view of the aerial ladder mounted upon a truck and partially extended therefrom with a workman standing upon the three section platform;

Fig. 2 is a foreshortened side view of the ladder with the outer rail removed to reveal the operating elements of the extensible inner section;

Fig. 3 is a detail view of the upper end of both sections of the ladder with the work platform shown retracted for storage or transportation;

Figs. 4 and 5 are related rear and side views of the pedestal or stand upon which the lower end of the ladder is mounted to provide three degrees of movement;

Fig. 6 is a broken detail view, taken substantially on the line 6—6 of Fig. 4, showing the details of the journaled housing which allows the ladder to be rotated about a vertical axis;

Fig. 7 is a detail view also partially broken away, taken substantially on the line 7—7 of Fig. 5, showing the hydraulic piston and cylinder motor which pivots the ladder up and down about a horizontal axis;

Fig. 8 is an enlarged detail view, taken substantially on the line 8—8 of Fig. 3, showing the relative positions of the upper and lower ladder elements during use;

Fig. 9 is a detail view, taken substantially on the line 9—9 of Fig. 8, showing one of the rungs of the ladder and the manner in which bolts hold that rung to the side rails;

Fig. 10 is an enlarged detail view in cross section showing one of the side rail stringers and more particularly indicating the laminar construction which encases the wood core and forms the flange; and

Fig. 11 is a schematic diagram showing both the electric and hydraulic elements which control the three degrees of movement of the ladder, certain of these elements being indicated diagrammatically by their conventional symbols.

The ladder illustrated in the drawings is shown mounted upon a utility truck 15 having a cab over frame 16 upon which the ladder rests while being transported from place to place. The ladder itself consists of a lower metal section 17 and an upper plastic, glass and wood section 18. A work platform 19 is mounted adjacent the terminal end of the upper section. In addition, the lower end of the section 17 is mounted upon a stand or base (illustrated in Figs. 4 and 5) and the upper section is mounted for extension and retraction with respect to the lower section. The aforementioned three degrees of movement are provided (up or down, in or out, and to and fro) so as to adapt the ladder for street light maintenance, general line work, and tree trimming operations. In many of these uses, it is essential that the workmen standing upon the platform 19 be electrically insulated from the ground so that inadvertent contact with high voltage lines will do no harm. To this end, the upper ladder section 18 is formed of a material of high electrical insulating value as now will be described.

Referring particularly to Figs. 8 and 10, the upper section of the ladder includes a pair of elongated parallel stringers 20 and 21. These define the side rails of the upper section and a plurality of parallel lateral tubular metal rungs 22 are carried therebetween. Each of the stringers or side rails is of a laminar construction of woven glass cloth and glass fiber matting with a thermosetting polyester casting resin as a binder. This material is possessed of high insulating value as well as a high tensile strength and the casting of an exemplary stringer side rail will be described in detail.

To the above end, it will be noted that each stringer has the form of a bulb bar structural member with the bulb portion 23 being rectangular in cross section and the flange portion 24 which extends the length of the stringer, being a flat plane extension of one long side of the rectangle. To lay up a stringer, I employ a cavity mold of the same configuration as the finished side rail illustrated in Fig. 10. The woven glass cloth is available commercially as a continuous long piece of material. A single layer of this cloth is placed in the bottom of the cavity of the mold and a layer of glass matting is placed thereover with the ends of both the cloth and matting draped over the outside of the mold. The matting itself is two inch long fibers of glass which are pressed together to form a one-eighth inch thick mat and it too is available commercially. The initial layer of cloth and matting are placed in the cavity so as to form a layer along the flange and across the sides and bottom of the bulb portion. Thereinafter, a casting resin which is a thermosetting polyester plastic having an accelerator and a catalyst is added to the cavity so as to impregnate the cloth and matting. Immediately thereafter and before the plastic has cured, the wood center core 25 is positioned in the mold on shoulders which hold it in place.

In detail, the wood center core 25 consists of two separate halves which are elongated pieces of wood arranged to abut and fit together along the longitudinal center line of the finished bulb portion 23. An ordinary two by four which has been split lengthwise will serve this purpose. In addition, the core of at least one of

the stringer side rails should contain a hollow longitudinal tunnel 26 which extends end to end. Each such tunnel (only one is illustrated) defines a cable way for an electric cable and/or an air hose. To form this hollow tunnel, a semicircular recess is rabbeted lengthwise in each half of the core before the wood pieces are fitted together.

After positioning the wood in the cavity of the bulb, a second layer of glass cloth and glass matting is cut to size and is placed over the wood and along the flange. Lastly, the remaining excess lengths of glass cloth and matting from the first layer in the mold are folded across the top of the wood and flange portions of the mold to define a fifth and sixth layer. In final effect, this provides six separate layers (three of glass cloth and three of glass matting) which extend lengthwise the entire length of the stringer. From bottom to top in the mold, these layers are one of cloth, matting, cloth, matting, matting, and cloth. With all of these layers in place, the material is impregnated thoroughly with the polyester resin. The mass then is cured for four hours with a top or lid over the mold. Upon removal from the mold, the side rail is ready for use in the aerial ladder. By actual test, I have found that the woven glass cloth which extends lengthwise along the flange adds sufficient tensile strength to the stringer to support the work platform 19 and a worker with a large margin of safety. At the same time, these laminar plastic and glass side rails are exceptionally good insulators and are substantially impervious to moisture and weather. Even under conditions of severe usage for a long period of time they will wear well and maintain their strength.

In assembling the upper section 18 of the ladder, two of the side rails and a plurality of the metal rungs 22 are provided. At equispaced points, the side rails are drilled so as to accommodate flush fitting bolts 27 to secure the rungs in place and, at the same time, to exert a lateral compressive squeeze upon the rails. Lengthwise, of course, the rungs 22 are spaced from one another thereby preserving the insulating qualities of the upper section. Further, the work platform 19 is pivoted adjacent the outer terminal end of this upper section as shown at 28 in Fig. 3 so as to allow adjustment and retraction movements. The platform itself includes three flat floor sections. The inner section is identified by the reference numeral 29, the intermediate section by the reference numeral 30, and the outer section by the reference numeral 31. Two chains 32 interconnect the outer section 31 with selected ones of the eyes 33 to provide an adjustment for the final position of the platform with respect to the ladder. Finally, a plurality of electric foot control switches 34 and a pair of looped safety rails 35 are added to the platform structure.

In use, a workman stands upon an appropriate one of the floor sections of the work platform as shown in Fig. 1 and either grasps the safety rail 35 or secures his safety belt to the loops provided on the inner side of this safety rail. In either event, his hands are free to work and a control of the movements of the ladder can be effected by a manipulation of the control switches 34 in a manner hereinafter to be described. At the same time, the worker is protected against falling forward by the lateral brace members 36 which join the looped safety rails 35. Several advantages flow from the use of this structure. First of all, the three flat floor sections allow the worker to stand on substantially a level floor section in any elevated position of the ladder. For example, in a lower position the worker will stand upon the outer section 31. With the ladder at an angle of approximately forty five degrees, the intermediate section 30 will be employed. Similarly, when the ladder is substantially vertical, the inner flat section 29 will be utilized to stand upon. Other intermediate adjustments can be effected by changing the position of the chains 32 in the eyes 33. In some instances, the workman will stand with one foot

5

upon one section and the other foot upon another section to brace himself. In this connection, it will be noted that the adjoining sections of the floor of the platform subtend an angle of less than 180 degrees. This provides, at all times, a substantially level section, a brace for the feet, and a telltale or an indicia for the position of the worker upon the platform. Independently of the safety rails 35 and 36, the worker will realize that he should not step beyond the third flat section. Knowing which section he is standing upon, he thus will be protected against inadvertently stepping off of the platform. Another advantage which occurs to the use of this flat surfaced platform is that it is more comfortable for a worker to stand upon a flat surface than upon a curved or a ladder like structure made up of rungs. For this reason, I form each of the flat floor sections of expanded metal or the like. This provides a continuous nonslip surface for the shoes of the worker.

Referring now to Figs. 2, 3, and 8, it will be seen that the lower ladder section preferably is a pair of trusses formed of metal and each including a channel section 37. The legs of the channel members straddle the bulb portion 23 of the upper side rails to serve as a guide during extension and retraction of the ladder. In addition, each of the side rails of the lower ladder section is reinforced with a structure 38 having two pairs of journaled wheels 39 adjacent the upper end thereof. As best shown in Figs. 3 and 8, the periphery of these wheels project within the outline bounded by the legs of the channels 37 as the upper and lower surfaces of the side rails roll thereupon. One pair of wheels 39 is positioned adjacent the lower surface of the side rails and a second pair adjacent the upper surface to allow the upper ladder section to slide smoothly during extension and retraction.

Turning now to Figs. 4 to 7 inclusive, the lower ladder section 17 is pivoted on a lateral bar or pivot member 40. The ladder thus can swing up and down as required. In addition, a hydraulic piston and cylinder motor 41 is secured at its lower end to a base member 42 and, at its upper end, to the truss structure 38 of the lower ladder section. As is evident in the broken sections of Fig. 7, a supply of hydraulic fluid to this motor unit 41 will raise the ladder by pivoting the same about the pivot bar 40. Similarly, when hydraulic pressure fluid is exhausted from this motor unit 41, the weight of the ladder allows the same to be lowered.

Means are provided in conjunction with the apparatus for raising the ladder to stabilize the ladder against lateral twisting. Referring particularly to Fig. 7, the motor 41 comprises a cylinder 60 pivotally connected by means of brackets 62 and a pin 63 to the lower end of the base member 42 the axis of the pin 63 being parallel to the axis of the pivot member 40. Mounted in the cylinder 60 is a piston 64 which extends outwardly of the upper end of the cylinder 60. Mounted exteriorly of the cylinder 60 is an elongate guide tube or rigid sleeve 65 which is slidable lengthwise of the cylinder. Extending between and journaled to the opposite truss structures 38 of the lower ladder section is a cross bar 66, the cross bar being parallel to the pivot member 40 and being spaced outwardly along the ladder section 17 with respect to the pivot member 40. The sleeve 65 and piston 64 are each rigidly secured at their upper ends to the cross bar 66. Thus, actuation of the motor 41 and extension of the piston 64 will effect pivoting of the ladder about the pivot member 40, the guide sleeve moving simultaneously upwardly along the cylinder 60 with the piston 64. Engaging the cross bar 66 adjacent the truss structure 38 of the opposite stringers are struts 67 which extend from the cross bar 66 angularly inwardly toward the lower end of the sleeve 65 and to which they are fixedly secured. A pair of brace members 68 may also be provided between each of the struts 67 and the sleeve 65 adjacent the upper end of the latter so as to assist in retaining the corresponding ends of the struts in fixed

6

relation relative to the sleeve. As will be apparent with reference to Fig. 7, any twisting of the ladder will be resisted by the struts 67 and the vertical component of any twisting force will be translated by the struts to a horizontal component against the motor cylinder 60. Since the cylinder 60 is fixed, twisting of the ladder will be prevented.

As will be seen by reference to Fig. 5, the axes of the pin 63 and the cross bar 66 are parallel to each other and are, in turn, parallel to the main pivot member 40. In fact, the pin 63, the cross bar 66, and the main pivot member 40 are all carried by the base member 42, which is, in turn, rotatably mounted upon the fixed standard 43, as shown in Fig. 6. Thus, the parallel relationship between the pin 63, the cross bar 66, and the main pivot member 40, is preserved at all times.

To revolve or swing the ladder about the fixed standard 43, the base member 42 is joined thereon as shown in Fig. 6. In cooperation therewith, an electric motor 44 is connected by appropriate chain and sprocket mechanism to a worm which engages a worm follower carried by the periphery of the fixed standard 43. This rotation mechanism is conventional and the details thereof will not be described except to point out that actuation of the electric motor 44 in one direction will swing the entire ladder about a vertical axis in one direction and an actuation of the electric motor for an opposite rotation will swing the ladder oppositely. Further, by utilizing an electric starter motor 44, I am able to operate the motor directly from the battery of the vehicle 15.

To extend and to retract the upper section 18 with respect to the lower section 17, I mount an elongated chain 45 adjacent each side of the ladder. These chains are reeved about appropriate sprockets and an electric motor drive 46 (see Fig. 11) is geared thereto. The lower ends of the upper section of the ladder are joined with bolts and metal plates to appropriate sections of these chains such that a rotation of the electric motor 46 in one direction will extend the ladder and a reverse rotation will retract the ladder. Further, in similarity with the electric motor 44, I prefer to utilize an electric starter motor which also can be operated from the vehicle battery represented by the numeral 47 in Fig. 11.

Referring now to the schematic diagram of Fig. 11, it will be seen that two sets of electric control switches are provided for the aerial ladder. The upper set of these control switches is a diagrammatic representation of the foot control switches 34 shown upon the platform 19. The lower set of these switches fits upon the base member 42 for access by a worker standing upon the bed of the truck should this optional method of actuation be desired. As shown in the schematic diagram, a plurality of electric wires interconnect these two sets of switches and the various electric motors which control the three degrees of movement of the ladder. These electric wires are gathered together in a single cable which is identified by the reference numeral 48. It is this same cable 48 which traverses the aforementioned hollow tunnel 26 within one of the side rails of the upper section. To maintain a constant tension in this cable while the ladder is extended and retracted, I reeve an intermediate portion thereof about a pulley wheel 49 and lay the remainder down along the length of the upper ladder section to a point where it enters the lower end of the hollow tunnel 26. The pulley wheel 49, in turn, is strapped to a second pulley wheel 50 having a tension cable 51 reeved thereabout. One end of this tension cable 51 is secured to the upper ladder section and the opposite end to the lower ladder section. In this manner, an extension of the upper ladder section carries with it the end of the cable 51 thereby drawing the pulleys 49 and 50 upwardly and maintaining the constant tension in the control cable 48.

Referring again to Fig. 11, the various electrical and hydraulic elements are represented diagrammatically to

illustrate their function. Each of the electric switches is spring biased to an open position and bears an identifying name related to the corresponding function which is effected by a closure thereof. For example, closure of the switch labeled "left" will swing the entire ladder to the left through an actuation of the solenoid L and an appropriate energization of the electric motor 44. The "master" switch, on the other hand, controls the hold solenoid "M." This acts as a master cutoff which opens the entire electric circuit upon deenergization of the solenoid M. After the master switch once has been depressed, a manual reset thereof is required as a safety feature.

To supply pressure fluid to and from the aforementioned hydraulic piston and cylinder motor 41, I provide two pumps 52 which derive hydraulic fluid from a reservoir 53 and are joined to the motor by a conduit 54. A pair of electric motors 55 actuate the pumps 52 through a single appropriate solenoid identified by the reference letter U. To lower the ladder, on the other hand, a solenoid valve D in a bypass line is actuated through depression of the control button labeled "down." Since the operation of most of these elements will be apparent, a detailed description will not be effected. Instead, the various functions will become apparent during a description of a typical use to which the aerial ladder is put.

In the operation of the aerial ladder, it will be assumed that the vehicle 15 has been located adjacent the base of a pole which supports high tension electric wires to which repairs must be made. During transportation, the ladder is retracted to rest upon the frame 16 thereby automatically pivoting the platform 19 to the position of Fig. 3 when the inner flat section 29 contacts a cross member on the lower section. To effect the required repair to the high tension lines, the workman can climb the ladder and stand upon the work platform 19 either before or after that platform is positioned adjacent the point of repair. In either event, an appropriate manipulation of either set of controls will move the ladder. For example, depression of the foot control switches 34 will manipulate the ladder in three degrees of movement to the desired position. To extend the ladder, the "out" push button is depressed. This will energize the relay "O" causing the electric motor 46 to rotate the chain 45 upon its sprockets. Rotation of this chain carries the upper ladder section outwardly until either the electric switch is opened or the parts reach their limit of travel through mechanical abutment.

In similar manner, the ladder can be swung to the right or to the left and can be pivoted up and down about the pivot rod 40. The latter type of movement, of course, is effected through the electric motors 55 and the pumps 52 to actuate the hydraulic piston and cylinder motor 41. Once in position, the desired repairs can be effected without fear of inadvertent contact of the ladder with the high voltage lines since the upper section 18 is an insulated entity. Further, the electric control cable 48 is protected within the coating or sheathing of plastic and glass which surrounds the core of the side rails 20 and 21. The workman is protected against falling by the safety rails 35 and 36 and, where desired, he can hook his safety belt to the loops shown carried by the inner portion of the rails 35. While standing upon the platform 19, the worker can manipulate the foot control switches 34 without fear of slipping since the floor of the platform is flat and continuous as illustrated. Should the ladder be raised or lowered with the workman thereon, he will step from section to section thereby maintaining an approximately level position at all times. During an actual movement, of course, he can brace himself by placing one foot on each of two adjoining sections.

In accordance with the objects of my invention, it will be seen that I have provided an inexpensive aerial ladder which is of superior structural strength yet of minimal size. This ladder is capable of three degrees of move-

ment with complete safety to the worker. Further, this ladder can be fabricated and sold at a minimal cost to be mounted upon any existing utility truck or other appropriate vehicle since the electric motors can be actuated

- 5 from the battery which is carried by such vehicles. In use, the combination plastic and glass ladder section is an insulator, is extremely durable, and is weather resistant. In addition, it has a high tensile strength without a massive or complex truss and will not bend because of the
10 glass cloth which is incorporated in the flange of the side rails.

I claim:

1. In combination, a ladder having electric actuation means mounted adjacent the lower end of said ladder
15 and operable selectively to move the ladder in any of three degrees of movement up or down, in or out and to or fro, a work platform carried adjacent the terminal end of said ladder, and electric control means mounted upon said platform for the selective control from the platform
20 of said electric actuation means, said ladder having two elongated side rail stringers one of which is pierced by a hollow longitudinal tunnel in which is carried an electric cable interconnecting said electric actuation and control means, said work platform including an inner, an intermediate and an outer continuous flat floor section joined
25 end to end with adjoining sections subtending an angle of less than 180 degrees, said inner floor section being journaled upon said ladder and cooperating with adjustable suspension means interconnecting the outer floor section and the ladder to position the platform with respect
30 to the ladder, said electric control means including a plurality of foot control switches arranged adjacent the outer edge of said outer floor section for actuation by the foot of a workman standing upon the work platform.

2. A ladder, comprising lower and upper ladder sections extensible with respect to one another, a pair of elongated parallel stringers defining the side rails of said upper sections, each of said stringers having the form of a bulb bar structural member having a cross sectional
40 shape consisting of a rectangle and an outwardly projecting flange substantially narrower in thickness than the thickness of the rectangle, said flange being substantially an extension of one side face of the rectangle, said lower ladder section including a pair of elongated metal truss
45 structures defining the lower section side rails and in which said upper section side rails slidably are mounted, and each said upper section stringer having a center core completely encased in a glass and plastic coating to yield a stringer of high electrical insulating value.

3. An aerial ladder, comprising a lower ladder section carrying an upper ladder section which is extensible with respect thereto, said upper section including a pair of elongated parallel stringers defining side rails and carrying a plurality of parallel lateral rungs therebetween, each of
55 said stringers having the form of a bulb bar structural member with the bulb portion being rectangular in cross section and the flange portion being a flat plane extension of one side of the bulb portion, said lower ladder section including a pair of side rails each of which comprises an elongated metal channel section in which one of said
60 upper section stringers is mounted, said upper section bulb portions being guided for extension movement upon journaled roller wheels which are carried by said lower section channels and which project within the outline bounded by the legs of the channels, and each said bulb
65 portion having a wood center core completely encased in a built up glass and plastic coating and each said flange portion being formed of the built up glass and plastic per se to yield a stringer of high electrical insulating value, said upper section lateral rungs being spaced and therefore insulated one from another.

4. An insulated extensible section for an aerial ladder, comprising a pair of elongated parallel stringers defining side rails and carrying a plurality of parallel lateral rungs
75 therebetween, each of said stringers having the form of a

bulb bar structural member with the bulb portion being rectangular in cross section and the flange portion being a flat plane extension of one long side of the bulb portion, said flange portion being substantially thinner in the transverse direction than the dimension of the rectangular bulb portion in its transverse dimension, each said bulb portion having a center core completely encased in a plastic coating and each said flange portion being formed of the built up laminar construction with glass and plastic materials to yield a stringer of high electrical insulating value and high mechanical strength, said lateral rungs being spaced and therefore electrically insulated one from another and being secured to said side rails by bolt means passing through and exerting a lateral compressive force upon said bulb portions.

5. An extensible section for a ladder, comprising a pair of elongated parallel stringers each having the form of a bulb bar structural member with bulb and flange portions, each said bulb portion being rectangular in cross section and each said flange portion being a flat plane extension of one side of the bulb portion, said flange portion being substantially thinner in the transverse direction than the dimension of the rectangular bulb portion in its transverse dimension, each said bulb portion having a wood center core completely encased in a built up glass and plastic coating and each said flange portion being formed of the built up glass and plastic per se to yield a stringer of high electrical insulating value, said glass and plastic including a laminar construction of woven glass cloth and glass fiber matting with a thermosetting polyester casting resin as a binder, there being plural layers of said woven glass cloth in said flange and each such layer being continuous the length of the stringer to impart thereto a high tensile strength.

6. An extensible section for an insulator ladder, comprising a pair of elongated parallel stringers defining side rails and carrying a plurality of parallel lateral rungs therebetween, each of said stringers having the form of a bulb bar structural member with the bulb portion being rectangular in cross section and the flange portion being a flat plane extension of one side of the bulb portion, each said bulb portion having a wood center core encased in a built up glass and plastic coating and each said flange portion being formed of the built up glass and plastic per se to yield a stringer of high electrical insulating value, said lateral rungs being spaced and therefore insulated one from another and being secured to said side rails by bolt means passing through and exerting a lateral compressive force upon said bulb portions, at least one of said wood center cores having two separate halves comprising elongated pieces of wood arranged to abut and fit together along the longitudinal centerline of the stringer, and a hollow longitudinal tunnel piercing said latter wood center core to define a cable way lengthwise through the stringer protected by said insulated coating.

7. In an extensible section of insulated ladder, an elongated continuous stringer defining one side rail of said ladder, said stringer having a center core which is encased in a glass and plastic coating, said coating extending and projecting out from said core in a plane parallel the longitudinal dimension of said stringer to form the flange portion of a structural member having the approximate form of a bulb bar having a cross-sectional shape consisting of a rectangle and an outwardly projecting flange substantially narrower in thickness than the thickness of the rectangle and consisting substantially of an extension of one side face of the rectangle, the coating encasing said core and defining said flange being formed of multiple layers of woven glass cloth and glass fiber matting with a thermosetting polyester casting resin as a binder to yield a high electrical insulating value and tensile strength.

8. In an extensible ladder for use by utility crews, an elongated continuous stringer defining one side rail of said ladder, said stringer including a wood center core

encased in a built up glass and plastic coating having a high electrical insulating value, said coating extending and projecting out from said core in a plane parallel the longitudinal dimension of said stringer to form the flange portion of a structural member having the approximate form of a bulb bar having a cross-sectional shape consisting of a rectangle and an outwardly projecting flange substantially narrower in thickness than the thickness of the rectangle and consisting substantially of an extension of one side face of the rectangle, the coating encasing said core and defining said flange being formed of woven glass cloth and glass fiber matting with a thermosetting polyester casting resin as a binder, the woven glass cloth in said flange extending continuously without break the length of the flange to impart thereto a high tensile strength.

9. An aerial ladder comprising an upright standard, a ladder including a pair of elongate parallel stringers, means pivotally mounting said stringers at the lower ends thereof upon the upper end of said standard for pivotal movement about a horizontal axis, motor means for effecting pivotal movement of said ladder about said axis comprising a cylinder secured at one end thereof to the lower end of said standard for pivotal movement about an axis parallel to said first mentioned axis, a piston in said cylinder extending outwardly of the end of said cylinder opposite said one end, an elongate rigid sleeve slidably mounted on said cylinder, a cross bar extending between and journaled to said stringers at a point spaced above the pivotal connection between said stringers and said standard, said cross bar being parallel to said axes, said sleeve and said piston being rigidly secured to said cross bar, whereby actuation of said motor effects pivoting of said ladder about the mounting thereof upon said standard, and means to stabilize said ladder against lateral twisting comprising a pair of struts each engaging said cross bar, one adjacent each of said stringers, said struts extending from said cross bar angularly inwardly toward and being fixedly secured to the lower end of said sleeve.

10. An aerial ladder comprising an upright standard, a ladder including a pair of elongate parallel stringers, means pivotally mounting said stringers at the lower ends thereof upon the upper end of said standard for pivotal movement about a horizontal axis, motor means for effecting pivotal movement of said ladder about said axis comprising a cylinder secured at one end thereof to the lower end of said standard for pivotal movement about an axis parallel to said first mentioned axis, a piston in said cylinder extending outwardly of the end of said cylinder opposite said one end, an elongate rigid sleeve slidably mounted on said cylinder, a cross bar extending between and journaled to said stringers at a point spaced above the pivotal connection between said stringers and said standard, said cross bar being parallel to said axes, said sleeve and said piston being rigidly secured at their upper ends to said cross bar, whereby actuation of said motor effects pivoting of said ladder about the mounting thereof upon said standard, and means to stabilize said ladder against lateral twisting comprising a pair of struts each engaging said cross bar, one adjacent each of said stringers, said struts extending from said cross bar angularly inwardly toward and being fixedly secured to the lower end of said sleeve, and a pair of brace members extending one between each of said struts and said sleeve adjacent the upper end of the latter, said members being fixedly secured to said sleeve and struts to retain the corresponding ends of said struts in fixed position relative to said sleeve.

11. A ladder, comprising lower and upper ladder sections extensible with respect to one another, a pair of elongated parallel stringers defining the side rails of said upper sections, each of said stringers having the form of a bulb bar structural member having a cross-sectional shape consisting of a rectangle and an outwardly project-

11

ing flange substantially narrower in thickness than the thickness of the rectangle, said flange being substantially an extension of one side face of the rectangle, and said lower ladder section including a pair of elongated metal truss structures defining the lower section side rails and in which said upper section side rails slidably are mounted.

12. An aerial ladder, comprising a lower ladder section carrying an upper ladder section which is extensible with respect thereto, said upper section including a pair of elongated parallel stringers defining side rails and carrying a plurality of parallel lateral rungs therebetween, each of said stringers having the form of a bulb bar structural member with the bulb portion being rectangular in cross section and the flange portion being a flat plane extension of one side of the bulb portion, said lower ladder section including a pair of side rails each of which comprises an elongated metal channel section in which one of said upper section stringers is mounted, and said upper section bulb portions being guided for extension movement upon journaled roller wheels which are carried by said lower section channels and which project within the outline bounded by the legs of the channels.

12

References Cited in the file of this patent

UNITED STATES PATENTS

168,378	Core	Oct. 5, 1875
567,814	Ornatowski	Sept. 15, 1896
1,691,976	Kramer	Nov. 20, 1928
1,908,969	Fox	May 16, 1933
2,035,537	Cowan et al.	Mar. 31, 1936
2,096,514	Havens	Oct. 19, 1937
2,248,794	Troche	July 8, 1941
2,450,152	Miller	Sept. 28, 1948
2,500,815	Gerli et al.	Mar. 14, 1950
2,531,001	Short	Nov. 21, 1950
2,573,361	Rodgers	Oct. 30, 1951
2,616,768	Stemm	Nov. 4, 1952
2,627,560	Eitel	Feb. 3, 1953
2,654,524	Humpal	Oct. 6, 1953
2,666,417	Harsch	Jan. 19, 1954
2,674,500	Hukari	Apr. 6, 1954
2,727,672	De Luca	Dec. 20, 1955
2,776,080	Hopfeld	Jan. 1, 1957
2,777,737	Balogh	Jan. 15, 1957