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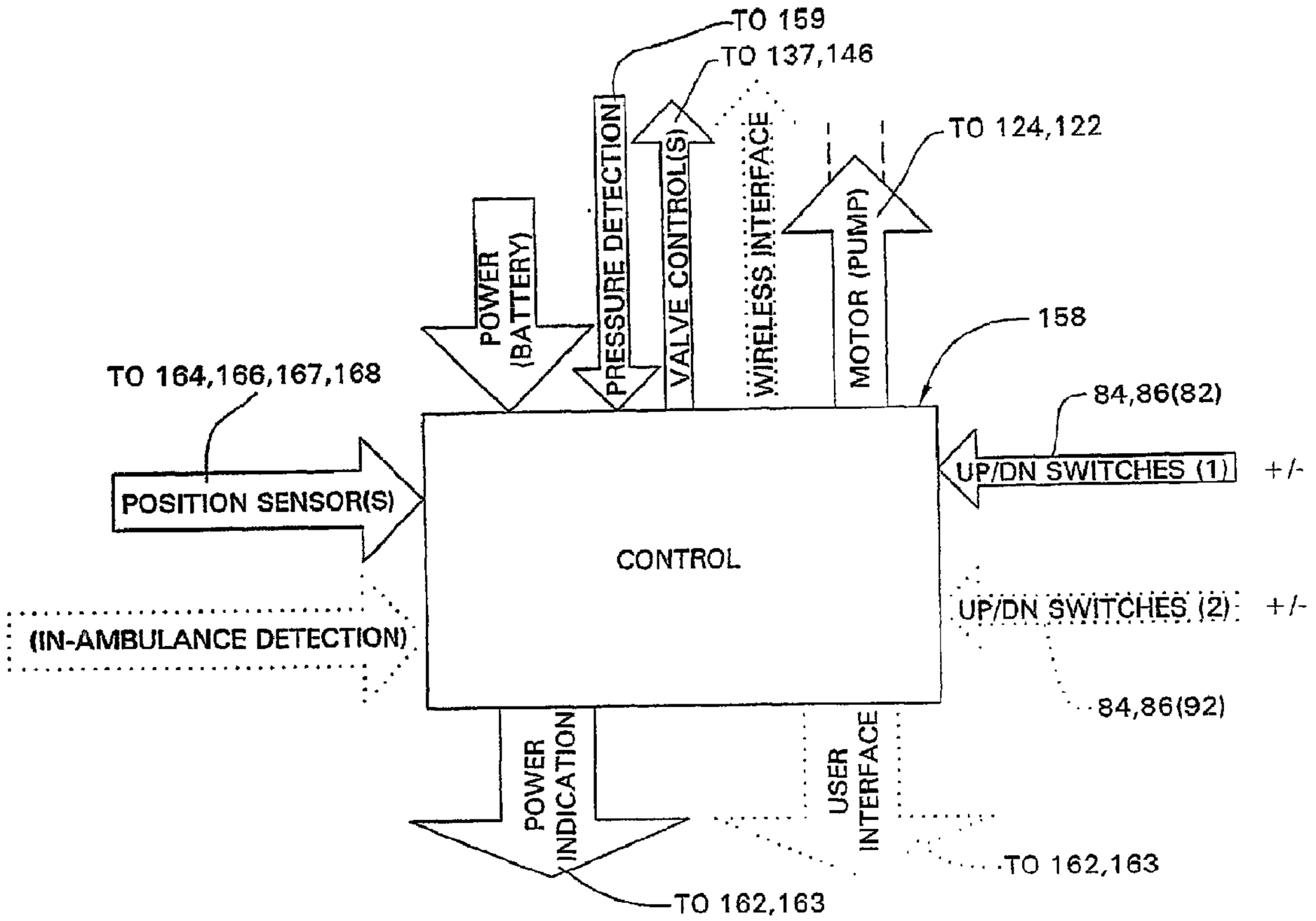
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(57) Abrégé/Abstract:
An ambulance cot is disclosed and the ambulance cot has, if desired, a wheel supported base and a litter raisable and lowerable by a powered elevating mechanism oriented between the base and the litter. The ambulance cot also has wireless communication capability to facilitate communication between the ambulance cot and a loading system on an ambulance as well as facilitating wireless troubleshooting via a handheld wireless unit. The ambulance cot also has a longitudinally extendable head section. The ambulance cot also has several accessories, such as an accessory hook mounted to the underside of the fowler, and a collapsible pouch accessory fastened to the retractable head section and the litter frame.

ABSTRACT

An ambulance cot is disclosed and the ambulance cot has, if desired, a wheel supported base and a litter raisable and lowerable by a powered elevating mechanism oriented between the base and the litter. The ambulance cot also has wireless communication capability to facilitate communication between the ambulance cot and a loading system on an ambulance as well as facilitating wireless troubleshooting via a handheld wireless unit. The ambulance cot also has a longitudinally extendable head section. The ambulance cot also has several accessories, such as an accessory hook mounted to the underside of the fowler, and a collapsible pouch accessory fastened to the retractable head section and the litter frame.

AMBULANCE COT WITH PINCH SAFETY FEATURE

FIELD OF THE INVENTION

[0002] This invention relates to an ambulance cot and accessories. This invention also relates to an ambulance cot having a wheel supported base and a litter raisable and lowerable by a powered elevating mechanism oriented between the base and the litter. This invention also relates to an ambulance cot having a wireless communication capability to facilitate communication between the ambulance cot and a loading system on an ambulance as well as facilitating wireless troubleshooting via a handheld wireless unit. This invention also relates to an ambulance cot having a longitudinally extendable head section with a latching mechanism to fix it in selected locations.

BACKGROUND OF THE INVENTION

[0003] Emergency Medical Service (EMS) personnel are required to handle the combined weight of a patient and the ambulance cot during various stages of maneuvering of the ambulance cot while separated from the ambulance. This cot manipulation often requires that the patient supported on the litter be lifted to various elevated heights above the floor. In some instances, the weight factor can cause EMS personnel injury that requires medical treatment.

[0004] As the inclusion of more and more sophisticated technology onto ambulance cots continues to occur, there is an increasing need to be able to quickly and

accurately diagnose the complex equipment without requiring the ambulance cot to be removed from service.

[0005] Accordingly, it is advantageous to provide an ambulance cot equipped with an elevating mechanism to facilitate a lifting and lowering of the litter as well as an ability of the ambulance cot to communicate diagnostic issues in a convenient way without requiring removal of the ambulance cot from a field of use for a prolonged period of time.

SUMMARY OF THE INVENTION

[0006] This invention relates to an ambulance cot and accessories. This invention also relates to an ambulance cot having a wheel supported base and a litter raisable and lowerable by a powered elevating mechanism oriented between the base and the litter. This invention also relates to an ambulance cot having a wireless communication capability to facilitate communication between the ambulance cot and a loading system on an ambulance as well as facilitating wireless troubleshooting via a handheld wireless unit. This invention also relates to an ambulance cot having a longitudinally extendable head section with a latching mechanism to fix it in selected locations.

[0006.1] In one aspect of the present invention, there is provided an ambulance cot, comprising:

a base frame;

a litter frame; and

an X-frame support mechanism interconnecting said base frame and said litter frame and being configured to support said litter frame in one of a plurality of positions relative to said base frame, said support mechanism including at least one pair of frame members pivotally secured to each other proximate the mid-length thereof, said frame members each having opposite ends respectively secured to one of said base frame and said litter frame, said at least one of said pair of frame members having a first mount oriented between said mid-length thereof and said base frame, said at least one of said pair of frame members having a second mount oriented between said mid-length thereof and said litter frame, said first and second mounts being configured to respectively engage said litter frame and said base frame in response to said litter frame becoming proximate said base frame; and

wherein said litter frame has longitudinally extending side rails and at least one first crosswise extending member interconnecting said side rails of said litter frame, said first mount being oriented in a path of movement of said first crosswise extending member as said litter frame becomes proximate said base frame so that said first crosswise extending member engages and rests upon said first mount, and wherein said base frame has longitudinally extending side rails and at least one second crosswise extending member interconnecting said side rails of said base frame and being oriented in a

path of movement of said second mount as said litter frame becomes proximate said base frame so that said second mount engages and rests upon said at least one second crosswise extending member.

[0006.2] In a further aspect of the present invention, there is provided an ambulance cot, comprising:

a base frame;

a litter frame; and

an X-frame support mechanism interconnecting said base frame and said litter frame and being configured to support said litter frame in one of a plurality of positions relative to said base frame, said support mechanism including at least one pair of frame members pivotally secured to each other proximate the mid-length thereof, said at least one pair of frame members each having opposite ends respectively secured to one of said base frame and said litter frame, at least one of said pair of frame members having a first mount oriented between said mid-length thereof and said litter frame, said first mount being configured to engage said base frame in response to said litter frame becoming proximate said base frame; and

wherein said base frame has longitudinally extending side rails and at least one crosswise extending member interconnecting said side rails and being oriented in a path of movement of said first mount as said litter frame becomes proximate said base frame so that said first mount engages and rests upon said at least one crosswise extending member.

[0006.3] In a further aspect of the present invention, there is provided an ambulance cot, comprising:

a base frame;

a litter frame; and

an X-frame support mechanism interconnecting said base frame and said litter frame and being configured to support said litter frame in one of a plurality of positions relative to said base frame, said support mechanism including at least one pair of frame members pivotally secured to each other proximate the mid-length thereof, said at least one pair of frame members each having opposite ends respectively secured to one of said base frame and said litter frame, at least one of said pair of frame members having a first mount oriented between said mid-length thereof and said base frame, said first mount being configured to engage said litter frame in response to said litter frame becoming proximate said base frame; and

wherein said litter frame has longitudinally extending side rails and at least one crosswise extending member interconnecting said side rails, said first mount being oriented in a path of movement of said at least one crosswise extending member as said litter frame becomes proximate said base frame so that said at least one crosswise extending member engages and rests upon said first mount.

[0006.4] In a further aspect of the present invention, there is provided an elongate ambulance cot having a head end and a foot end, comprising:

a base frame having a first lateral width;

a litter frame having a second lateral width and a manually engageable handle adjacent one end configured to facilitate a manual lifting of said one end and a set of load wheels adjacent an opposite end; and

an X-frame support mechanism having a third lateral width less than said first and second widths, said support mechanism interconnecting said base frame and said litter frame and being configured to support said litter frame in one of a plurality of positions relative to said base frame, said support mechanism including at least one pair of frame members pivotally secured to each other proximate the mid-length thereof, said frame members each having opposite ends respectively secured to one of said base frame and said litter frame, said at least one of said pair of frame members having a first mount oriented between said mid-length thereof and said base frame, said at least one of said pair of frame members having a second mount oriented between said mid-length thereof and said litter frame, said first and second mounts being configured to respectively engage said litter frame and said base frame in response to said litter frame becoming proximate said base frame;

said litter frame having longitudinally extending side rails and at least one first crosswise extending member on at least one of said side rails of said litter frame, said first mount being oriented in a path of movement of said at least one first crosswise extending member as said litter frame becomes proximate said base frame so that said at least one first crosswise extending member engages and rests upon said first mount, and wherein said base frame has longitudinally extending side rails and at least one second crosswise extending member on at least one of said side rails of said base frame and being oriented in a path of movement of said second mount as said litter frame becomes proximate said base frame so that said second mount

engages and rests upon said at least one second crosswise extending member.

[0006.5] In a further aspect of the present invention, there is provided an elongate ambulance cot having a head end and a foot end, comprising:

a base frame having a first lateral width;

a litter frame having a second lateral width and a manually engageable handle adjacent one end configured to facilitate a manual lifting of said one end and a set of load wheels adjacent an opposite end; and

an X-frame support mechanism having a third lateral width less than said first and second widths, said support mechanism interconnecting said base frame and said litter frame and being configured to support said litter frame in one of a plurality of positions relative to said base frame, said support mechanism including at least one pair of frame members pivotally secured to each other proximate the mid-length thereof, said at least one pair of frame members each having opposite ends respectively secured to one of said base frame and said litter frame, at least one of said pair of frame members having a first mount oriented between said mid-length thereof and said base frame, said first mount being configured to engage said litter frame in response to said litter frame becoming proximate said base frame;

said litter frame having longitudinally extending side rails and at least one crosswise extending member on at least one of said side rails, said first mount being oriented in a path of movement of said at least one crosswise extending member as said litter frame becomes proximate said base frame so that said one

crosswise extending member engages and rests upon said first mount.

[0006.6] In a further aspect of the present invention, there is provided an elongate ambulance cot having a head end and a foot end, comprising:

a base frame having a first lateral width;

a litter frame having a second lateral width and a manually engageable handle adjacent one end configured to facilitate a manual lifting of said one end and a set of load wheels adjacent an opposite end; and

an X-frame support mechanism having a third lateral width less than said first and second widths, said support mechanism interconnecting said base frame and said litter frame and being configured to support said litter frame in one of a plurality of positions relative to said base frame, said support mechanism including at least one pair of frame members pivotally secured to each other proximate the mid-length thereof, said at least one pair of frame members each having opposite ends respectively secured to one of said base frame and said litter frame, at least one of said pair of frame members having a first mount oriented between said mid-length thereof and said litter frame, said first mount being configured to engage said base frame in response to said litter frame becoming proximate said base frame;

said base frame having longitudinally extending side rails and at least one crosswise extending member on at least one of said side rails and being oriented in a path of movement of said first mount as said litter frame becomes proximate said base frame so that said first mount engages and rests upon said at least one crosswise extending member.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Various objects and purposes of the invention will become apparent based upon a review of the following specification and upon a review of the several drawings, in which:

[0008] Figure 1 is an isometric view of an ambulance cot embodying the invention, which ambulance cot is in the fully raised position;

[0009] Figure 2 is an isometric view of an ambulance cot similar to Figure 1, except that the ambulance cot is in a mid-height position;

[0010] Figure 3 is an isometric view of an ambulance cot similar to Figure 1, except that the ambulance cot is in the fully collapsed and lowered position;

[0011] Figure 4 is an isometric view of a fragment of the hydraulic elevating mechanism on the ambulance cot;

[0012] Figure 5 is a fragmentary isometric view of the base, elevating mechanism and a fragment of the litter on the ambulance cot;

[0013] Figure 6 is an isometric view of a fragment of the litter frame;

[0014] Figure 7 is a side view of a collapsed base and elevating mechanism on the ambulance cot;

[0015] Figure 8 is an isometric view of a foot end lift handle assembly on the ambulance cot;

[0016] Figure 9 is a side elevational sectional view of the foot end lift handle assembly sectioned through the switches;

[0017] Figure 10 is an isometric view of a switch housing that is mounted on the foot end lift handle assembly;

[0018] Figure 11 is an electrical schematic of a switch mounted on the switch housing illustrated in Figure 10;

[0019] Figure 12 is a bottom view of a release handle mechanism mounted on the foot end lift handle assembly, which handle is in the stowed position;

[0020] Figure 13 is a view similar to Figure 12, except that the handle has been shifted to an operative position;

[0021] Figure 14 is a view similar to Figure 13, except that the handle has been moved to an operated position;

[0022] Figure 15 is an isometric view of a mounting assembly on the ambulance cot for the hydraulic circuit;

[0023] Figure 16 is a fragmentary sectional view of a portion of the base whereat the base connects to an X frame member;

[0024] Figure 17 is a hydraulic circuit diagram embodied on the ambulance cot;

[0025] Figures 18-23 are additional illustrations of the hydraulic circuit diagram illustrated in Figure 17, except that various valves have been shifted to demonstrate operation of the hydraulic circuit;

[0026] Figure 24 is a schematic representation of a control for the hydraulic circuit;

[0027] Figure 25 is a decision tree diagram representative of the operational characteristics of the control illustrated in Figure 24 and the hydraulic circuit of Figures 17-23;

[0028] Figure 26 is an isometric view of the litter and similar to the illustration in Figure 1;

[0029] Figure 27 is an isometric view of a fragment of the ambulance cot in the collapsed and lowered position inside a cargo area of an ambulance;

[0030] Figure 28 is a bottom view of the hydraulic assembly illustrated in Figure 15 (minus the mounting assembly);

[0031] Figure 29 is a view similar to Figure 28, except that one of the valves has been actuated;

[0032] Figure 30 is a view similar to Figure 29, except that both of the valves have been actuated;

[0033] Figure 31 is a sectional view of one of the valves illustrated in Figures 28-30;

[0034] Figure 32 is a decision tree diagram for the logic employed on a handheld diagnostics tool;

[0035] Figure 33 is a decision tree diagram for the general logic employed on the cot and load system in an ambulance to facilitate wireless diagnostics;

[0036] Figure 33A is a modified decision tree diagram for the logic employed on a handheld tool used for wireless programming, remote control and diagnostics.

[0037] Figure 34 is a fragmentary isometric view of an antenna system on the ambulance cot as well as an antenna system on a load arm provided on the ambulance;

[0038] Figure 35 is a side elevational view of the ambulance cot in the fully collapsed position with the head section retracted;

[0039] Figure 36 is a view similar to Figure 35, except that the head section on the ambulance cot has been moved to the fully deployed position;

[0040] Figure 37 is a fragmentary isometric view of the head section on the ambulance cot;

[0041] Figure 38 is a view similar to Figure 37, except that a handle has been shifted to a fully operated position;

[0042] Figure 39 is a side view of the head section with the handle in a first position;

[0043] Figure 40 is a view similar to Figure 39, except that the handle has been moved to the fully operated second position;

[0044] Figure 41 is a view similar to Figure 40, except that the handle has been shifted back to its first position illustrated in Figure 39;

[0045] Figure 42 is a sectional view of a latch mechanism on the head section;

[0046] Figure 43 is a view similar to Figure 42, except that the latch mechanism has been shifted to its fully operated position;

[0047] Figure 44 is an isometric view of a fully folded foldable safety bar on the head section;

[0048] Figure 45 is a side elevational view of the safety bar in the fully folded position as illustrated in Figure 44;

[0049] Figure 46 is a view of the safety bar in the unfolded position;

[0050] Figure 47 is a bottom isometric view of the foot end lift handle assembly with a battery locked into an operating position;

[0051] Figure 48 is a view similar to Figure 47 except that the battery has been moved to an inoperative position;

[0052] Figure 49 is a fragmentary isometric view of a non-circular X frame member receiving therein a circular further X frame member;

[0053] Figure 50 is an isometric view of the head end of the cot and showing on the underside of the fowler an accessory hook;

[0054] Figure 51 is an enlarged view of a fragment of Figure 50;

[0055] Figure 52 is an isometric view of the cot having a collapsible pouch accessory thereon, which pouch is in the extended position of use in response to an extension of the head section;

[0056] Figure 53 is an enlarged view of a fragment of Figure 52;

[0057] Figure 54 is a plan view of the pouch accessory;

[0058] Figure 55 is a view similar to Figure 52 but with the pouch in the collapsed condition in response to a retraction of the head section;

[0059] Figure 56 is an enlarged view of a fragment of Figure 55;

[0060] Figure 57 is a partial cross-sectional view of a retractable head section latch disabler in a disengaged position;

[0061] Figure 58 is a partial cross-sectional view according to Figure 57 of the latch disabler in an engaged position;

[0062] Figure 59 is a decision tree diagram for the logic employed in environments utilizing a Radio Frequency Identification tag;

[0063] Figure 60 is an enhanced decision tree diagram for Figure 59 presenting the general logic employed during a normal drive mode;

[0064] Figure 61 is a decision tree diagram for the logic employed in the Figure 59 environment, particularly during a loading of the ambulance cot onto the load mechanism on the ambulance;

[0065] Figure 62 is an exploded perspective view of the retractable head section and latch disabler of Figures 57-58;

[0066] Figure 63 is a perspective view of the head section of the ambulance cot aligned with an antler system for an ambulance cargo area; and

[0067] Figure 64 is a perspective view of the head section engaged with the antler system of Figure 63.

DETAILED DESCRIPTION

AMBULANCE COT

[0068] An ambulance cot 10 embodying the invention is illustrated in the drawings. The ambulance cot 10 is similar to the ambulance cots disclosed in U.S. Patent No. 5 537 700 and WO 2004/064698, the subject matters thereof being incorporated herein by reference. The ambulance cot 10 includes a base frame 11 composed of longitudinally extending side rails 12 and crosswise extending rails 13 interconnected at the ends thereof to the side rails 12 to form a rectangle. Castered wheels 14 are operatively connected to each corner of the rectangle base frame formed by the rails 12 and 13.

[0069] The ambulance cot 10 includes a litter 16 comprising a litter frame 17. An elevating mechanism 18 is provided between the base frame 11 and the litter frame 17 in order to facilitate a lifting and lowering of

the litter 16 relative to the ground. More specifically, the elevating mechanism 18 includes a pair of side-by-side oriented "X" frames 19 and 21. The X frame 19 includes a pair of X frame members 22 and 23 connected together adjacent their midlength portions by means of a pivot axle 24. Each of the X frame members 22 and 23 is hollow and telescopingly receives therein a further X frame member 26 and an X frame member 27, respectively. The further X frame members 26 and 27 are supported for movement into and out of the respective X frame members 22 and 23. The distal end of the further X frame member 26 is secured via a connection 28 to the cross rail 13 at the left end (foot end) of the base frame illustrated in Figure 1 whereas the distal end of the further X frame member 27 is connected via a connection 29 to the cross rail 13 at the right end of the base frame 11.

[0070] The X frame 21 is similarly constructed and includes a pair of X frame members 32 and 33 which are connected together at about their midlength portions by the aforesaid axle 24. While the axle 24 is illustrated to extend laterally between the X frames 19 and 21, it is to be understood that separate axles 24 can, if desired, be employed (as shown in Figure 50). The X frame members 32 and 33 are hollow and telescopingly receive therein a further X frame member 36 telescopingly received in the X frame member 32 whereas a further X frame member 37 is telescopingly received in the X frame member 33. The distal end of the further X frame member 36 is connected via a connector 38 to the cross rail 13 at the foot end of the base frame 11 and the distal end of the further X frame member 37 is connected via a connector 39 to the cross rail 13 at the head end of the base frame 11. The X frame members 22, 26 extend parallel to the X frame members 32, 36 whereas the X frame members 23, 27 extend parallel to the X frame members 33, 37.

[0071] Referring to Figure 4, the cross rail 13 at the foot end of the base frame 11 is illustrated. To the cross rail 13 there is pivotally connected a pair of laterally spaced linkage members 41. In this particular embodiment, each of the linkage members 41 includes at the end thereof adjacent the cross rail 13 a bore 42 which encircles the cross rail 13 to facilitate the pivotal connection of each of the linkages 41 about the longitudinal axis of the cross rail 13. The ends of each of the linkages 41 remote from the cross rail 13 are connected to respective laterally spaced brackets 43 by means of a fastener 44. In this particular embodiment, a sleeve 46 extends between the respective brackets 43 and receives therein the respective fastener 44 to facilitate the connection of the linkages 41 to the brackets 43. The axle 24 also facilitates a connection of the respective brackets 43. Each of the brackets 43 includes a receptacle 47 into which is received a respective X frame member 23 and 33 as illustrated in Figure 1. In this particular embodiment, the axle 24 passes through an opening provided in each of the respective X frame members 23 and 33.

[0072] A first bracket 48 (Figure 4) is fixedly secured to the cross rail 13. A second bracket 49 is secured to a rod 51 that is connected to and extends between the respective brackets 43. In this particular embodiment, the rod 51 is connected to each bracket by a respective fastener 52. It is to be noted that there is a spacing between the axle 24 and the respective rods 46 and 51. The purpose of this spacing will become apparent below.

[0073] At least one linear actuator 53 (two, if desired to provide improved stability) is connected to and extends between the respective brackets 48 and 49. In this particular embodiment, the linear actuator 53

includes a hydraulic cylinder housing 54 fastened to the bracket 49, which cylinder housing 54 includes a reciprocal rod 56 having a piston (not illustrated) at one end thereof located within the cylinder housing 54. The distal end of the reciprocal rod 56 is connected in a conventional manner by a universal-like joint 55 to the bracket 48. That is, the universal joint allows pivotal movement about two orthogonally related axes. As will be evident from Figure 4, extension and retraction of the reciprocal rod 56 will facilitate movement of the brackets 43 about the axis of the rod 46. The end of the rod is lengthwise adjustable to accommodate tolerances encountered during production.

[0074] As is illustrated in Figure 5, the ends of the X frame members 22 and 32 remote from the base frame 11 are each pivotally secured to a cross rail 59 adjacent the head end of the litter frame 17 as at 57 and by respective connectors 58. The connectors 58 are each relatively movable with respect to the cross rail 59. In one embodiment (Figure 6), on the other hand, the ends of the X frame members 23 and 33 remote from the base frame 11 are connected by a hollow pivot tube 61 via connectors 62. Only one of the connectors 62 is illustrated in Figure 6, it being understood that the end of the X frame member 23 remote from the base frame 11 also has a connector 62 thereon. A slide bearing (not shown) can, if desired, be provided to allow longitudinal movement of the X frame member 33 along the litter rail 66. Alternatively, a timing rod 63 can be relatively rotatably received inside the pivot tube 61. Opposite ends of the timing rod 63 have a pinion gear 64 fastened thereto and rotatable therewith. The purpose of the timing rod and the pinion gear 64 oriented at the opposite ends thereof will become apparent below. If desired, the X frame members 23, 33 and the pivot tube 61

can be welded together to enhance the overall strength and resistance to twisting characteristics.

[0075] As is shown in Figure 5, the litter 16 comprises a litter frame 17 which consists of a pair of lengthwise extending side rails that are laterally spaced from one another, which side rails 66 are connected at the head end by the aforesaid cross rail 59, further cross rails 67 and other cross rails not illustrated. A housing 68 (see also Figure 6) is secured to the underside of each of the side rails 66 at a location spaced from the head ends thereof. Each housing 68 has an inwardly opening recess 69 therein, the openings in each of the housings 68 opposing one another. In one embodiment, the openings 69 each have a downwardly facing upper wall 71 to which is secured a toothed rack 72 extending lengthwise of each of the respective side rails 66. The teeth of each of the pinion gears 64 are configured to mesh with the teeth of the toothed rack 72. Since the pinion gears 64 are fixedly secured to the timing rod 63, the mating teeth on the pinion gear 64 and the rack 72 will prevent twisting of the elevating mechanism 18 as it raises and lowers the litter 16 relative to the base frame 11.

[0076] In this particular embodiment, the longitudinally extending side rails 66 of the litter frame 17 are hollow. Thus, the cross rails 59 and 67 as well as others not specifically described are secured by brackets to the exterior surface of each of the side rails 66. Several of the brackets 71 are illustrated in Figure 5.

[0077] A foot end lift handle mechanism 72 is illustrated in Figure 8 and consists of a pair of vertically spaced U shaped frame members 73 and 74. The legs of each of the U shaped frame members 73 and 74 are joined together by a bracket 76 (only one bracket being

illustrated in Figure 8), which bracket 76 is fastened to the respective legs by fasteners not illustrated. Each bracket 76 is telescoped inside of the foot end of the respective side rail 66 as illustrated in Figure 1. Further, the legs of the lower frame member 74 diverge away from the legs of the frame member 73 so that there is provided pairs of vertically spaced hand grip areas as at 77 and 78 on the respective frame members 73 and 74, respectively. Plural spacer brackets 79 are connected to the bight portions of each of the frame members 73 and 74 to maintain the vertical spacing between the grip areas 77 and 78. Fasteners (not illustrated) facilitate a connection of the brackets 76 to the interior of each of the respective side rails 66.

[0078] A battery mount 89 is secured to the foot end lift handle assembly 72, preferably to the underside of the assembly as show in Figures 47 and 48. The battery mount 89 includes a downwardly opening bayonet socket 90 having electrical contacts 94 exposed therein for connection to a properly configured battery 160 shown in broken lines. The manner in which the battery 160 connects to the electrical contacts 94 when the battery is in the broken line position shown in Figure 48 is conventional and, therefore, further discussion about this connection is believed unnecessary. The electrical contacts 94 on the battery mount 89 are connected to the control 158 as schematically shown in Figure 24. In order to connect the battery 160 into place in the battery mount 89, the battery is moved leftwardly from the Figure 47 disconnected inactive position to the Figure 48 connected and active position. The battery 160 in the installed position of Figure 48 is releasably locked in place and is capable of withstanding excessive acceleration forces that will occur during an accident to remain locked in place in the Figure 48 position.

[0079] One leg 81 of the frame member 73 includes a switch housing 82 fastened thereto by at least one fastener 83 (Figure 9). The switch housing 82 is located in an ergonomically advantageous position to the obvious grasping point of the user. An enlarged isometric view of the switch housing 82 is illustrated in Figure 10. The switch housing has a pair of manually engageable buttons 84 and 86 thereon. The manually engageable buttons 84 and 86 are shielded from above by a shroud 87 and are of a low profile membrane design so as to prevent inadvertent actuation of the buttons 84 and 86 by a patient lying on the upper surface of the litter 16. That is, the shroud 87 is oriented at the head end of the switch housing 82. The switch housing 82 includes an opening 88 extending therethrough and through which the leg 81 of the frame 73 extends. The fastener 83 extends through a hole in the leg 81 to facilitate a connection of the housing 82 to the leg 81 extending through the opening 88.

[0080] Similarly, the leg 91 of the frame member 74 includes a further switch housing 92, located in an ergonomically advantageous position to the obvious grasping point for the user, having an opening 98 extending therethrough and through which the leg 91 extends. A fastener 93 facilitates a connection of the switch housing 92 to the leg 91 that extends through the opening 98. The switch housing 92 includes a construction identical to the switch housing 82 illustrated in Figure 10 and it includes a pair of manually engageable buttons 84 and 86 which, as will be explained in more detail below, provide a redundant operation with respect to the buttons in the switch housing 82. The switch housing 92 also includes a shroud 97 similar to the shroud 87 and it is provided for the same purpose, namely, to shield the buttons 84, 86 from

inadvertent actuation by a patient lying on the litter 16. In addition to the safety shrouds 87 and 97 preventing inadvertent actuation of the push buttons 84 and 86, each of the push button switches 84, 86 have a dual switch closing feature requiring both switch contacts to be closed (see Figure 11) in order to effect the desired operation as will be explained in more detail below.

[0081] The bight section 99 of the frame member 74, particularly at the base of one of the spacers 79, there is provided a bracket 101 secured to the bight section by a fastener 102 (Figure 12). A manually engageable handle 103 is pivotally secured to the bracket 102 by a pivot axle 104. The handle includes a pair of arcuately spaced shoulders 106 and 107. A cable support member 108 is pivotally secured to the bracket 101 by a pivot axle 109. A cable, here a Bowden cable 111, is fastened as at 112 to the cable support 108 (at one end) while the other end is fastened to a valve actuation device which will be explained in more detail below. The cable 111 extends into and through the hollow interior of the frame member 74. The cable support member 108 has a pair of arcuately spaced shoulders 113 and 114 that operatively cooperate with the arcuate shoulders 106 and 107, respectively, as will be explained in more detail below. The handle 103 as illustrated in Figure 12, is in a stowed out of the way position. When it is desired to move the handle and use it for operation of the ambulance cot, it is shifted clockwise in its position from the position illustrated in Figure 12 to the position illustrated in Figure 13 at which time the shoulder 107 engages the shoulder 114 on the cable support member 108. When the handle 103 is further pivoted clockwise about the axle 104 to the position illustrated in Figure 14, the cable support member 108 will pivot about the axle 109 to effect a

pulling of the cable 111 to effect actuation of a valve structure that will be described in more detail below. A torsional spring 116 (only the ends of which are illustrated in Figures 12-14) serves to continually urge the handle 103 counterclockwise to the stowed position so that the shoulders 106 and 113 will engage one another.

[0082] Referring to Figure 5, and as stated above, there is provided a pair of longitudinally spaced brackets 71 on each of the side rails 66. Between laterally spaced ones of the brackets 71, there extends a respective cross rail 67. Referring to Figure 15, these cross rails 67 support a hydraulic assembly bracket 121. More specifically, the hydraulic assembly bracket 121 includes several ears 117 which operatively engage the respective cross rails 67 and from which ears is suspended the hydraulic assembly bracket 121. The hydraulic assembly bracket 121 is generally U shaped with the bight section forming a base upon which is mounted a variable speed electric motor 122, a hydraulic manifold plate 123 and a hydraulic pump 124. The hydraulic pump 124 has two outlets 126 and 127. The hydraulic outlets 126 and 127 are connected through hydraulic conduits 128, 129, respectively (Figure 4), to respective opposite ends of the hydraulic cylinder housing 54. In this particular embodiment, the cross rails 67 also provide a support for a seat section 130 (Figure 1) on the litter 16.

[0083] Referring to Figures 1 and 16, the further X frame members 26, 27, 36 and 37 are all connected through respective connectors 28, 29, 38 and 39 to a cross rail 13. Figure 16 illustrates a representative example of the connectors 28, 29, 38 and 39. That is, each connector includes a sleeve 118 that encircles the cross rail 13 and includes a stem 119 that is telescoped inside the interior of each of the respective further X frame members 26, 27, 36, 37. A bearing assembly 131 is

provided between the stem 119 and the interior surface of the further X frame members 26, 27, 36, 37. Thus during normal use, off center loads and flex in the aluminum frame members may cause some twisting in the geometry of the frame members which will cause a binding of the mechanism. In order to accommodate this twist, the bearing assembly 131 will facilitate a relative rotation between the sleeve 118 and the further X frame members 26, 27, 36, 37. The bearing assembly 131 becomes particularly important when the X frame members 22, 23, 32, 33 are not circular in cross section and the further X frame members 26, 27, 36, 37 are circular in cross section (as depicted in Figure 49). That is, a bushing 236 is fixedly positioned inside the non-circular X frame members 22, 23, 32, 33, which bushing 236 has a circular opening therethrough through which the further X frame members 26, 27, 36, 37 slidably extend. The end of the further X frame members 26, 27, 36, 37 remote from the base 11 have a further bushing 237 longitudinally slidably disposed in the X frame members 22, 23, 32, 33. The bushing 237 is relatively moveably secured to the respective further X frame members 26, 27, 36, 37, such as through the use of a rivet and washer mechanism 238 being secured to the further X frame members 26, 27, 36, 37 on opposite sides of the bushing 237 so as to prevent a relative longitudinal movement of the bushing 237 along the length of the further X frame members and so that the further X frame members can rotate about their respective longitudinal axes relative to the bushing 237.

HYDRAULIC CIRCUIT

[0084] A hydraulic circuit 132, illustrated in Figures 17-23, is included in the manifold plate 123 (Figure 15). It is to be understood that the pump 124 and the linear actuator 53 and the conduits carrying hydraulic fluid to the linear actuator 53 are preferably always filled with

hydraulic fluid. Further, the pump 124 is reversible and the electric motor 122 driving same is also reversible. As a result, there will be no delay in actuation of the linear actuator in response to an operation of the pump 124 by the electric motor 122. The output of the pump 124, in one direction of operation, will supply hydraulic fluid through a pilot operated check valve 133 to the outlet 126 connected through the hydraulic conduit 128 to the end of the cylinder housing 54 remote from the reciprocal rod 56. Operation of the pump 124 in the opposite direction will direct fluid through a poppet valve 134 having in parallel therewith an orifice or fluid throttle 136 and a two way poppet valve 137 to the outlet 127 which in turn is connected through a conduit 129 to the end of the cylinder housing 54 adjacent the reciprocal rod 56. The fluid controlling the pilot operated check valve 133 is delivered to it through a conduit 138 connected to the fluid path intermediate the poppet valve 134 and the pump 124. There is also provided a pressure relief operated check valve 139 connected at one end between the pilot operated check valve 133 and the pump 124 and, at the other end, to a tank or reservoir for the hydraulic fluid. Intermediate the pilot operated check valve 133 and the outlet 126, there is provided a fluid passageway 142 extending to a series connected pressure compensated flow controller 143, a spring controlled check valve 144 and a two way poppet valve 146 connected to the tank 141. The spring is sized in this check valve so as to provide a dampening against a surge of fluid when passively lowering. This prevents a lurch in the lowering action providing increased comfort to the patient during lowering. The passageway 142 includes a further passageway 147 connected through a spring biased check valve 148 to tank 141, on the one hand and through a passageway 149 to a

manual release valve 151 also connected to tank 141. The outlet 127 is connected through a passageway 152 to a spring biased check valve 153 connected to the tank 141, on the one hand, and through a passageway 154 to a series connected fluid throttle 156 and thence to a further manual release valve 157 connected to the tank 141.

[0085] The hydraulic circuit 132 is controlled by a control mechanism 158, which control mechanism is also schematically represented in Figures 24 and 25. A hydraulic fluid pressure monitoring mechanism 159 is connected to the outlet 126 and provides a signal indicative of the magnitude of the fluid pressure to the control mechanism 158. The battery 160 (Figures 47 and 48) on board the ambulance cot provides power to the control mechanism 158. The charged status of the battery 160 is linked to a display 161 on a user interface 162 mounted on the foot end lift handle assembly 72 near the battery mount 89, particularly between the spacer members 79. The user interface 162 also includes a mode switch (not illustrated) for allowing the user interface to display a multitude of different functions, one of which can be an hour meter indicative of the total elapsed time that the electrical motor 122 has been operated, such as "HH:MM", where H is hour and M is minute or in tenths of an hour such as "HH.H hours". Any other indication of total elapsed time from a set point is contemplated. In addition, it is also possible for the user interface to display the elapsed amount of time that the control 158 has been on, the elapsed amount of time a certain switch is activated, the elapsed amount of time certain valves have been actuated or the elapsed amount of time a certain pressure has been maintained on the system. These values may be combined to a suitable display to accurately determine the amount of wear that can be expected on the system. As a result, ambulance

attendants can more accurately determine what preventative maintenance is required based upon the aforesaid displays. Additionally, a symbol (preferably iconic) can be provided at pre-programmed interval(s) to indicate when service may be necessary.

[0086] The control mechanism 158 also receives signals from position sensors provided on the ambulance cot. More specifically, and referring to Figure 26, a cover 163 has been removed from the housing 68 to reveal the opening 69 inside the housing. A first transducer 164 is provided inside the opening 69, particularly at the foot end of the opening 69 whereas a second transducer 166 is oriented at the head end of the opening 69. These transducers 164 and 166 are, in this embodiment, Hall effect sensors which are used to indicate the low and high heights of the ambulance cot. Alternatively, proximity sensors or reed switches can be employed in place of the Hall effect sensors. These transducers are adjustably positioned in the opening 69 such that they detect a magnetic field of a magnet mounted, for example, on one end of the pivot tube 61 (Figure 5) or on the slide bearing thereat (not shown) and oriented on the outboard side of the pinion gear 64 or slide bearing located thereat. Thus, as the pinion gear 64 approaches either one of the transducers 164 or 166, the magnetic field of the magnet will saturate the respective transducer to create an appropriate signal to the control mechanism 158 that is indicative of the height position of the cot. The position of the transducers 164, 166 are variable lengthwise of the opening 69 so as to provide an ability to effect a height adjustment for the ambulance cot in both its collapsed and its uppermost position. A specific advantage of having a movable second transducer 166 is that the high height of the ambulance cot can be adjusted to provide a stopping point custom adjusted to a

specific ambulance for ease of loading the cot into the ambulance. A further transducer 167 is provided adjacent the second transducer 166 so as to cause an additional signal to be sent to the control mechanism 158. This additional signal is supplied as feedback to the control mechanism 158 to subsequently control motor speed to effect a smooth stop of the litter 16 in the uppermost position. Similarly, a further transducer 168 can be provided adjacent the first transducer 164 so as to cause a further signal in the form of feedback to be sent to the control mechanism 158 to effect a subsequent controlling of motor speed to effect a smooth stop of the litter 16 in the lowered position. This smooth stopping operation is provided for patient comfort.

[0087] The control mechanism 158 also receives signals indicative of the presence of the ambulance cot inside the ambulance. In the preferred embodiment and referring to Figure 27, an ambulance cot latching mechanism inside the ambulance includes a rod 169 that extends along one side of the ambulance cot and has adjacent its distal end 171 a bracket 172 which has a magnet 173 provided thereon. The magnet 173 becomes positioned adjacent a transducer (not shown) to send a signal to the control mechanism 158 to effect a total and complete deactivation of the hydraulic lift or lower operation capabilities of the hydraulic circuit. This transducer may optionally be the position transducer 164.

[0088] Figures 28-30 are a bottom view of the manifold plate 123 having mounted thereon the reversible electric motor 122 and the reversible pump 124. If desired, the motor 122 could be driven in one direction and a transmission utilized to effect a reverse operation of the pump 124. The release valves 151 and 157 are mounted on the manifold plate 123. The release valve 151 includes a reciprocal stem 174 which, when moved to the

right in the aforesaid figures, effects an opening of the valve to allow fluid flow to pass therethrough. Similarly, the release valve 157 has a stem 176 which, when moved to the right in the aforesaid drawing figures, also effects an opening of the valve 157 to allow hydraulic fluid to pass therethrough. Incrementally opening the valve will effect a variable flow through the valve, allowing variable drop rates of the litter. Additionally, the orifice 156 may be sized to control the drop rate of the base 11 when the litter 16 is supported by an attendant or plural attendants. A plate 177 is provided and has holes therethrough which receive the respective stems 174 and 176 therethrough so that an appropriate fastener 178 can effect a fastening of the respective stems 174 and 176 to the plate 177. The cable 111 is connected to the plate as at 179. The opposite end of the cable 111 is connected to the release handle mechanism illustrated in Figures 12-14.

[0089] In this particular embodiment, and referring to Figure 31, the release valves 151 and 157 each have a fluid chamber 181 therein into which hydraulic fluid directly from the outlet port 126 is fed through an inlet port 183. The valves 151 and 157 each have a reciprocal spool 184 therein, the movement of which is controlled by the tension applied to the stems 174, 176 by the cable 111. The spool 184 includes a land 186 having a valve seat surface 187 thereon which mates with a valve seat surface 188 provided on the body 189 of the release valve 151. A spring (not illustrated) serves to urge the valve seat surface 187 against the valve seat surface 188, especially when no fluid pressure is applied to the chamber 181. Once the fluid pressure inside the chamber 181 has been reduced to a desired level, tension applied to the cable 111 urging the spool 184 to the right (Figure 31) against the urging of the return spring, the

seat surface 187 will be separated from the seat surface 188 to allow fluid to flow from the inlet port 183 to an outlet port 191 and thence to tank 141. The purpose of the aforesaid construction of the valves 151 and 157 will facilitate it being necessary that the ambulance cot attendants lift the cot prior to activation of the manual release valves 151 and 157 so that the fluid pressure in the chamber 181 will be reduced to facilitate a rightward movement of the spool 184.

[0090] A conventional velocity fuse 192 (Figure 17) is provided in the inlet port to the end of the cylinder housing 54 of the linear actuator 53, particularly at the end thereof remote from the reciprocal rod 56. The velocity fuse can also be an integral component of the cylinder housing 54. This conventional velocity fuse is Model No. 8506 available from Vonberg Valve, Inc. of Rolling Meadows, Illinois. The purpose of the velocity fuse is to prevent a rapid lowering of the cot when there is a sudden loss of hydraulic pressure as in the case of a severed hydraulic hose, or accidental manual release with a patient on the cot. A check-valve 195 is provided in parallel to the velocity fuse in order to affect an increased speed of extending of the base. This allows the same or similar speed in powered, and manual mode such that the manual mode may be used in normal use to extend the base when unloading the cot from the ambulance.

WIRELESS DIAGNOSIS

[0091] The ambulance cot and load system electronics for facilitating a loading of the cot into an ambulance (see also WO 2004/064698, the subject matter of which is to be incorporated herein) contain the capability to interact with a handheld diagnostics tool over a wireless communication link. This tool allows manufacturing and maintenance personnel to perform basic configuration,

troubleshooting and complex diagnostic operations on both the cot and load system, while remaining free from physical cable attachment to either unit. An example of the functional descriptions for each of the elements involved in wireless diagnostics are set forth below.

WIRELESS DIAGNOSTIC TOOL

[0092] The handheld device or tool 300 (Figure 34) is self contained, and includes an antenna 301, a wireless transmitter and receiver that operate under the same basic protocol as the wireless link connecting the cot and load system during normal operation. Operations such as collecting and configuring control parameters and initiating simple or complex diagnostics tests are supported through this interface. By design, this handheld device is capable of four main modes of operation:

- Two-way active communication mode: The handheld device interacts with one other wireless-capable unit;
- Multi-way active communication mode: The handheld device interacts with two or more wireless-capable units;
- Passive "listen only" mode: The handheld device observes the communication activity which exists near one or more wireless-capable units without disrupting it; and
- Power and at least one of read from and write to an RFID tag described below (can also be included in two-way communication).

[0093] Two-way active communication allows the handheld device to interact directly and exclusively with one cot (or one load system) in order to provide streamlined communication during programming or troubleshooting phases. Multi-way communication allows the handheld device to participate in communications with

multiple other parties, and allows for more complex troubleshooting and diagnostics operations. For example, when a cot is docked in the load system and a handheld device is brought into proximity of the wireless communication field, it will be able to interact with both units to gather information or allow the user to invoke special tests to verify operation of the loading algorithm. *For two-way and multi-way modes, the wireless* diagnostic tool is capable of auto-detecting the proper mode in which to operate, which is based on the number of active participants it senses in the wireless communication field. The "listen only" mode is entered at the prompting of the user of the handheld device. This mode is passive in nature, and can be used to analyze communications coming from one unit (cot or load system), or multiple units which are in dialog with one another.

COT

[0094] The ambulance cot's electronic controller contains software components to support wireless diagnostics capabilities. This software functionality is capable of detecting the difference between a load system that is trying to communicate and a wireless handheld device that is trying to initiate a diagnostic session. As this determination is made, the cot is able to enter *into either a normal session with the load system,* a dedicated session with the handheld device (if no load system is present), or a three-way session that involves both the handheld device and the load system. In the latter case, the cot software allows normal operation of the loading sequence, while simultaneously supporting a specific set of diagnostics that are useful in troubleshooting the overall system.

LOAD SYSTEM

[0095] The load system's electronic controller is also capable of distinguishing between a basic communication session for loading and unloading, and a session which involves diagnostics operations. Using similar software components, the load system will participate in dedicated two-way communication with a handheld device, or allow the device to coexist during a load or unload operation with the cot being present. It is capable of detecting the difference between these various modes of operation, and react accordingly to provide the necessary functional behavior.

[0096] Figures 32 and 33 provide a further description of the software functionality used in the wireless control and diagnostics features. In Figure 33, the blocks entitled "Execute Configure Option" and "Transmit Wireless Response Message" include a read/write command to the RFID tag 302 (described below) when applicable in order to change the user statistics which may be coded on the RFID tag (Count of times programmer accessed, revision of software (if updated) etc).

[0097] Referring to Figure 34, beneath the seat section 130 there is provided a cot antenna 193. The load arm on the ambulance (see WO 2004/064698, here in Figure 34 the load arm 194) includes a load arm antenna 196. The two antennas 193 and 196 provide communication between the cot and the load system as well as communication with the handheld unit. The antennas also provide a controlled communication envelope to allow any cot to communicate with any load system or handheld trouble shooting device while not interfering with other load systems/cots in the area. In the preferred embodiment, the cot antenna 193 (Figure 34) consists of a loop of wire, as does the load antenna 196, and the tool antenna 301. It has been demonstrated that by passing a

modulated current through a loop of wire, an electromagnetic field is produced that can be received by other loops of wire in the environment. It is further known that this modulated "carrier" can be added to a digital signal, allowing the transmission of the digital signal on the modulated carrier. This type of communication is commonly referred to as an active inductive link.

[0098] The cot antenna 193, when configured as described, can additionally be used to remotely power and read a Radio Frequency Identification, or RFID tag 302 (Figure 34) mounted on the load arm 194 or a trolley 190 to which the load arm 194 is mounted. Thus, the cot can be configured to selectively communicate with one of the load system and the tool through an active, inductive link; and power and one of read from and write to the RFID tag 302. The RFID tag 302 is useful in implementing the in-ambulance/in fastener shut-off feature (shown and described in more detail below) as well as for identifying the device for use with other specific RFID readers specifically as follows:

code (1 byte)	product code (2 bytes)	CRC (1 byte)	Product specific RFID tag.....

More specifically:

Product name	Group name	Group (1 byte)	Product (2 bytes)	CRC
EMS_COT_LOADING_SYS	**Medical_Beds**	**2**	**1**	**0x11**

This information may be used to configure the hand-held tool, or provide contact information for service.

[0099] Additionally, other information may be at least one of written to and read from the RFID tag 302 including at least one of the following: Model, Serial number of the unit, Software revision, and Usage

statistics (which may include at least one of a count of different powered cots used with the system, and a count of times diagnostic tools accessed or changed the cot or load system(s)).

[00100] One exemplary way of establishing communication between the cot and the fastener system or between the cot or load system and the troubleshooting handheld device, as well as communication therebetween, is set forth below.

Preamble	P0	P1	D0	P2	D1	D2	P3	D3	D4	D5	D6	D7	P

	Preamble for signal detection
Px	Parity bits for error detection (Hamming Code)
P	Parity bit for extra check of data integrity
Dx	Data bits

PREAMBLE

[00101] The preamble is a special sequence to separate real data from the random noise. The preamble will contain special characters that are of 'illegal' length. This will cue the processor for a start of packet.

ERROR CORRECTION BITS

[00102] The packet uses four bits for error correction (P0, P1, P2, P3). The error correction technique employs a Hamming code algorithm that will allow the processor to correct one bit that has been misinterpreted. Assuming a moderate bit error rate, the odds of a single bit being corrupted are relatively high while the odds of multiple bits being corrupted is relatively very low. Allowing for 1 bit to be corrected will result in an overall

greater throughput at a relatively low cost of extra bits.

PARITY BIT

[00103] The parity bit is an extra check to ensure data integrity. The parity bit is calculated using basic even parity checking; the parity bit is set so that the number of 1s in the packet will always be an even number. The parity bit will allow detection of a second bit error; however, it will not be able to correct it.

DATA BITS

[00104] There are 8 data bits. The data bits communicate information about the cot status, an action request or diagnostic information. The most significant bit (D7) indicates whether the data is in diagnostic mode or not. If in diagnostic mode, remaining 7 bits indicate a diagnostic code or response. Otherwise each bit acts as an independent flag for a certain condition. If the transmission gets a response, the value is passed to the master controller; if no response is found, a value of '0'.

Table 1 - Example of possible Ambulance to Cot Data Bits

Bit	Name	Value = 1	Value = 0
7	Normal/Diagnostic	In Normal Mode	In Diagnostic Mode
6	Arm Load	Detect load on arm	No load detected
5	Arm Up	Load arm is fully up	Load arm not fully up
4	Arm Down	Load arm is fully down	Load arm not fully down
3	Proximity Switch	Prox switch closed	Prox switch open
2	TBD		
1	TBD		
0	Comm present	Comm is active	No Comm

Table 2 - Example of possible Cot to Ambulance Data Bits

Bit	Name	Value = 1	Value = 0
7	Normal/Diagnostic	In Normal Mode	In Diagnostic Mode
6	Cot load	Detect load on cot legs	No load detected
5	Cot legs up	Cot legs are fully up/not extended	legs not fully up
4	Cot legs down	Cot legs are fully down/extended	legs not fully down
3	Plus button	"+" button is pressed	"+" button not pressed
2	Minus button	"-" button is pressed	"-" button is not pressed
1	TBD		
0	Comm present	Comm is active	No Comm

Table 3 - Example

Event	A→C	C→A	Comment
Cot "-" button pressed, turns on	----	111001xx	Patient on Cot, Ambulance not yet in range No response from Ambulance, a value of zero is passed to the cot controller
Cot moved within range of Ambulance	10010xxx	111001xx	"-" button is still pressed Prox switch is not set, Arm not bearing load
Cot docked to prox switch	10011xxx	111001xx	"-" button is still pressed Prox switch is set, Arm not bearing load
Cot legs folding up, Cot drop slightly	11011xxx	110001xx	Arm starts to take weight, still down

Cot legs continue folding up	11001xxx	100001xx	Arm starts lifting up
Cot legs completely up	11001xxx	101001xx	Arm still lifting
Arm is all the Way up	11101xxx	101001xx	
Button is released Arm still up	11101xxx	101000xx	Waiting for cot to be pushed on

[00105] Further software may be provided for the in-ambulance/in-ambulance shut-off feature when used with an RFID tag 302. When used with the load system (to detect the RFID tag), the upper-level software diagram may look like that illustrated in Figure 59.

[00106] In operation, and referring to Figure 59, upon power-up, the cot attempts communication with the load system in order to detect if it is present. If communication (com) is present, it executes function according to a specific and separate load protocol. If not, the cot communication will switch to check for the RFID tag. If it is not present, the cot drives according to the normal cot protocol. If the cot sees the RFID tag, it will then check for the low Hall Effect (HE) sensor (to determine if the cot legs are retracted). Once fully retracted, the cot inhibits driving (up), and thus activates the in-ambulance/in fastener shut-off feature. The advantages of looking for the Low HE sensor is allowing function of the cot while docked, but not fully loaded. It is reasonably assumed that once the cot is fully retracted, it is locked into the load system, and will be pushed into the ambulance. A further advantage is that normal drive function is returned by simply manually dropping the base such that the low HE sensor is no longer activated, thus allowing normal

driving of the cot in the specific instance of a loss of load communication.

[00107] Driving normally is described in Figure 25, but Figures 60 and 61 illustrate the decision tree for the software when the RFID tag 302 is present in the overall system.

RETRACTABLE HEAD SECTION AND LATCH

[00108] By comparing Figures 35 and 36, it will be noted that the ambulance cot 10 includes a retractable head section 197. This feature can be provided on a manual lift cot or a power lift cot. In the power lift environment, and as is illustrated in Figure 37, the retractable head section 197 is generally U shaped, namely, having a pair of parallel legs 198 and 199 connected by a pair of brackets 202 to a head rail 203. A cross brace 200 (Figure 62) also connects the brackets 202. A tubular cross rail 201 is rotatably mounted to the cross brace 200. The legs 198 and 199 are configured to be slidably received by, into the interior of (shown), next to, or below the respective longitudinally extending side rails 66 on the cot 10. The handles 210 are fixed to the cross rail 201 for pivotal movement with the cross rail 201 about an axis corresponding to or parallel to the axis of the cross rail 201 in order to facilitate the movement of a pin 204 projecting from each handle 210 about an axis of rotation defined by or parallel to the axis of the cross rail 201. The pin 204 extends through an arcuate slot 215 in the bracket 202. The handles 210 are affixed such that actuation of one handle 210 effects a rotation of cross rail 201 and subsequent actuation of the other handle 210 so that the head section may be released by the actuation of a single handle 210. The pin 204 is connected by a linkage 206 to a latch mechanism 207 on each leg 198 and 199. The latch mechanism 207 is illustrated in more detail in Figures 42

and 43. More specifically, the latch mechanism 207 includes a housing 208 in which a ramp mechanism 209 is slidably disposed lengthwise of the housing 208. The ramp mechanism 209 includes a ramp surface 211 against which a pin 212 rests. The pin 212 includes a latch pin 213 that is configured to move laterally into and out of the housing 208. The position located outside the housing is illustrated in Figures 37 and 42. A spring (not illustrated) urges the pin 212 against the ramp surface 211. When the handle 210 is rotated about the axis of rotation corresponding to or parallel to the longitudinal axis of the cross rail 201, the pin 204 is moved from the position illustrated in Figure 39 to the position illustrated in Figure 40 to cause a leftward movement of the linkage 206 in each leg 198 and 199 to cause the pin 212 to shift in its position illustrated in Figure 42 to the position illustrated in Figure 43, namely, a position wherein the latch pin 212 has been retracted laterally into the housing 208 of the latch mechanism 207. A slot 205 in the link 206 is provided which allows independent, passive engagement of the latch pins 213 when the handles 210 are released. This is illustrated in Figure 41. A plurality of holes 214 are provided along the length of the side rails 66 and are configured to receive therein the latch pin 213 when in the extended position thereof as shown in Figure 37. These holes are located such that access to them is not possible, i.e., under a bumper provided on the exterior of the litter rail 66. This is done for protection against inadvertent release, foreign matter, or potential pinching point. When the latch pin is received in an associated hole 214 provided in the side rail 66, the retractable head section will be physically locked to the cot in either the retracted position (Figure 35) or the extended position (Figure 36).

[00109] In a further embodiment of the retractable head section 197, shown in Figures 57-58 and 62, the handles 210 are capable of being locked against rotation about the cross rail 201 to prevent release of the latch mechanism 207. Referring to Figure 57, the safety bar 218 is fixed to a mounting bracket 260 that is pivotally mounted to the cross brace 200. The mounting bracket 260 is biased into an at rest position by a torsion spring 261 mounted on the cross brace 200 and engaging the mounting bracket 260 and the bracket 202. Reference is made to pending patent application serial no. 10/850 144, wherein the safety bar 218 can be rotated upwardly in a counterclockwise fashion, by an attendant, toward the head end of the ambulance cot to clear a hook mounted at the mouth of an ambulance cargo area. In the instant invention, the mounting bracket 260 is configured so that the safety bar 218 can also be rotated upwardly in a clockwise fashion toward the interior of the cot, and function as a "latch disabler" to prevent release of the latch mechanism 207.

[00110] A head portion 262 of the mounting bracket 260 is received on the cross brace 200. The head portion 262 is eccentrically configured about the cross brace 200 such that it includes a ramp portion 264 that extends toward the bracket 202 joining the leg 198 to the head rail 203. The mounting bracket 260 is arranged underneath a shaft 266 formed in the bracket 202. The shaft 266 is formed to extend into a central portion of the arcuate slot 215 that receives the pin 204 when the handle 210 is actuated. The shaft 266 is configured to received a pin 268 surrounded by a compression spring 270. The pin 268 and spring 270 are arranged in the shaft 266 so that the pin is biased out of the arcuate slot 215 by the spring 270. The pin 268 is held within

the shaft 266 by the head portion 262 of the mounting bracket 260.

[00111] In Figures 57-58, the pin 204 is shown in the at rest position, that is wherein the handles 210 are not actuated. In order for the handles 210 to be actuated, the pin 204 must travel along the arcuate slot 215. During certain stages of transport, it is desirable to prevent the retractable head section 197 from changing its status from extended to retracted or vice versa. Therefore, it would be advantageous to prevent the inadvertent actuation of the handles 210. This can be accomplished by preventing the travel of the pin 204 through the arcuate slot 215, such as by pushing the pin 268 into the slot 215 to block the travel of the pin 204.

[00112] Referring to Figure 58, the safety bar 218 has been rotated clockwise about the cross brace 200. As the safety bar 218 rotates from the position shown in Figure 57, the pin 268 rides along the ramp portion 264 of the mounting bracket 260. The ramp portion 264 is eccentrically configured, so that as the mounting bracket 260 rotates about the cross brace 200, the radius of the head portion 262 increases, forcing the pin 268 through the shaft 266 and into a blocking position in the arcuate slot 215 as when the safety bar slides over an existing cot fastening mechanism in an ambulance. The safety bar 218 can rotate so that the pin 268 blocks the arcuate slot 215, preventing the handles 210 from being actuated. Full engagement of the pin 268 occurs when the pin 268 reaches an end 269 of the ramp 264. This occurs prior to a stop 272 of the mounting bracket 260 abutting the shaft 266, which prevents further rotation of the safety bar 218. The torsion springs 261 are mounted one on each side of the safety bar 218, and act in torsion in opposing directions about cross brace 200, urging the brackets 260 and the safety bar 218 to a downward,

neutral position, whereby the latch disabler is disengaged.

[00113] Referring now to Figures 63–64, the retractable head section 197 is configured to engage a portion of a cot fastening mechanism or "antler" system 276 configured for mounting to the floor of the cargo area of an ambulance. The antler system 276 includes a center yoke 278 and a forward yoke 280. Both yokes 278, 280 are mounted to the ambulance cargo area floor, with a centerline of the antler system 276 aligned in the fore-aft direction of the ambulance.

[00114] The center yoke 278 is formed of two rods 282, 283 arranged as mirror images about the centerline of the antler system 276. Each rod 282, 283 includes a longitudinal segment 284, 285 and an outwardly divergent segment 286, 287, each outwardly divergent segment rising to a rearwardly directed hook or "ear" 288, 289.

[00115] The forward yoke 280 includes a central segment 290 secured to the ambulance cargo floor and two outwardly divergent arms 291, 292. The arms each terminate in an "ear" 293, 294 that is joined with a respective ear 288, 289 of the center yoke 278.

[00116] As the ambulance cot 10 is rolled into the ambulance cargo area head end first, as shown by the arrow in Figure 63, the safety bar 218 contacts the center yoke 278. As the cot 10 is rolled further, the center yoke 278 forces the safety bar 218 rearwardly until the safety bar 218 rides on top of the longitudinal segments 284, 285 of the rods 282, 283 of the center yoke 278. Again referring to Figure 58, the latch disabler is activated prior to the stop 272 reaching the shaft 266. This enables use of the cot 10 with an antler system having a lower profile, while still activating the latch disabler. With the safety bar 218 in the rotated position of Figure 64, the latch disabler is activated,

thereby locking the retractable head section 197 in the extended position. The latch disabler will remain activated until the ambulance cot 10 is removed from the antler system 276. As the ambulance cot 10 is pushed further forward, the fixed wheels 216 roll between the ears 288, 289 and 293, 294 of the center and forward yokes 278, 280 and the into the antler system 276.

[00117] It is to be noted that the longitudinal axis of the side rails 66 are inclined to the horizontal at an angle α (see Figure 35) that is in the range of 1 to 10°. In this embodiment, the preferred angle is in the range of 2 to 3°. Thus, when the retractable head section 197 is retracted, the load wheels 216 on the retractable frame of the head section 197 are lifted from the ground surface 217 thereby enabling the cot to roll in any direction on the four castered wheels 14. This is referred to as the "no steer" condition. When the retractable head section 197 is extended to the position illustrated in Figure 36, the load wheels 216 will engage the support surface 217 to provide a steering effect for the cot as it is moved over the surface 217 (a "steer" condition). In this particular embodiment, the load wheels 216 are each rotatable about a fixed horizontal axis of rotation. That is, the wheels 216 are not supported in a castered manner. The head section 197 must be in the extended position of Figure 36 in order to be steered into the ambulance for engagement with the antler system 276.

FOLDED SAFETY BAR

[00118] As is illustrated in Figure 37, the retractable head section 197 includes a safety bar 218. The safety bar is configured to operatively engage a safety hook provided on the floor surface of a cargo area of an ambulance to prevent the cot from rolling completely out of the ambulance without an attendant being there to

handle the head end of the cot. Reference is to be made to pending U.S. Patent Application Serial No. 10/850 144, filed May 20, 2004, the subject matter of which is to be incorporated herein by reference. As is illustrated in Figures 44-46, a modified safety bar 218A can be provided which is foldable between the folded position illustrated in Figure 45 and an unfolded position illustrated in Figure 46. That is, the safety bar 218A includes two sections 219 and 221 interconnected by a pivot axle 222. The safety bar sections 219 and 221 are approximately of the same length so that the pivot axle 222 is oriented at the midlength portion of the extended handle as is illustrated in Figure 46. Releasable locking pins 223 are provided to lock the handle sections 219 and 221 in the respective folded position (Figure 45) and the unfolded position (Figure 46). A push button release or removable pin or other means of release (not illustrated) is provided for facilitating an activation of the locking pins to unlock them and facilitate relative movement between the handle sections 219 and 221.

ACCESSORIES

[00119] Figures 50-56 illustrate two accessories that can, if desired, be incorporated on the ambulance cot 10. The first accessory is depicted in Figures 50-51 and is a hook 239 oriented within the cot perimeter and which, specifically, is secured to the underside of the raisable and lowerable fowler 241 on the ambulance cot 10. The hook 239 consists of a sheet of material formed into a J with the stem of the J being secured to a cross rail 242 on the underside of the fowler 241 and the hook part 243 of the J facing toward the head end (left end) of the cot as depicted in Figures 50-51. The hook 239 facilitates the hanging of various articles therefrom while the cot is in use.

[00120] The second accessory is depicted in Figures 52-56 and is a collapsible pouch 244 secured to and extending between the legs 198, 199 of the head section 197 as well as to and extending between the cross rail 201 on the head section and the cross rail 59 (Figure 5) on the litter frame 17. As is shown in Figure 54, the pouch 244 consists of a planar sheet of fabric 237 to which are sewn plural fasteners 247 and 248 at spaced locations around the perimeter of the fabric sheet 246. The fasteners 247 are looped around the cross rails 59 and 201 while the fasteners 248 are looped around the laterally space legs 198 on the head section. When the head section 197 is in the extended position shown in Figure 52 and 53, the fabric sheet 246 is stretched between the longitudinally spaced cross rails 59 and 201 and laterally spaced legs 198 so as to provide a support surface 249. When the head section 197 is retracted to the position illustrated in Figures 55 and 56, the cross rails 59 and 201 become closely adjacent one another and the fabric sheet 246 is collapsed in an accordion style therebetween.

OPERATION

[00121] While the operative characteristics of the ambulance cot will be apparent to those skilled in the art upon reading the above set forth description and referring to the accompanying drawings, a discussion of the operational characteristics of the ambulance cot are set forth below for convenience.

[00122] When the ambulance cot is in the fully collapsed position, and referring to Figures 4 and 7, an extension of the linear actuator 53 will cause a clockwise (Figure 7) rotation of the bracket 43 about the axis of the fastener 44, the linear actuator being extended in the direction of the arrow 224. The position of the fastener 44 (Figure 4) is determined by the fixed

length linkage members 41. As a result of this geometry, the amount of force in the direction of the arrow 224 is optimal and effects a rapid lifting of the litter 16 from the positions illustrated in Figures 3 and 4 through the mid-height position illustrated in Figure 2 to the full height position of the litter illustrated in Figure 1. As the brackets 43 are lifted with continued extension of the linear actuator 53, the further X frame members 32, 33, 36 and 37 will telescope outwardly to accommodate the changing height of the frame members 22 and 23 from the base 11. In this particular embodiment, the pivot axle 24 for the two brackets 43 extend through the respective X frame members 22, 23 and 32, 33. As a result, it is necessary to provide an elongate slot in each of the further X frame members 26, 27 and 36, 37 in order to accommodate the presence of the pivot axle 24. It is to be recognized that a placement of the pivot axle 24 can be oriented at a location on the bracket 43 which will make it unnecessary to provide an axle receiving hole in each of the X frame members 23 and 33 as well as the elongate slots in the further X frame members 27 and 37. This provides an advantage of increased strength and stiffness of the base. When the litter 16 is lowered to the position illustrated in Figures 3 and 4, mounts 226 (Figure 1) will operatively engage a cross rail provided on the underside of the litter 16 and additional mounts 227 will rest on the cross rail 13 on the base. The mounts 226 and 227 are oriented so that they are not readily accessible by attendants in the region of the ambulance cot and, therefore, pinching issues are avoided.

[00123] Referring to Figure 11, each push button switch 84, 86 on the foot end lift handle assembly 72 requires two sets of switch contacts to be engaged in order to effect the desired command. That is, the set of contacts

228, 229 must both be closed in order to effect, for example, a retraction of the reciprocal rod 56 into the cylinder housing 54. Similarly, the two sets of contacts 231 and 232 of the switch 86 will effect an extension of the reciprocal rod 56 from the cylinder housing 54.

[00124] Turning now to Figures 17-25, the hydraulic circuit operation will now be described. Assuming the ambulance cot is in an ambulance and is now in the process of being removed from the ambulance, it is necessary to deploy the base from the position illustrated in Figure 3 to the position illustrated in Figure 1 and as taught in WO 2004/064698. Normally, the control 158 is in what is referred to as the "sleep" mode. Once a command is presented, such as by depressing the switch 86 to close the contacts 231 and 232, such action is noted by the control 158 to effect a powering up of the circuit to effect an opening of the valve 137 (Valve A) to shift the valve from its Figure 17 position to the Figure 18 position. The control will also make inquiry concerning whether the high top sensors 166 and 167 have been detected (see Figure 25) and, if not, the electric motor 122 is ramped in to effect a driving of the hydraulic pump 124. As soon as the motor reaches its maximum speed, the motor is continued to operate driving the pump at maximum speed until the sensor 167 is detected at which time the speed of the motor is ramped down or gradually slowed until the high top sensor 166 is detected, at which time the motor is brought to a stop. If the contacts 231 and 232 remain closed, the motor will remain stopped until the button 86 has been released by the attendant. Rapid uncontrolled deployment of the base from the Figure 3 position to the Figure 1 position is prevented by the orifice 136 in the valve 134 (Valve F). The attendant can thereafter "jog" the litter further upwardly by pressing the switch. In this case, the

controller will activate the motor for a short interval of time, allowing incremental upward movement of the litter.

[00125] Figure 19 illustrates a lowering of the litter from the Figure 1 position toward the Figure 3 position. In this instance, the switch 84 is actuated to close the contacts 228 and 229 to cause an opening of the valve 146 (Valve B). It will be noted that fluid flows out of the closed end of the linear actuator 53 through the pressure compensated flow control valve 143, through the check valve 144, through the opened Valve B to tank 141. The hydraulic fluid enters the rod end of the linear actuator 53 by sucking same out of the tank 141 through a check valve 153. In this particular situation, operation of the motor 122 is not required and hence is not activated. If the litter of the ambulance cot is lifted (no weight on the base of the ambulance cot), the pressure switch 159 will detect the lifting by reason of a reduced pressure and as long as the switch 84 and the contacts 228 and 229 thereof remain closed, the motor 122 will be activated and driven in the opposite direction of rotation to effect a rapid driving of fluid into the rod end of the linear actuator 53 to rapidly collapse the cot. Prior to this occurring, however, the Valve B will be returned to its initial position illustrated in Figure 17 as will Valve A. Alternatively, a separate switch (not shown) can be provided for effecting the same rapid collapse of the cot. Since less hydraulic fluid is required in the rod end of the linear actuator 53 by reason of the presence of the reciprocal rod 56 than is required at the opposite end of the cylinder housing 54, excess fluid will need to be bled from the closed end of the cylinder housing and this is accomplished through the high pressure side of the pump feeding a pressurized signal to open the check valve 133 and the check valve

139 to facilitate a bleeding of some of the hydraulic fluid to tank during the time that the base frame 11 is rapidly raised by the hydraulic circuit. Once the low position sensor is detected, the speed of the motor is gradually reduced until the lowermost sensor 164 is detected at which time the motor is brought to a halt. If the push button switch 84 remains activated, the motor will remain stopped until the attendant releases the manual engagement of the button 84. The attendant can thereafter "jog" the litter further downwardly by pressing the switch. In this case, the controller will activate the motor for a short interval of time, allowing incremental downward movement of the litter.

[00126] The operative characteristics illustrated in Figure 21 are similar to those depicted in Figure 18. Even when the motor 122 is activated to drive the pump 124, the orifice or throttle 136 limits the amount of fluid that can be driven so that the base unit does not uncontrollably fall away from the litter when it is being lifted by the ambulance attendants.

[00127] In the situation where there is a loss of electrical function, it must be possible to operate the ambulance cot manually. In addition, a weep valve 233 is provided at the rod end of the cylinder housing 54 to cause a pressure relief to occur when the rod is fully extended. That is, hydraulic fluid inside the cylinder housing 54 will communicate with the outlet 127 to limit the pressure buildup inside the cylinder housing 54. In view of the construction of the valves 151 and 157, with weight on the cot 10, the handle 103 and the valve 157 are allowed to operate, as Figure 12-14 and Figure 29 indicate. Since the pressure is high in the chamber 181 of the valve 151, the valve 151 will not shift (as shown in Figure 29) in response to an operative movement of the handle 103 and the litter 16 of the cot 10 will not

lower. On the other hand, when weight on the litter 16 is removed by the attendant or plural attendants lifting the litter 16 away from the base frame 11, the hydraulic pressure in the chamber 181 of the valve 151 is reduced to facilitate an easy movement of the land 186 and the valve seat surface 187 thereon (Figure 31) away from the valve seat surface 188 in order to facilitate the operation of the valve 151 simultaneously with the valve 157 (Figures 28-30, particularly Figure 30). That is, fluid flows from the closed end of the linear actuator 53 to tank through the valve 151 whereas hydraulic fluid is siphoned from the tank 141 into the rod end of the linear actuator 53 to effect a lowering of the litter 16 relative to the base frame 11. Similarly, and assuming that electrical function has still been disrupted and it is desired to deploy the base from the Figure 3 position to the Figure 1 position, the attendants will need to lift the cot while simultaneously operating the handle 103 causing the weight of the base frame 11 to effect a drawing of fluid from the tank into the closed end of the linear actuator 53 while the hydraulic fluid in the rod end of the linear actuator 53 extends through the open valve 157 to tank.

[00128] Although particular preferred embodiments of the invention have been disclosed in detail for illustrative purposes, it will be recognized that variations or modifications of the disclosed apparatus, including the rearrangement of parts, lie within the scope of the present invention.

CLAIMS:

1. An ambulance cot, comprising:

a base frame;

a litter frame; and

an X-frame support mechanism interconnecting said base frame and said litter frame and being configured to support said litter frame in one of a plurality of positions relative to said base frame, said support mechanism including at least one pair of frame members pivotally secured to each other proximate the mid-length thereof, said frame members each having opposite ends respectively secured to one of said base frame and said litter frame, said at least one of said pair of frame members having a first mount oriented between said mid-length thereof and said base frame, said at least one of said pair of frame members having a second mount oriented between said mid-length thereof and said litter frame, said first and second mounts being configured to respectively engage said litter frame and said base frame in response to said litter frame becoming proximate said base frame; and

wherein said litter frame has longitudinally extending side rails and at least one first crosswise extending member interconnecting said side rails of said litter frame, said first mount being oriented in a path of movement of said first crosswise extending member as said litter frame becomes proximate said base frame so that said first crosswise extending member engages and rests upon said first mount, and wherein said base frame has longitudinally extending side rails and at least one second crosswise extending member interconnecting said side rails of said base frame and being oriented in a path of movement of said second mount as said litter frame becomes proximate said base frame so that said

second mount engages and rests upon said at least one second crosswise extending member.

2. The ambulance cot according to claim 1, wherein said first and second mounts each engage respective ones of said at least one first and second crosswise extending members between the respective said side rails of said litter frame and said base frame.

3. An ambulance cot, comprising:

a base frame;

a litter frame; and

an X-frame support mechanism interconnecting said base frame and said litter frame and being configured to support said litter frame in one of a plurality of positions relative to said base frame, said support mechanism including at least one pair of frame members pivotally secured to each other proximate the mid-length thereof, said at least one pair of frame members each having opposite ends respectively secured to one of said base frame and said litter frame, at least one of said pair of frame members having a first mount oriented between said mid-length thereof and said litter frame, said first mount being configured to engage said base frame in response to said litter frame becoming proximate said base frame; and

wherein said base frame has longitudinally extending side rails and at least one crosswise extending member interconnecting said side rails and being oriented in a path of movement of said first mount as said litter frame becomes proximate said base frame so that said first mount engages and rests upon said at least one crosswise extending member.

4. The ambulance cot according to claim 3, wherein said first mount engages said at least one crosswise extending member between the respective said side rails of said base frame.

5. An ambulance cot, comprising:

a base frame;

a litter frame; and

an X-frame support mechanism interconnecting said base frame and said litter frame and being configured to support said litter frame in one of a plurality of positions relative to said base frame, said support mechanism including at least one pair of frame members pivotally secured to each other proximate the mid-length thereof, said at least one pair of frame members each having opposite ends respectively secured to one of said base frame and said litter frame, at least one of said pair of frame members having a first mount oriented between said mid-length thereof and said base frame, said first mount being configured to engage said litter frame in response to said litter frame becoming proximate said base frame; and

wherein said litter frame has longitudinally extending side rails and at least one crosswise extending member interconnecting said side rails, said first mount being oriented in a path of movement of said at least one crosswise extending member as said litter frame becomes proximate said base frame so that said at least one crosswise extending member engages and rests upon said first mount.

6. The ambulance cot according to claim 5, wherein said first mount engages said at least one crosswise extending

member between the respective said side rails of said litter frame.

7. An elongate ambulance cot having a head end and a foot end, comprising:

a base frame having a first lateral width;

a litter frame having a second lateral width and a manually engageable handle adjacent one end configured to facilitate a manual lifting of said one end and a set of load wheels adjacent an opposite end; and

an X-frame support mechanism having a third lateral width less than said first and second widths, said support mechanism interconnecting said base frame and said litter frame and being configured to support said litter frame in one of a plurality of positions relative to said base frame, said support mechanism including at least one pair of frame members pivotally secured to each other proximate the mid-length thereof, said frame members each having opposite ends respectively secured to one of said base frame and said litter frame, said at least one of said pair of frame members having a first mount oriented between said mid-length thereof and said base frame, said at least one of said pair of frame members having a second mount oriented between said mid-length thereof and said litter frame, said first and second mounts being configured to respectively engage said litter frame and said base frame in response to said litter frame becoming proximate said base frame;

said litter frame having longitudinally extending side rails and at least one first crosswise extending member on at least one of said side rails of said litter frame, said first mount being oriented in a path of movement of said at least one first crosswise extending member as said litter frame

becomes proximate said base frame so that said at least one first crosswise extending member engages and rests upon said first mount, and wherein said base frame has longitudinally extending side rails and at least one second crosswise extending member on at least one of said side rails of said base frame and being oriented in a path of movement of said second mount as said litter frame becomes proximate said base frame so that said second mount engages and rests upon said at least one second crosswise extending member.

8. The ambulance cot according to claim 7, wherein said first and second mounts each engage respective ones of said at least one first and second crosswise extending members between the respective said side rails of said litter frame and said base frame.

9. An elongate ambulance cot having a head end and a foot end, comprising:

a base frame having a first lateral width;

a litter frame having a second lateral width and a manually engageable handle adjacent one end configured to facilitate a manual lifting of said one end and a set of load wheels adjacent an opposite end; and

an X-frame support mechanism having a third lateral width less than said first and second widths, said support mechanism interconnecting said base frame and said litter frame and being configured to support said litter frame in one of a plurality of positions relative to said base frame, said support mechanism including at least one pair of frame members pivotally secured to each other proximate the mid-length thereof, said at least one pair of frame members each having opposite ends respectively secured to one of said base frame

and said litter frame, at least one of said pair of frame members having a first mount oriented between said mid-length thereof and said base frame, said first mount being configured to engage said litter frame in response to said litter frame becoming proximate said base frame;

said litter frame having longitudinally extending side rails and at least one crosswise extending member on at least one of said side rails, said first mount being oriented in a path of movement of said at least one crosswise extending member as said litter frame becomes proximate said base frame so that said one crosswise extending member engages and rests upon said first mount.

10. The ambulance cot according to claim 9, wherein said first mount engages said at least one crosswise extending member between the respective said side rails of said litter frame.

11. An elongate ambulance cot having a head end and a foot end, comprising:

a base frame having a first lateral width;

a litter frame having a second lateral width and a manually engageable handle adjacent one end configured to facilitate a manual lifting of said one end and a set of load wheels adjacent an opposite end; and

an X-frame support mechanism having a third lateral width less than said first and second widths, said support mechanism interconnecting said base frame and said litter frame and being configured to support said litter frame in one of a plurality of positions relative to said base frame, said support mechanism including at least one pair of frame members pivotally secured to each other proximate the mid-length

thereof, said at least one pair of frame members each having opposite ends respectively secured to one of said base frame and said litter frame, at least one of said pair of frame members having a first mount oriented between said mid-length thereof and said litter frame, said first mount being configured to engage said base frame in response to said litter frame becoming proximate said base frame;

said base frame having longitudinally extending side rails and at least one crosswise extending member on at least one of said side rails and being oriented in a path of movement of said first mount as said litter frame becomes proximate said base frame so that said first mount engages and rests upon said at least one crosswise extending member.

12. The ambulance cot according to claim 11, wherein said first mount engages said at least one crosswise extending member between the respective said side rails of said base frame.

Application number / Numéro de demande: 2784816

Figures: _____

Pages: 1/61 TO 9/61 - 11/61 TO 13/61
15/61 TO 21/61 - 24/61 TO 29/61
33/61 TO 55/61 - 59/61 TO 61/61

Unscannable items received with this application
(Request original documents in File Prep. Section on the 10th floor)

Documents reçu avec cette demande ne pouvant être balayés
(Commander les documents originaux dans la section de la préparation des dossiers au 10ième étage)

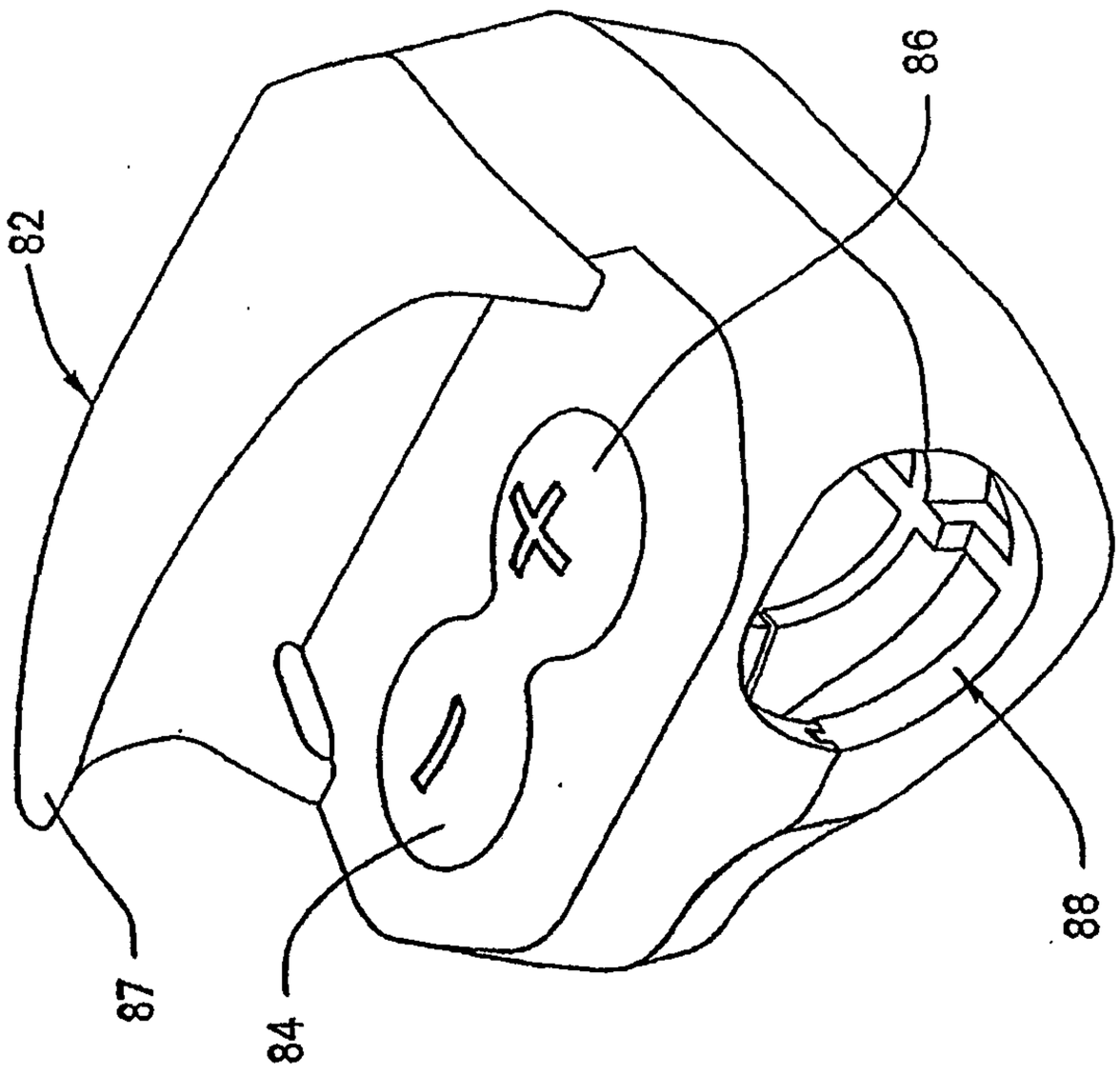


FIG. 10

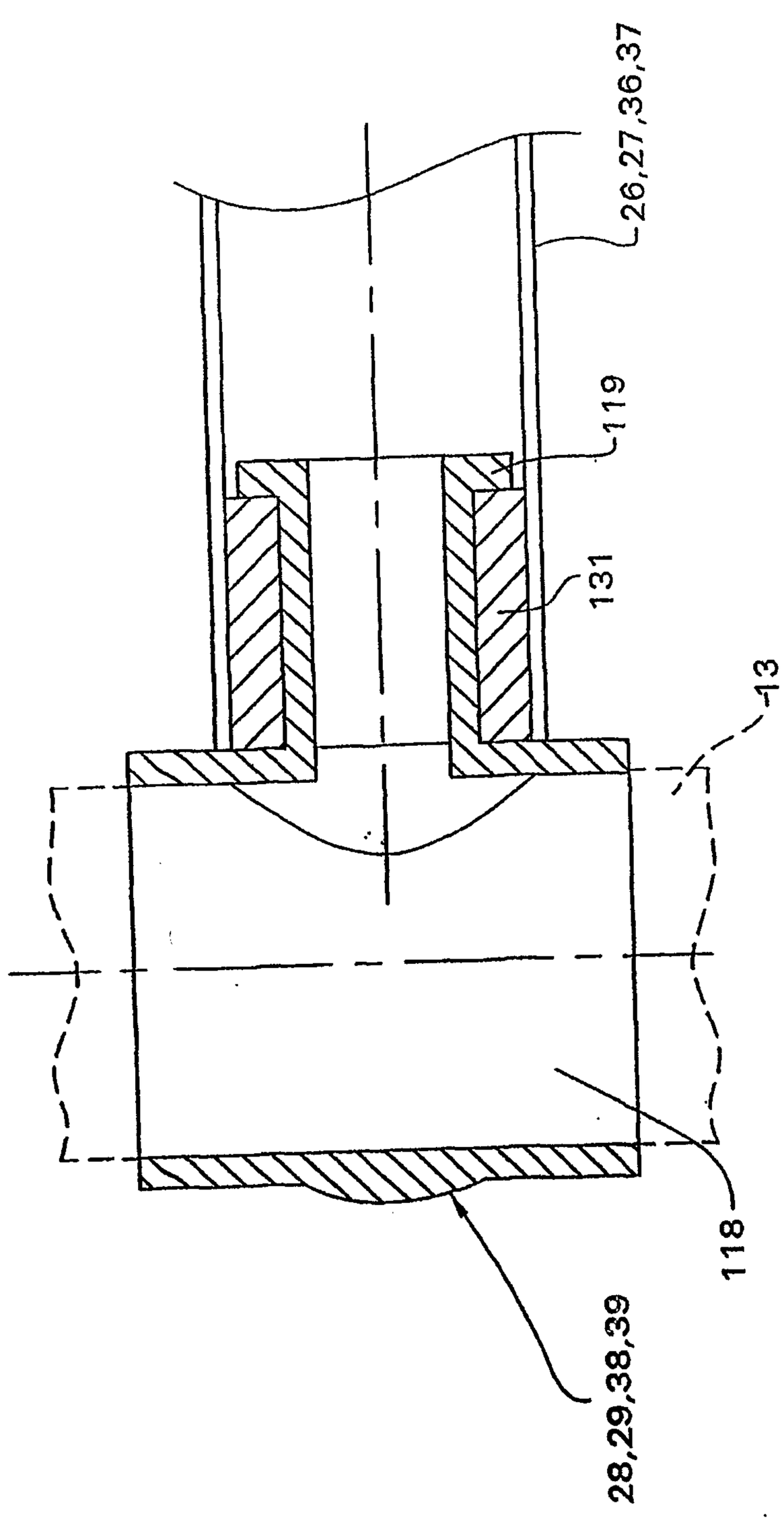


FIG. 16

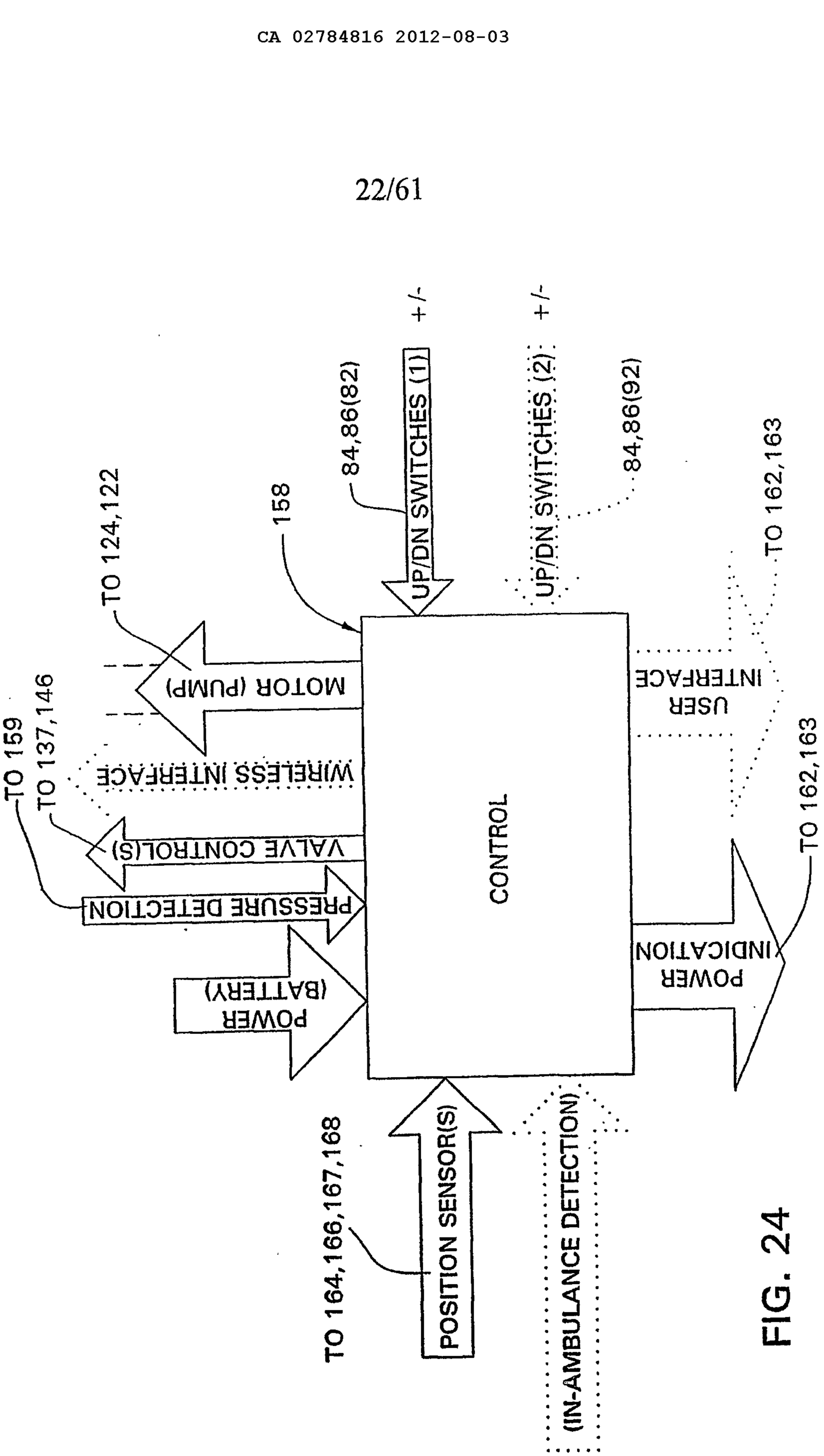

84,86(82)
+/-
UP/DN SWITCHES (1)
84,86(92)
+/-
UP/DN SWITCHES (2)
TO 162,163
158
TO 124,122
MOTOR (PUMP)
WIRELESS INTERFACE
TO 159
TO 137,146
VALVE CONTROL(S)
PRESSURE DETECTION
POWER (BATTERY)
CONTROL
USER INTERFACE
POWER INDICATION
TO 162,163
TO 164,166,167,168
POSITION SENSOR(S)
(IN-AMBULANCE DETECTION)

FIG. 24

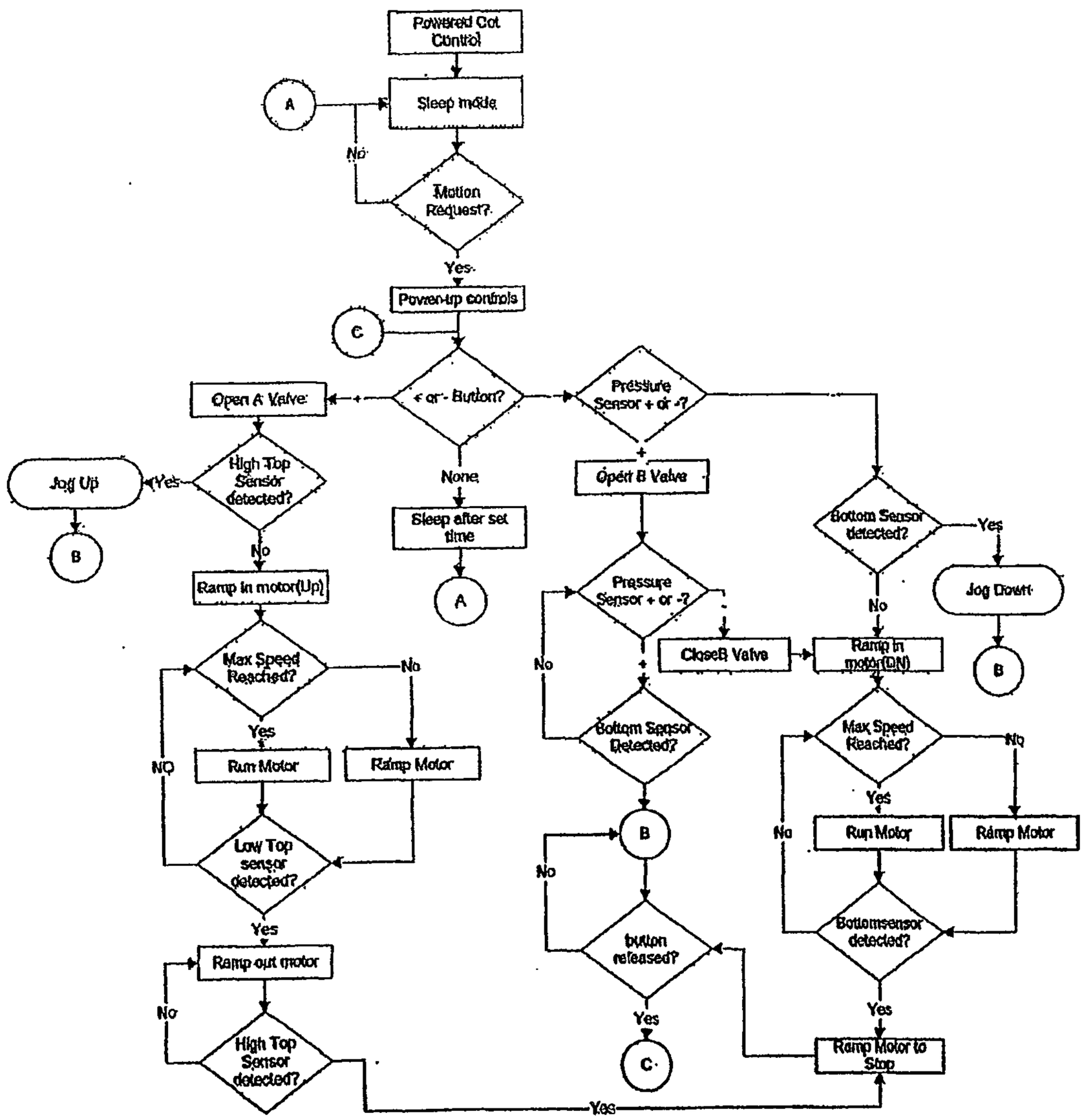

Powered Cot Control
A
Sleep mode
No
Motion Request?
Yes
Power-up controls
C
< or - Button?
Pressure Sensor + or -?
Open A Valve
Jog Up
Yes
High Top Sensor detected?
B
No
Ramp in motor(Up)
Max Speed Reached?
No
Yes
NO
Run Motor
Ramp Motor
Low Top sensor detected?
Yes
Ramp out motor
No
High Top Sensor detected?
None
Sleep after set time
A
Open B Valve
Pressure Sensor + or -?
No
Close B Valve
Bottom Sensor Detected?
B
No
button released?
Yes
C
Bottom Sensor detected?
Yes
Jog Down
B
No
Ramp in motor(DN)
Max Speed Reached?
No
Yes
No
Run Motor
Ramp Motor
Bottomsensor detected?
Yes
Ramp Motor to Stop
Yes

FIG. 25

FIG. 32

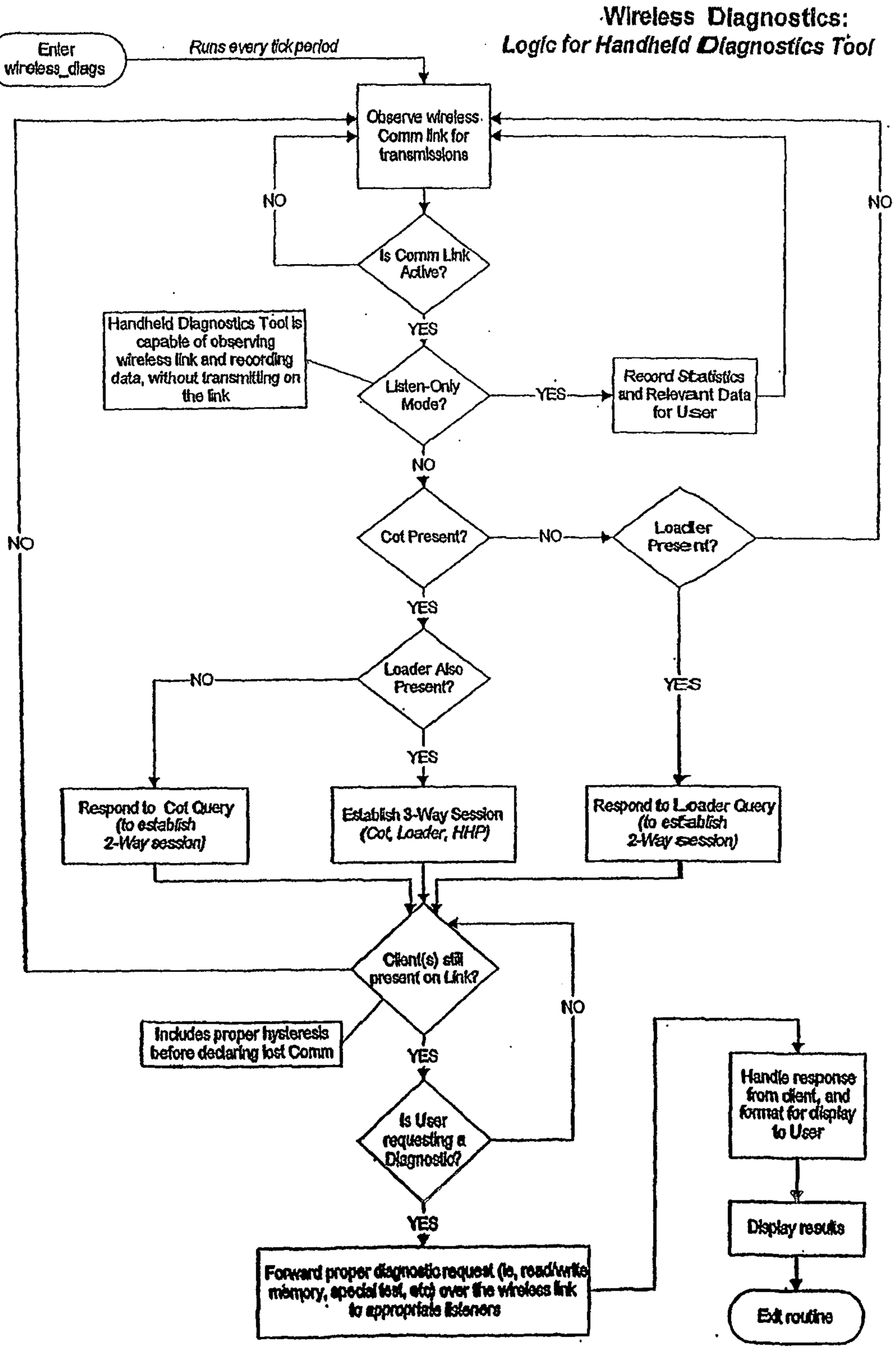

Wireless Diagnostics:
Logic for Handheld Diagnostics Tool
Enter wireless_diags
Runs every tick period
Observe wireless Comm link for transmissions
NO
Is Comm Link Active?
YES
Handheld Diagnostics Tool is capable of observing wireless link and recording data, without transmitting on the link
Listen-Only Mode?
YES
Record Statistics and Relevant Data for User
NO
Cot Present?
NO
Loader Present?
NO
YES
Loader Also Present?
NO
YES
YES
Respond to Cot Query (to establish 2-Way session)
Establish 3-Way Session (Cot, Loader, HHP)
Respond to Loader Query (to establish 2-Way session)
Client(s) still present on Link?
NO
Includes proper hysteresis before declaring lost Comm
YES
Is User requesting a Diagnostic?
YES
Forward proper diagnostic request (ie, read/write memory, special test, etc) over the wireless link to appropriate listeners
Handle response from client, and format for display to User
Display results
Exit routine

FIG. 33

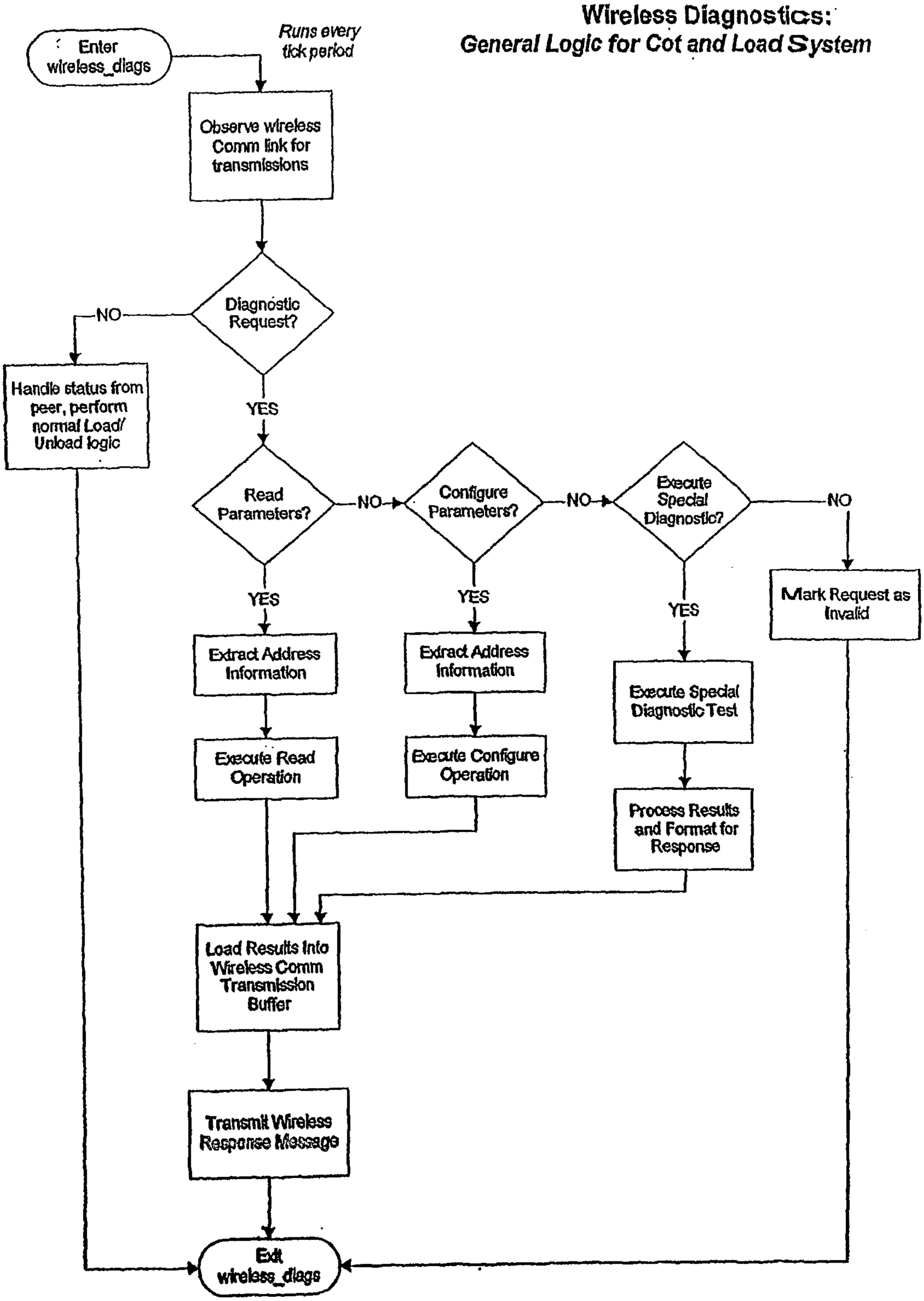
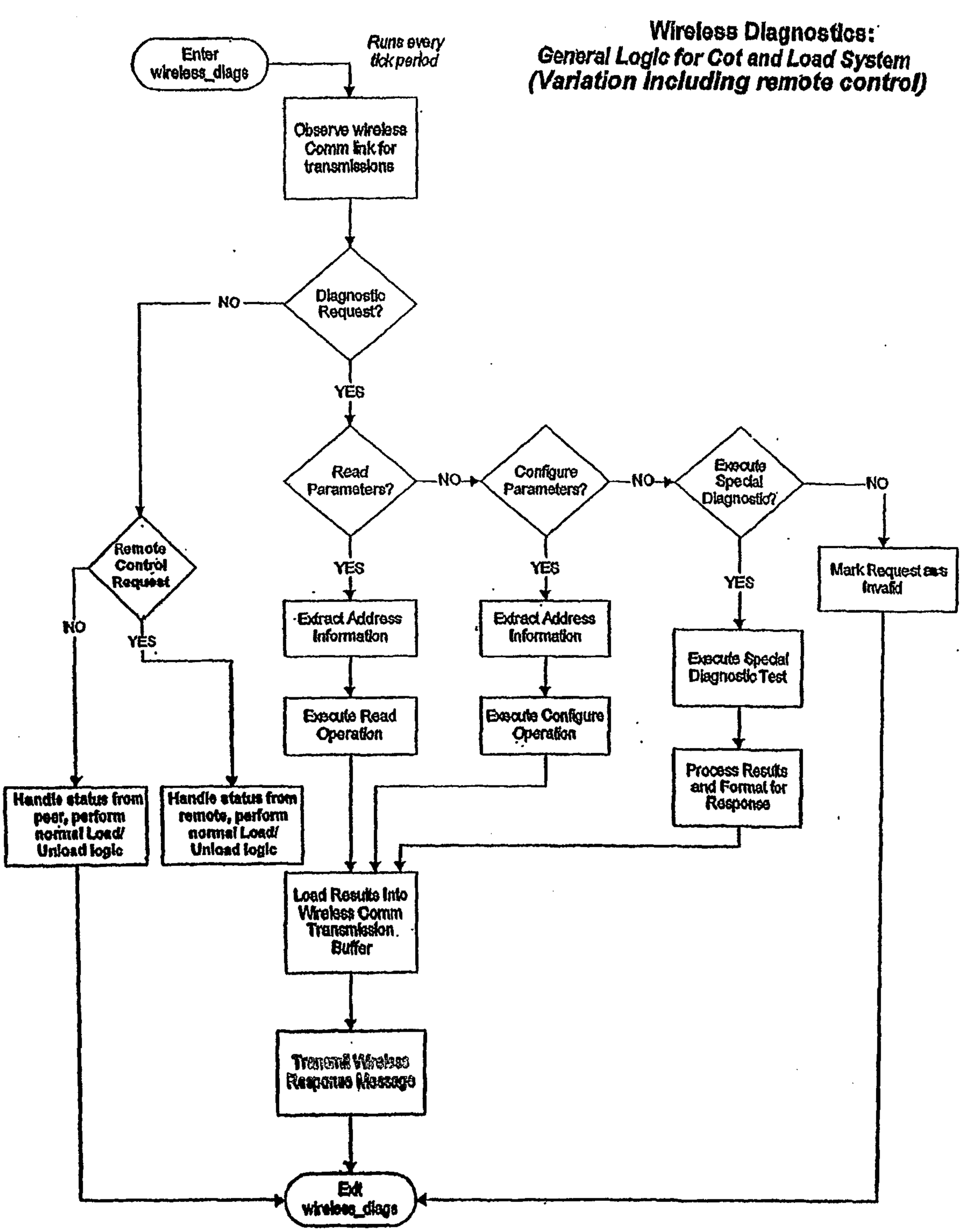

Wireless Diagnostics:
General Logic for Cot and Load System
Enter wireless_diags
Runs every tick period
Observe wireless Comm link for transmissions
Diagnostic Request?
NO
YES
Handle status from peer, perform normal Load/ Unload logic
Read Parameters?
NO
Configure Parameters?
NO
Execute Special Diagnostic?
NO
YES
YES
YES
Extract Address Information
Extract Address Information
Execute Special Diagnostic Test
Execute Read Operation
Execute Configure Operation
Process Results and Format for Response
Mark Request as Invalid
Load Results Into Wireless Comm Transmission Buffer
Transmit Wireless Response Message
Exit wireless_diags

FIG. 33A


Wireless Diagnostics:
General Logic for Cot and Load System
(Variation Including remote control)
Enter wireless_diags
Runs every tick period
Observe wireless Comm link for transmissions
Diagnostic Request?
NO
YES
Read Parameters?
NO
Configure Parameters?
NO
Execute Special Diagnostic?
NO
Remote Control Request
NO
YES
YES
YES
YES
Extract Address Information
Extract Address Information
Execute Special Diagnostic Test
Mark Request as Invalid
Execute Read Operation
Execute Configure Operation
Process Results and Format for Response
Handle status from peer, perform normal Load/ Unload logic
Handle status from remote, perform normal Load/ Unload logic
Load Results Into Wireless Comm Transmission Buffer
Transmit Wireless Response Message
Exit wireless_diags

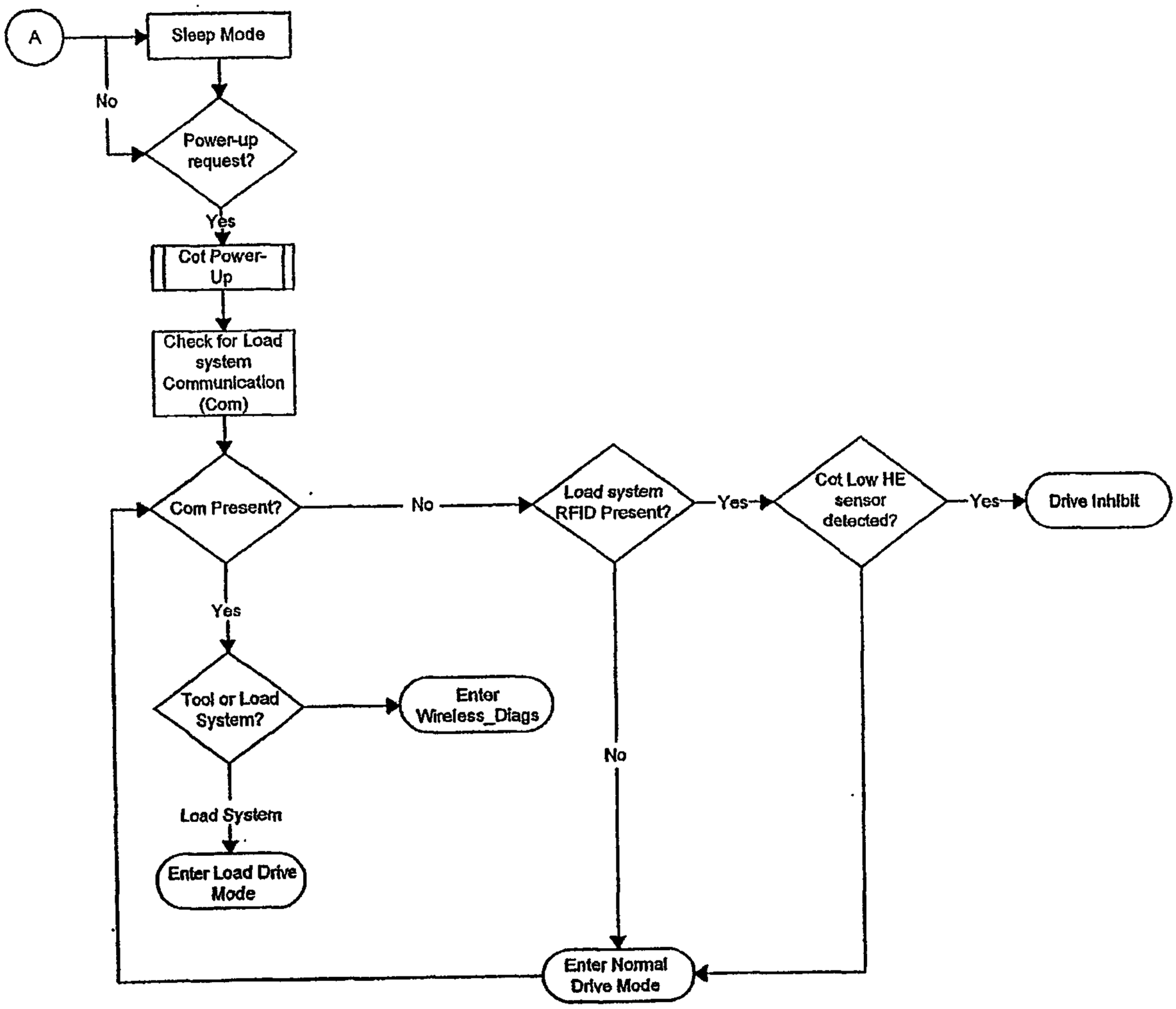

A
Sleep Mode
No
Power-up request?
Yes
Cot Power-Up
Check for Load system Communication (Com)
Com Present?
No
Load system RFID Present?
Yes
Cot Low HE sensor detected?
Yes
Drive Inhibit
Yes
Tool or Load System?
Enter Wireless_Diags
Load System
Enter Load Drive Mode
No
Enter Normal Drive Mode

FIG. 59

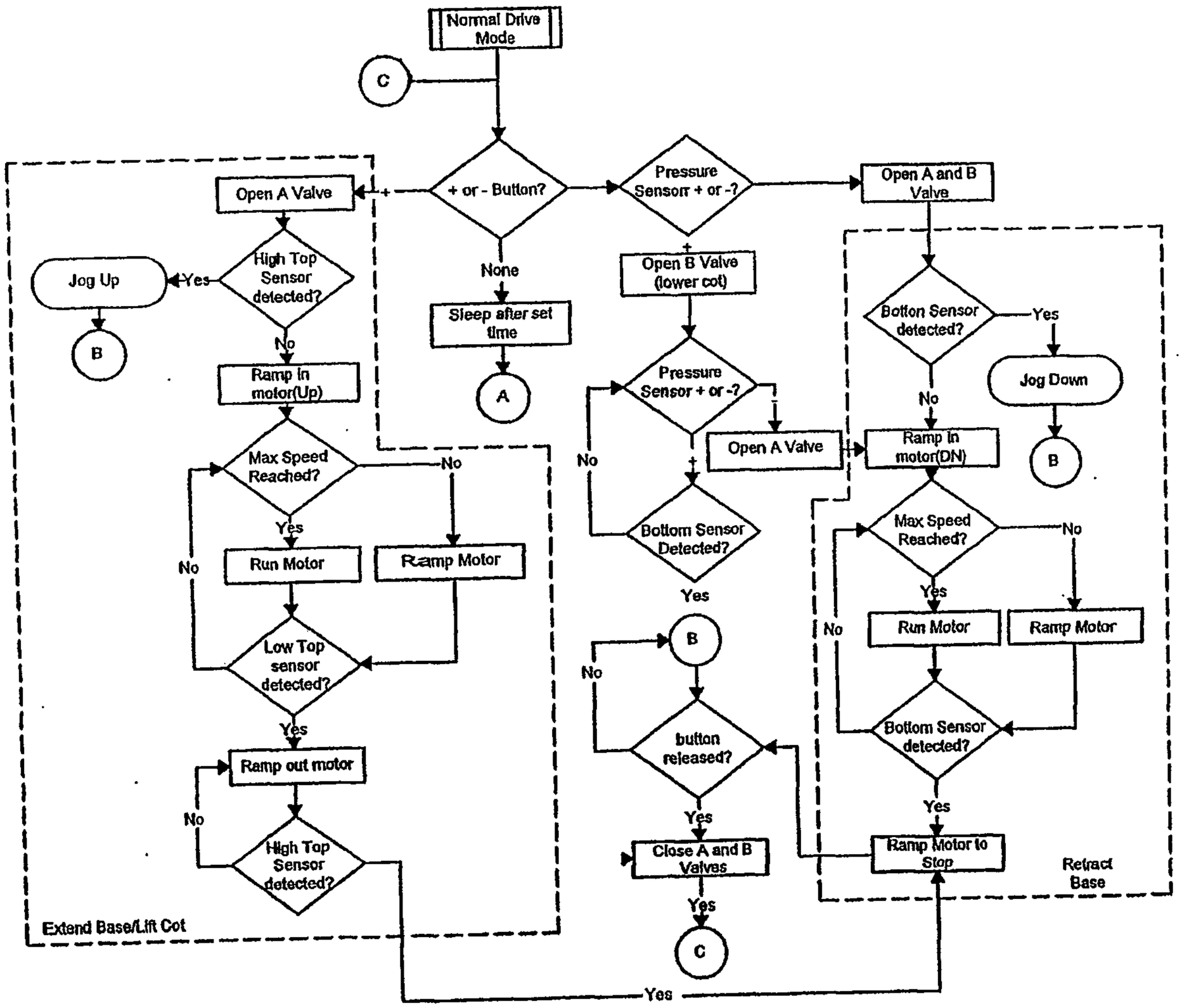

Normal Drive Mode
C
+ or - Button?
+
Open A Valve
High Top Sensor detected?
Yes
Jog Up
B
No
Ramp in motor(Up)
Max Speed Reached?
No
Yes
Run Motor
Ramp Motor
No
Low Top sensor detected?
Yes
Ramp out motor
No
High Top Sensor detected?
Extend Base/Lift Cot
None
Sleep after set time
A
Pressure Sensor + or -?
+
Open B Valve (lower cot)
Pressure Sensor + or -?
No
+
Bottom Sensor Detected?
Yes
B
No
button released?
Yes
Close A and B Valves
Yes
C
Open A and B Valve
Bottom Sensor detected?
Yes
Jog Down
B
No
Open A Valve
Ramp in motor(DN)
Max Speed Reached?
No
Yes
No
Run Motor
Ramp Motor
Bottom Sensor detected?
Yes
Ramp Motor to Stop
Retract Base
Yes

FIG. 60

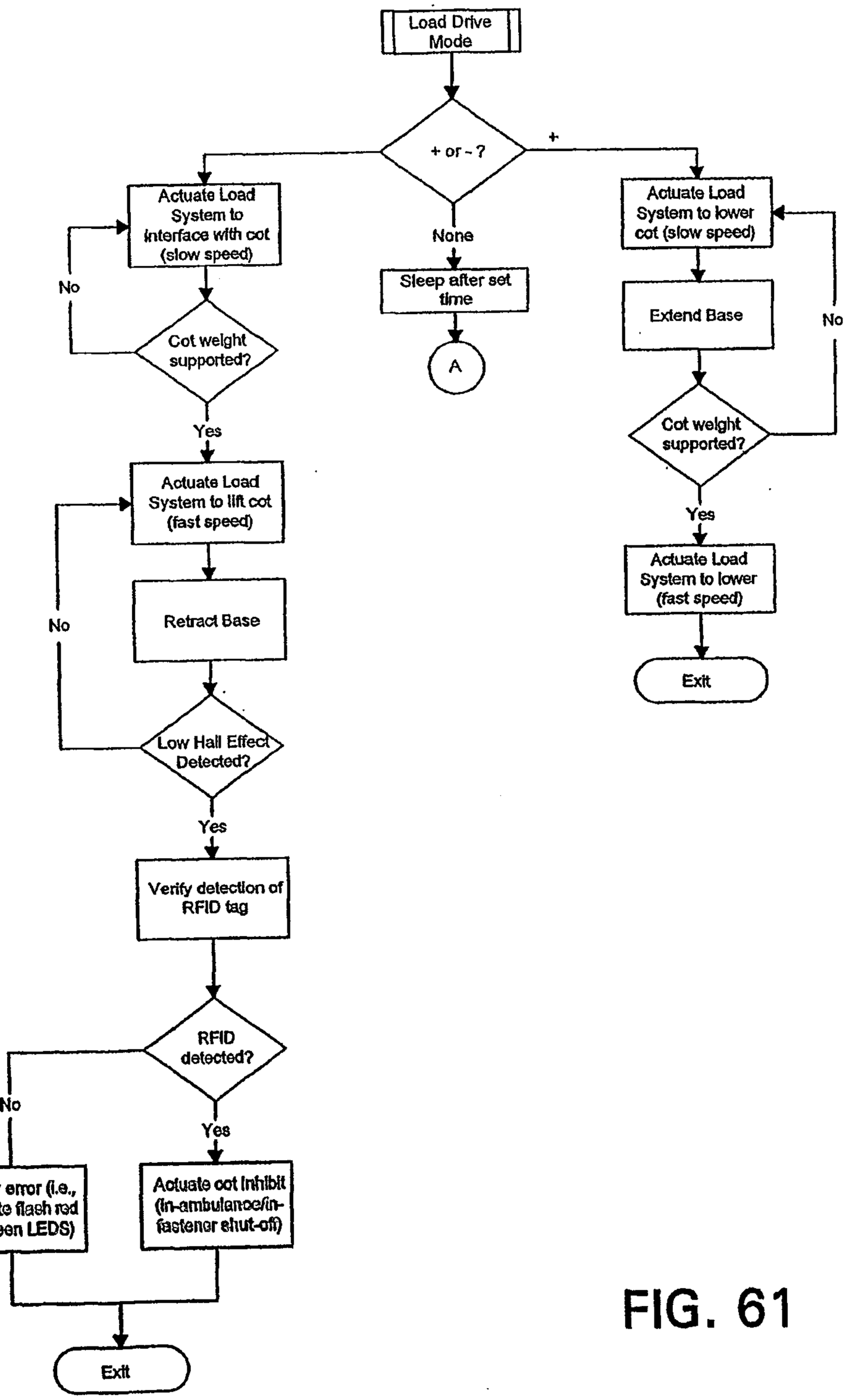
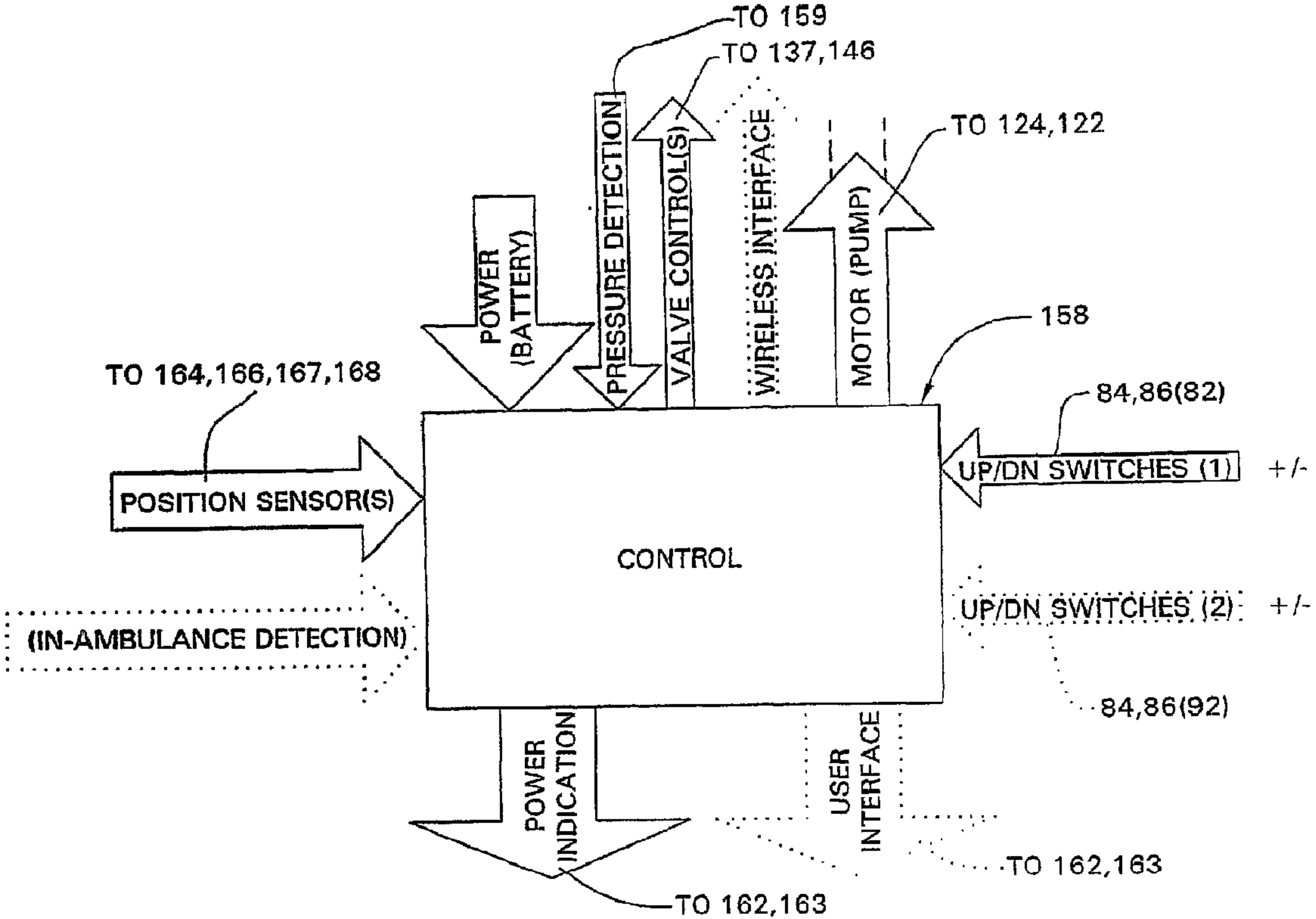

Load Drive Mode
+ or - ?
+
None
Actuate Load System to interface with cot (slow speed)
No
Cot weight supported?
Yes
Actuate Load System to lift cot (fast speed)
No
Retract Base
Low Hall Effect Detected?
Yes
Verify detection of RFID tag
RFID detected?
No
Yes
Display error (i.e., Alternate flash red and green LEDS)
Actuate cot Inhibit (in-ambulance/in-fastener shut-off)
Exit
Sleep after set time
A
Actuate Load System to lower cot (slow speed)
Extend Base
Cot weight supported?
No
Yes
Actuate Load System to lower (fast speed)
Exit

FIG. 61


TO 159
TO 137,146
TO 124,122
158
84,86(82)
TO 164,166,167,168
POWER (BATTERY)
PRESSURE DETECTION
VALVE CONTROL(S)
WIRELESS INTERFACE
MOTOR (PUMP)
POSITION SENSOR(S)
CONTROL
UP/DN SWITCHES (1) +/-
UP/DN SWITCHES (2) +/-
(IN-AMBULANCE DETECTION)
84,86(92)
POWER INDICATION
USER INTERFACE
TO 162,163
TO 162,163