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[Continued on next page]

(54) Title: LIGHTWEIGHT COLLAPSIBLE STROLLER

(57) Abstract: A stroller is provided which includes a right frame and a left frame. Each frame has a front support rotatably connected to a rear support at a frame joint. The front support of each frame is a telescoping tube assembly. The stroller further includes a linkage comprising at least two substantially rigid members connected between the right frame and the left frame, the rigid members being connected to the front supports at a right slideable joint and a left slidable joint. The joints are received within the slot of the outer tube. A drive mechanism coupled to the right or left frame is also provided. The front support and the rear support of the right frame and the left frame are movable from an open position to a closed position by the drive mechanism.

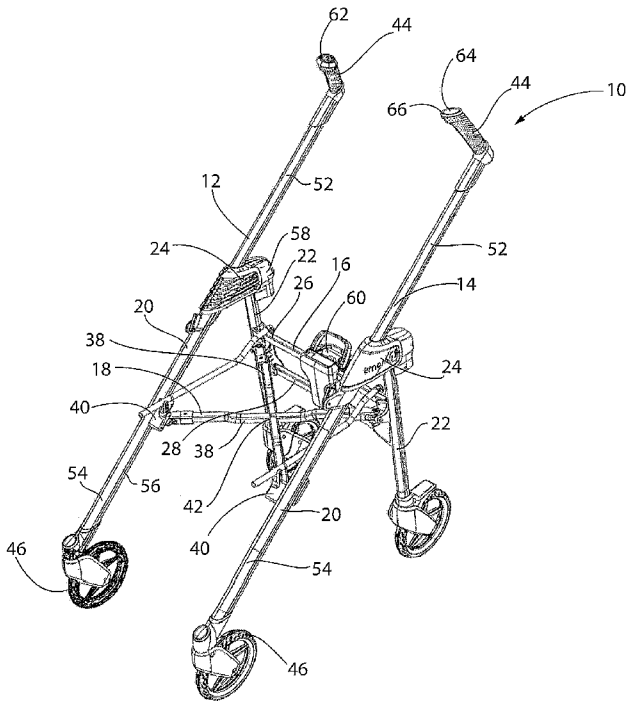


FIG. 1

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LIGHTWEIGHT COLLAPSIBLE STROLLER

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is based on United States Provisional Patent Application No. 61/557,694 filed on November 9, 2011, on which priority of this patent application is based and which is hereby incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present invention relates generally to strollers, and more particularly, to lightweight baby strollers adapted for use during active movement such as jogging.

Description of Related Art

[0003] Baby strollers, also referred to as baby carriages, baby buggies, or prams, have been used to hold and transport babies and young children for many years. Early baby strollers had parts which were fixedly secured to one another such that they did not fold for compactness. Baby strollers have been designed to have some parts which are movable relative to one another to allow movement of some parts of the stroller to achieve a more compact configuration when not in use. However, current strollers do not allow for movement or folding to compact configuration as desired, and are cumbersome and sometimes difficult to move between their collapsed (closed) positions and their operative (open) positions, particularly when attending to a baby or child. More recently, strollers that automatically transition between their collapsed and operative positions, such as a stroller that does so upon the push of a button via motorized movement, have recently been created.

[0004] In addition to designing baby strollers that are easily foldable to compact and transportable configurations, efforts have been directed to reducing the total weight of baby strollers so that the effort required to push the stroller is effectively reduced. Lightweight strollers are especially desirable for use during physically demanding activities such as pushing the stroller while jogging. In addition, lightweight strollers are clearly easier to transport (e.g., loading into cars, carrying up stairs) particularly for smaller users. Efforts to reduce the overall weight of a baby stroller include replacing metal structural materials with lightweight structural materials such as hard plastics. In addition, new stroller designs have been proposed which use fewer structural members, reduce the length and width of frame materials, or which replace structural framing materials with tubular hollow framing

materials. However, lightweight strollers generally lack the improved functionality, structural stability, and stylish design which users expect from larger heavier models.

[0005] Therefore, a need exists for a lightweight jogging stroller formed substantially from lightweight materials such as hard plastics. The stroller should effectively achieve the functional advantages of heavier strollers (e.g., automatic folding, full suspension, expansive onboard storage, electric safety features such as day time running lights, safety sensors, etc.). The stroller should also exhibit good structural stability and should not bend or pivot when pushed on by a user. The stability of the device should inspire confidence in users. A lightweight stroller exhibiting at least these features is described herein.

SUMMARY OF INVENTION

[0006] The present invention provides a lightweight stroller which can be quickly and easily transitioned between a closed position and an open position. The stroller includes a right frame and a left frame. Each frame has a front support rotatably connected to a rear support at a frame joint. The front support of each frame is a telescoping tube assembly which includes: an outer tube extending from an end of the front support to the frame joint of the support; an inner tube assembly partially inserted within the outer tube and protruding from the outer tube; and, a slot extending longitudinally along at least a portion of the outer tube. The stroller further includes a linkage comprising at least two substantially rigid members connected between the right frame and the left frame, the rigid members being connected to the front supports at a right slideable joint and a left slidable joint. The joints are received within the slot of the outer tube. A drive mechanism coupled to the right or left frame is also provided. The front support and the rear support of the right frame and the left frame are movable from an open position to a closed position by the drive mechanism. In addition, transitioning the stroller from the open position to the closed position causes the slideable joints to slide downward along the slots of the outer tube.

[0007] In certain configurations, the inner tube assembly of the stroller includes: an inner tube which is inserted partially within the outer tube and protrudes from the outer tube at the frame joint; a tube stiffening member inserted within the outer tube and disposed below the slideable joint when the front support is in the open position, the tube stiffener having a slot which corresponds with the slot of the outer tube; and, an extension member extending between an end of the inner tube which is inserted in the outer tube and the slidable joint. Optionally, the extension member is configured to push the slideable joint longitudinally through the slot of the tube stiffener and the slot of the outer tube when the stroller transitions

from the open position to the closed position, and the extension member is received within the slot of the tube stiffener. The tube stiffener may further include an unbroken sidewall enclosing a hollow portion extending longitudinally through the tube stiffener.

[0008] In certain further configurations of the stroller, the drive mechanism includes a cable drive, a spool rotated by the cable drive, and a cable received by the spool, wherein the cable is coupled to the inner tube. The cable drive may be in direct rotational connection with the spool. Preferably, the cable is formed of a synthetic polymer, such as ultra high molecular weight polyethylene. The stroller may also include a biasing member connected in series with the cable for removing slack from the cable while the drive mechanism is engaged. The drive mechanism may be powered by a battery, an electrical generator, a spring, compressed air, or any combination thereof.

[0009] In certain configurations, the linkage of the stroller is a scissor linkage configured such that the rigid members are connected between the front support of one frame and the rear support of the other frame and, wherein the rigid members of the scissor linkage are connected at a rotatable center joint such that as the stroller transitions from the open position to the closed position, the rigid members rotate about the center joint bringing ends of the rigid members closer together. Optionally, the stroller also includes an activation button for engaging the drive mechanism. The activation button may be a dead man switch. The stroller may further include a screen for presenting information to a user, wherein the information includes air temperature, battery power, time, speed, or distance traveled.

[0010] In certain configurations, the stroller further includes a parallelogram linkage connected between the right frame and the left frame, the parallelogram linkage comprising: a foldable upper horizontal member; a foldable lower horizontal member approximately parallel to the upper horizontal member; and, a latch, which when engaged, maintains the members in an extended position and when disengaged permits the members to fold. In addition, the stroller may further include a parallelogram drive mechanism coupled to the parallelogram linkage for transitioning the horizontal members of the parallelogram linkage from the extended position to the folded position.

[0011] In certain configurations, a storage assembly may be affixed to the stroller. Optionally, the storage assembly includes: a storage bag; at least one cable fixedly attached to the right frame and at least one cable fixedly attached to the left frame; and a flexible joint for connecting the cables to the bag. The storage assembly is configured such that the bag remains in an expanded position when the frame moves from the open position to the closed position.

[0012] In accordance with a further aspect of the present invention, a stroller is provided which includes: a right frame and a left frame, each frame comprising a front support rotatably connected to a rear support at a frame joint; a parallelogram linkage connected between the right frame and the left frame comprising a foldable upper horizontal member, a foldable lower horizontal member approximately parallel to the upper horizontal member, and, a latch, which when engaged, maintains the members in an extended position and when disengaged permits the members to fold; and, a drive mechanism coupled to the frame or parallelogram linkage. The invented stroller provides that the front support and the rear support of the right frame and the left frame are movable from an open position to a closed position, the horizontal members of the parallelogram linkage transition from the extended position to the folded position concurrently with the transition of the frame from the open position to the closed position, and movement of the frames or transition of the parallelogram linkage is effectuated by the drive mechanism.

[0013] In certain configurations, the drive mechanism includes a drive, a gear engaged with and driven by the drive, and a locking member connected to the gear. Optionally, the locking member engages the upper or lower horizontal member of the parallelogram linkage for transitioning the parallelogram linkage from the extended position to the folded position. The drive mechanism includes a manual clutch configured to selectively engage and disengage the drive from the gear. Furthermore, the drive may be configured such that as the drive is being engaged with the gear, the drive applies a light preload pressure to align the drive and gear before a full force of the drive is applied to the gear.

[0014] In accordance with a further aspect of the present invention, a stroller is provided which includes a frame moveable from an open position to a closed position and a drive mechanism coupled to a portion of the frame. The drive mechanism includes: a cable drive; a spool rotated by and in direct rotational connection with the cable drive; a cable received by the spool; and, a biasing member connected in series with the cable for removing slack from the cable when the drive mechanism is engaged.

[0015] These and other features and characteristics of the present invention, as well as the methods of operation and functions of the related elements of structures and the combination of parts and economies of manufacture, will become more apparent upon consideration of the following description and the appended claims with reference to the accompanying drawings, all of which form a part of this specification, wherein like reference numerals designate corresponding parts in the various figures. It is to be expressly understood, however, that the drawings are for the purpose of illustration and description only and are not intended as a

definition of the limits of the invention. As used in the specification and the claims, the singular form of "a", "an", and "the" include plural referents unless the context clearly dictates otherwise.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] **FIG. 1** is a forwardly directed perspective view of a collapsible stroller, according to an embodiment of the present invention, shown in its open position;

[0017] **FIG. 2** is a front view of the stroller of **FIG. 1** shown in its open position;

[0018] **FIG. 3** is a rear view of the stroller of **FIG. 1** shown in its open position;

[0019] **FIG. 4** is a side view of the stroller of **FIG. 1** shown in its open position;

[0020] **FIG. 5** is a perspective view of the stroller of **FIG. 1** shown in its fully closed position;

[0021] **FIG. 6** is a front view of the stroller of **FIG. 1** shown in its fully closed position;

[0022] **FIG. 7** is a side view of the stroller of **FIG. 1** shown in its fully closed position;

[0023] **FIG. 8** is a forwardly directed perspective view of the stroller of **FIG. 1** having a seat and a storage bag affixed thereto;

[0024] **FIG. 9** is a rearwardly directed perspective view of the stroller of **FIG. 1** having a seat and a storage bag attached thereto;

[0025] **FIG. 10** is a perspective view of the inner tube assembly of the front support of the stroller of **FIG. 1**;

[0026] **FIG. 11** is a perspective cross-sectional view of the angled member of stroller of **FIG. 1** with an inner tube nested within an outer tube;

[0027] **FIG. 12** is a magnified side view of the stroller of **FIG. 1** focusing on the drive mechanism for the frame;

[0028] **FIG. 13** is a cross-sectional view of the drive mechanism of **FIG. 12**;

[0029] **FIG. 14** is a cross-sectional view of the upper portion of the inner tube of the angled member of the stroller of **FIG. 1**;

[0030] **FIG. 15** is a magnified rear view of the stroller of **FIG. 1** focusing on the parallelogram linkage and driving mechanism for the parallelogram linkage;

[0031] **FIG. 16** is a magnified cross-sectional view of the drive mechanism for the foldable linkage of the stroller of **FIG. 1** with the horizontal members in the extended position;

[0032] **FIG. 17** is a top view of the stroller of **FIG. 1** focusing on the a handles, activation button, and LCD screen;

[0033] **FIG. 18** is a magnified view of the LED screen of the stroller of **FIG. 1**, positioned on the handle bar assembly;

[0034] **FIG. 19** is a block diagram depicting the activation sequence of the stroller of **FIG. 1**; and,

[0035] **FIG. 20** is a block diagram depicting the folding sequence of the stroller of **FIG. 1**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0036] For purposes of the description hereinafter, the terms "upper", "lower", "right", "left", "vertical", "horizontal", "top", "bottom", "lateral", "longitudinal", and derivatives thereof shall relate to the invention as it is oriented in the drawing figures. However, it is to be understood that the invention may assume alternative variations and step sequences, except where expressly specified to the contrary. It is also to be understood that the specific devices and processes illustrated in the attached drawings, and described in the following specification, are simply exemplary embodiments of the invention. Hence, specific dimensions and other physical characteristics related to the embodiments disclosed herein are not to be considered as limiting.

[0037] With reference to **FIGS. 1-9**, a stroller **10** includes a right frame **12**, a left frame **14**, and a linkage (e.g., a parallelogram linkage **16** and/or a scissor linkage **18**) connected therebetween. The frames **12, 14** and linkage **16, 18** may be formed from any suitable material strong enough to support the stroller **10** and occupant including hard plastics and metal. In certain embodiments, the frames **12, 14** are formed from hollow tubular members to reduce the weight of the stroller **10**.

[0038] The right frame **12** and left frame **14** are substantially identical in appearance and construction. The right frame **12** is described hereinafter. However, it is understood that the left frame **14** is constructed to mirror the right frame **12**. The right frame **12** includes a front support **20** rotatably connected to a rear support **22** at a frame joint **24**. The front support **20** and the rear support **22** are moveable from an open position to a closed position. In the open position, the front support **20** is positioned at approximately a 45 degree angle relative to the rear support **22**. In the closed position, the front support **20** and rear support **22** are approximately parallel. However, these angles are not intended to be limiting and may vary within the scope of the present invention. In one exemplary embodiment, the stroller in the open position is depicted in **FIGS. 1-4**. The stroller in the closed position is depicted in **FIGS. 5-7**.

[0039] The linkage connecting the right frame **12** to the left frame **14** may be any suitable structural member including, but not limited to, the parallelogram linkage **16** and/or the scissor linkage **18**. In one non-limiting embodiment, a parallelogram linkage **16** is formed of a foldable upper horizontal member **26** and a foldable lower horizontal member **28**, wherein the members **26, 28** are connected between the rear supports **22** of the right frame **12** and the left frame **14**. The horizontal members **26, 28** each include a first section **30** and a second section **32** connected by a folding joint **34**. The parallelogram linkage **16** further includes a latch **36** engaged with the folding joint **34** which, when locked, maintains the horizontal members **26, 28** in an extended position and which, when released, permits the folding joint **34** to transition to the folded position. The parallelogram linkage **16** is configured to transition from the extended position to the folded position concurrently with the transition of the frames **12, 14** from the open position to the closed position. A parallelogram linkage **16** containing two horizontal members **26, 28** is found to offer advantages compared to other known configurations for connecting frame structures of a stroller. Specifically, since the members **26, 28** are relatively small and since there is a large space between the horizontal members **26, 28** and the ground, a user will not kick or bump the linkage **16** while pushing the stroller **10**. In addition, since the parallelogram linkage **16** takes up only a small portion of the rear supports **22**, there is sufficient space to hang storage devices such as bags or panniers off of the rear supports **22** without obstructing the folding motion of the linkage **16**. Finally, a linkage **16** comprising two parallel horizontal members **26, 28** is generally believed to be visually appealing and less cluttered than alternative linkage designs which include more parts and fewer straight lines.

[0040] In certain embodiments, the stroller **10** further includes the scissor linkage **18**. The scissor linkage **18** includes two substantially rigid members **38** connected between a rear support **22** and a front support **20** of the opposing frame. The rigid members **38** are connected to the front support **20** at a slideable joint **40** capable of sliding upward and downward along a lower portion of the front support **20**. The slideable joints **40** are configured to slide downward along the front supports **20** concurrently with the transition of the frames **12, 14** from the open position to the closed position. In certain embodiments, the rigid members **38** are connected together at a rotatable center joint **42**. The members **38** are rotated together around the center joint **42** as the frames **12, 14** transition from the open position to the closed position.

[0041] The stroller **10** may further include additional elements extending from the frames to facilitate pushing the stroller. For example, in certain embodiments, handles **44** extend from the top of the front supports **20** for pushing the stroller.

[0042] Additionally, the stroller **10** includes front **46** and rear wheels **48** attached to the lower end of the front support **20** and rear supports **22**, respectively. In one embodiment, the wheels **46, 48** are connected to the frames **12, 14** through a suspension system for absorbing bumps or depressions in the ground to make pushing the stroller **10** easier and to improve ride comfort for the child occupant. The suspension system may be a spring based suspension system or any other suitable system as is known in the art.

[0043] The stroller **10** may further include a foot stand (not shown) which may further assist in keeping the stroller upright in the folded (e.g., closed) position. The foot stand may extend between the lower portions of the front supports **20** and may also house additional electronic features such as day time running lights (not shown).

[0044] With reference to **FIG. 8**, in certain embodiments, the lower portion of the front supports **20** may provide an attachment mechanism for a child support area including a child seat **50**. The child support area may be anchored to the front supports **20** at a position between the slideable joint **40** and frame joint **24**, such that movement of the slideable joint **40** is not obstructed by seat **50**. A cover or umbrella (not shown) may also be connected to the frames **12, 14**, for protecting the child from exposure to the sun. In certain embodiments, the cover (not shown) is connected to the upper portion of the front supports **20**, at a point above the frame joint **24**.

[0045] With reference to **FIGS. 8** and **9**, a storage bag **70** may be attached to the rear supports **22** of the stroller **10**. The storage bag can be used to carry supplies for the child occupant or for the user, such as food items, clothing, diapers, toys, etc. With most folding strollers, storage bags are generally folded up in connection with the folding of the stroller frame. It was important to remove all items from the bag before folding the stroller so that nothing would be damaged. Alternatively, the bag could be removed before folding the stroller. When manually closing a stroller, a user would typically notice if objects were still in the bag and could remove the objects or bag from the stroller before continuing to fold the stroller. A unique problem with power folding strollers, such as the stroller **10** of the present invention, is that the user may initiate automatic folding of the stroller **10** without realizing that objects are contained within the bag. Since the folding process is automatic, the bag may collapse breaking objects contained therein, before the user realizes that the bag was loaded. Therefore, in a preferred and non-limiting embodiment of the present invention, the storage

bag **70** is configured to remain in an unfolded (e.g., expanded) position while the stroller **10** transitions between the open and closed positions. To maintain the bag **70** in the expanded position, in one embodiment, the bag **70** further includes cables **72** fixedly connected to the frame **12, 14**. For example, the cables **72** may be anchored to the frame joints **24**. The cables **72** may be any sort of webbing, fabric, or material which is sufficiently strong to support the weight of the bag **70** and objects contained therein. The cables **72** are coupled to the bag **70** at a flexible joint. The cables **72** and flexible joint are configured such that, as shown in **FIG. 9**, when the stroller **10** is in the open position, the cables **72** are oriented at approximately a 45 degree angle relative to the ground. As the stroller **10** transitions to the closed position, the fixed ends of the cables **72** are brought together such that, when the stroller **10** is in the closed position, the cables **72** are substantially parallel. In this way, the bag **70** does not collapse as the stroller **10** transitions between the open and closed positions.

[0046] With continued reference to **FIGS. 1-9**, in a non-limiting embodiment, the front supports **20** of the stroller **10** are formed with a telescoping tube-in-tube design to reduce weight and improve overall appearance. In certain other embodiments of the stroller **10**, rather than a telescoping tube-in-tube design, the front support **20** could be constructed as a non-coaxial tube with an external telescoping guide, as is known in the art.

[0047] In a tube-in-tube configuration, the front support **20** includes an inner tube **52** and a hollow outer tube **54**. The outer tube **54** extends from an end of the front support **20** to the frame joint **24**. In the embodiment of the stroller **10**, depicted in **FIGS. 1-9**, the outer tube **54** is positioned at the lower portion of the front support **20,** and the inner tube **52** is positioned at the upper portion of the front support **20**. However, it is understood that this configuration may be reversed, such that the outer tube **54** is positioned at the upper portion of the stroller **10**. The outer tube **54** includes a longitudinal slot extending, at least partially, along the length of the outer tube **54**. The slideable joint **40** of the scissor linkage **18** is configured to be received within the slot **56**.

[0048] Generally, a tube **54** having a longitudinal slot **56** would lack rigidity unless additional stiffening structures are disposed within the tube to contribute additional structural stability. Accordingly, if no additional structural members were included in the outer tube **54**, when the stroller **10** is pushed with substantial force, the front supports **20** may bend or flex causing the stroller **10** to feel unstable or poorly made. However, inserting additional structural supports into the outer tube **54** is difficult because the inner tube **52** is configured to insert farther within the outer tube **54** as the stroller **10** transitions to the closed position. Thus, there is limited space in the outer tube **54** for including additional structural supports.

[0049] With reference to **FIGS. 10** and **11**, to counteract this lack of rigidity, the stroller **10** includes an inner tube assembly **51** consisting of the inner tube **52** which is inserted partially within the outer tube **54**, a tube stiffener **80**, and an extension member **82** extending between an end of the inner tube **52** and the tube stiffener **80**. The inner tube **52** is inserted within the outer tube **54** approximately 5 to 6 inches when the stroller is in the open position and is configured to insert farther into the outer tube **54** as the stroller transitions to the closed position. The tube stiffener **80** is a substantially hollow member disposed within the outer tube **54** below the slideable joint **40** when the front support **20** is in the open position. The tube stiffener **80** includes a slot **84** which corresponds with the slot **56** of the outer tube **54**. The tube stiffener **80** provides rigidity for the lower portion of the outer tube **54**. When the stroller is in the open position, the extension member **82** extends from an end of the inner tube **52** to the slideable joint **40**. As the stroller **10** transitions from the open position to the closed position, the extension member **82** pushes on the slideable joint **40** advancing the joint **40** downward through the slot **56** of the outer tube **54** and the corresponding slot **84** of the tube stiffener **80**. As the extension member **82** is advanced downward, the extension member **82** is also received within the slot of the tube stiffener **80**.

[0050] As shown in **FIG. 11**, the tube stiffener **80** may further include a portion having an unbroken sidewall **86** defining an entirely enclosed portion **88**. The slot **84** is separate from the enclosed portion **88**. As described above, an unbroken tubular member has increased rigidity compared to a member having a slot. By including the unbroken enclosed portion **88**, the rigidity of the tube stiffener is enhanced. Alternatively, the tube stiffener **80** could include a cross member extending longitudinally along the hollow interior of the tube. The cross member would contribute rigidity to the tube stiffener **80**. However, including a cross member extending along the entire length of the tube stiffener **80** would add additional weight.

[0051] In this configuration, it is understood that the outer tube **54** is effectively divided into three segments when the stroller **10** is in the open position. The first segment is the portion of the tube **54** between the front wheels **46** and the slideable joint **40**. The tube stiffener **80** is disposed within this segment and contributes additional rigidity to this segment of the outer tube **54**. The second segment is the portion of the outer tube **54** from the slideable joint **40** to the inserted end of the inner tube **52**. This segment of the outer tube **54** lacks rigidity since the only additional structure in this segment of the outer tube **54** is the extension member **82**. However, the rigidity of the other segments of the outer tube **54** has been found to be sufficient to ensure proper function of the stroller **10** even though this

middle segment lacks rigidity. The third segment corresponds to the 5 to 6 inches of overlap between the inner tube **52** and the outer tube **54.** In this segment, the inner tube **52** provides additional rigidity for the outer tube **54.**

[0052] Alternatively, the slot **56** of the outer tube **54** could be manufactured to extend only along the portion of the outer tube **54** between the slideable joint **40** and lower end of the outer tube **54** (e.g., the portion of the outer tube **54** which includes the tube stiffener **80**). In that way, the rigidity of the second segment of the outer tube **54** would be preserved since it would not include a slot **56.** However, machining a slot extending only partially along the length of the outer tube **54** is more expensive than is machining a slot **56** along the entire length of the outer tube **54.**

[0053] In a non-limiting embodiment of the inner tube assembly **51**, the slideable joint **40** includes a key, which functions as a locking structure for the outer tube **54.** The key is inserted into the slot **56** of the outer tube **54.** The rigid member **38** of the scissor linkage **18** is connected to the key to form the slideable joint **40.** In this configuration, the slidable joint **40** is freely rotatable, relative to the key, along both the horizontal and vertical axis. When the stroller **10** is in the open position, the key provides additional rigidity for the outer tube **54,** helping to prevent the middle segment of the other tube from flexing or twisting during use. As the stroller **10** transitions to the closed position, the key slides downward along the slot **56** as the rigid members **38** are being rotated together about the center joint **42.** Thus, the slideable joint **40** must freely rotate to accommodate both the downward motion of the key and the horizontal rotation of the rigid member **38.**

[0054] With reference again to **FIGS. 1-9**, the stroller **10** further includes one or more drive systems (e.g., an electric motor, hydraulic system, or manually operable mechanical system) for transitioning the stroller **10** between the open and closed positions. In one non-limiting embodiment, the stroller includes two driving subsystems, namely, a system for transitioning the frames **12, 14** between the open and closed positions, and a system for latching and folding the parallelogram linkage **16.**

[0055] The drive system for the frame consists of a drive mechanism **58** coupled to the front support **20.** The drive mechanism **58** transitions the right **12** and/or left frame **14** between the open and closed positions by inserting or removing the inner tube **52** from the outer tube **54.** With reference to **FIG. 13**, the drive mechanism **58** includes a cable drive **112** coupled to a first spool **114** and a second spool **116.** It is understood that the spools **114, 116** may be separate structures or integrally formed. A first cable **118** and a second cable **120** are connected to the spools **114, 116.** The first cable **118** and the second cable **120** are disposed

within the hollow portion of the front support **20** and extend longitudinally along the length of the front support **20** from the frame joint **24** toward the upper end of the front support **20**. The spools **114, 116** are configured such that when the first spool **114** is full, the second spool **116** is empty. Accordingly, when the stroller **10** transitions from the open position to the closed position, one spool is rotated to release the cable while the other spool winds the cable inward. In this way, the drive mechanism **58** pulls on the inner tube **52** to effectuate the transition to the closed position. When the stroller **10** is transitioned to the open position, the process is reversed, meaning that the spool which received the cable when closing the stroller releases the cable when opening and vice versa.

[0056] In one preferred non-limiting embodiment, the cable drive **112** is directly connected to the first spool **114** and the second spool **116** such that a single revolution of the cable drive **112** causes a single rotation of the spools **114, 116**. In such a configuration, it is necessary that the spools **114, 116** have a narrow diameter so that only a small amount of cable is drawn in or released by each successive revolution of the cable drive **112**. Accordingly, a narrow gauge cable must also be used to fit on the narrow spool. It has been determined that cables formed from synthetic polymers such as ultra high molecular weight polyethylene (UHMWPE) form an effective thin cable having good mechanical strength. Connecting the cable drive **112** directly to the spindle reduces the weight of the drive mechanism **58** by reducing the number of parts. Alternatively, the cable drive **112** may be connected to the spools **114, 116** through a gear box (not shown). The gear box permits slower revolution of the spools **114, 116**, which permits use of a larger diameter spool and cable. However, adding a gear box to the drive mechanism **58** increases the total weight of the system.

[0057] With reference to **FIG. 14**, the present invention recognizes that for drive mechanisms **58** having narrow spools **114, 116**, the difference in the amount of cable wound or unwound by each revolution of the spindle is substantially different based on whether the spool is fully loaded or empty. Therefore, in the cable drive system of the present invention, in which, at the beginning of the transition from closed position to the open position, one spool is empty and one is full, the amount of the cable being wound by one spool is substantially different from the amount of cable being unwound on the other spool. The discrepancy between the amount of cable being wound and unwound means that one cable will have excess slack when the drive mechanism is engaged. The excess slack could cause the cable to tangle during winding. To counteract this difference in the amount of cable being released, the drive system further includes a first biasing member **122** and second biasing member **124** connected in series with the first cable **118** and the second cable **120** and

anchored to an upper portion of the front support **20**. The springs **122, 124** remove excess slack from the cables **118, 120**. In one non-limiting embodiment, the springs **118, 120** are in the extended position when the stroller **10** is open and closed. However, during the transition, while the drive mechanism **58** is engaged, the biasing members **118, 120** compress longitudinally toward the upper portion of the front support **20**, thereby removing any slack in the cables **118, 120**.

[0058] In the above described embodiment of the stroller **10** and drive mechanism **58**, the stroller **10** includes only one drive mechanism **58** coupled to the front support **20**. A single drive mechanism can be used as long as the stroller **10** is sufficiently rigid so that movement of one front support **20** causes corresponding parallel movement of the opposing front support **20**. Alternatively, the stroller **10** may include a drive mechanism **58** coupled to each of the front supports **20**. In that case, the drive mechanisms **58** may be configured to operate concurrently to synchronize movement (e.g., opening or closing) of the right frame **12** and the left frame **14**.

[0059] With reference to **FIGS. 15-16**, the stroller **10** may further include a drive mechanism **60** coupled to the parallelogram linkage **16** for transitioning the horizontal members **26, 28** of the parallelogram linkage **16** from the extended position (when the stroller **10** is in the open position) to the folded position (when the stroller **10** is in the closed position). The drive mechanism **60** should also function as a latch or locking member for maintaining the parallelogram linkage **16** in the open position. In a preferred non-limiting embodiment, the drive mechanism **60** is driven by an electric motor; however, other drive mechanisms as are known in the art (mechanical, hydraulic, etc.) may also be used within the scope of the invention.

[0060] With specific reference to **FIG. 16**, in one non-limiting embodiment, the drive mechanism **60** includes a screw drive **212** coupled to a rotatable gear **214**. Rotation of the gear **214** drives a locking support element **216** which is connected between the gear **214** and the folding joint **34** of the lower horizontal member **28**. When the parallelogram linkage **16** is in the open (e.g., extended) position, the locking support element **216** is a latch for preventing the horizontal members **26, 28** from folding. More specifically, in the open position, the locking support element **216** is approximately singular (i.e., in alignment) with an axis **218** of the gear **214** to effectively counteract any upward or downward force applied to the horizontal members **26, 28**. However, the drive mechanism **60** is configured so that the gear **214** and locking support element **216** are stopped just short (e.g., approximately 10 degrees short) of the singular (i.e. aligned) position. Stopping rotation of the gear **214** short

of the singular position ensures that the gear **214** will not be accidently rotated past the singular position. Since the drive mechanism **60** cannot be driven backwards, if the gear **214** were accidently advanced past the singular position, the transition between the closed and open position would need to be repeated to lock the horizontal member **26** in place. It has been determined that maintaining the locking support element **216** in an approximately singular position (within 10 degrees of singular) is sufficient to counteract folding forces and to effectively maintain and lock the parallelogram linkage **16** in the open position.

[0061] With continued reference to **FIG. 16**, in one non-limiting embodiment, the drive mechanism **60** further includes a manual override clutch for transitioning the drive mechanism **60** from an automatically folding configuration to a manually folding configuration. The manual clutch includes a lever **220** coupled to a rotatable cam **222**. In the engaged (i.e., automatic) configuration, the lever **220** orients the cam **222** to exert a downward force on the screw drive **212** to maintain contact between the screw drive **212** and gear **214**. A spring **224** also coupled to the cam **222** provides additional downward force for maintaining the contact between the screw drive **212** and gear **214**. When the lever **220** is released (i.e., transitioned to the manual position), the cam **222** rotates, thereby disengaging the screw drive **212** from the gear **214**. When the screw drive **212** is disengaged from the gear **214**, the user can manually fold the stroller **10** by applying downward force to the horizontal members **26, 28**.

[0062] A potential problem with a screw drive **212** which is configured to engage and disengage with a gear **214** is aligning the threads **226** of the screw drive **212** with the teeth **228** of the gear **214**. If the threads **226** and teeth **228** are not aligned when contact between the gear **214** and screw drive **212** is established, the possibility exists that the threads **226** will be pressed against the upper portion of the gear teeth **228**, rather than into the gear **214**, causing damage to the teeth **228** and/or threads **226**. In a preferred embodiment, the drive mechanism **60** prevents damage to the teeth **228** and gears **214** by initially applying a light preload and slowly rotating the screw drive **212** until the gear teeth **228** and threads **226** of the screw drive **212** catch and align. Once the gear **214** and threads **226** are correctly aligned, additional compressive force between the screw drive **212** and gear **214** is applied and the rotation speed of the screw drive **212** is increased. However, the gears **214** and screw drive **212** are not subjected to this additional force until it is determined that the screw thread **226** and gear **214** are aligned. In certain embodiments, the drive mechanism **60** further comprises a sensor (not shown) for determining whether the screw drive **212** and the teeth **228** of the gear **214** are correctly aligned. If the sensor determines that the alignment is correct, there is

no need to apply the light preload force for aligning the gear **214**. If the sensor determines that the gear **214** is not in alignment, the light preload is applied. In an alternative embodiment, the drive mechanism **60** does not include an alignment sensor. In that case, the preload pressure will be applied each time that the gear **214** is brought into contact with the screw drive **212**, whether or not they are in alignment.

[0063] The drive mechanism **60** may further include a visual indicator (not shown) such as a display, switch, or lighted button for informing the user about what position the drive system is in. For example, the visual indicator could indicate three possible stages: auto, in which the gear **214** and screw drive **212** are engaged and locked together such that full power can be applied to open or close the stroller **10**; manual, in which the gear **214** and screw drive **212** are not engaged allowing users to manually open or close the stroller **10**; or auto but disengaged, in which the gear **214** is not properly aligned and light pressure will be applied to align the gear **214**. Alternatively, the position of the lever **220** may be sufficient to indicate to a user whether the clutch is in the automatic or manual position.

[0064] The present invention also recognizes the possibility that a user may try to force the stroller **10** to close while the drive mechanism is in the automatic position and the gear **214** is engaged with the screw drive **212**. Such forcing motion would potentially strip the gear **214** damaging the driving mechanism **60**. To counteract such forcing motion, in one preferred embodiment, the drive mechanism **60** is configured to automatically transition from the engaged to disengaged position. Specifically, when a user applies substantial downward force to the horizontal members **26, 28**, the cam **222** will rotate, thereby disengaging the screw drive **212** from the gear **214**.

[0065] With reference to **FIGS. 13** and **15**, the drive mechanisms **58, 60** further include a synchronizing connection between the frame drive mechanism **58** and the parallelogram drive mechanism **60** to ensure that the frame drive mechanism **58** will not engage when the parallelogram drive mechanism **60** is in the manual (i.e., disengaged) position. In one non-limiting embodiment, the connection **230** includes a rotatable cam **232** coupled with the parallelogram drive mechanism **60** which is in mechanical connection with a corresponding rotatable cam **126** of the frame drive system **58** through a cable **230**. When the parallelogram drive mechanism **60** transitions from the engaged position to the disengaged (i.e., the manual) position, the cam **232** rotates causing the corresponding cam **126** of the frame drive mechanism **58**, which is connected by the cable **230**, to rotate. Rotation of the cam **126** of the frame drive mechanism **58** causes the cable drive **112** to disengage from the spools **114, 116** to prevent rotation. When the parallelogram drive mechanism **60** is transitioned to the

automatic position, the cam **126** of the frame drive mechanism **58** is rotated to reinitiate connection between the spools **114, 116** and cable drive **112** to permit folding movement of the front support **20**.

[0066] In addition to the above described drive mechanisms **58, 60**, the stroller **10** may include numerous other electrical systems within the scope of the present invention. For example, the stroller **10** may include headlights, daytime running lights, as well as a user interface system. Several user interface options are provided within the scope of the present invention ranging from a simple interface to a complete interface offering information about the stroller **10** and surrounding environment. With reference to **FIGS. 17-18**, in one embodiment, the user interface is presented on a LCD visual display **62** disposed on an end of the handles **44** of the stroller **10**. An exemplary schematic drawing of a visual interface **62** in accordance with the present invention is depicted in **FIG. 18**. The visual interface **62** displays information from the plurality of sensors on the stroller **10** including speed, baby on board, open or closed, as well as, temperature, total distance traveled, and time, as well as other relevant information important to a user.

[0067] In one non-limiting embodiment, the electronics systems of the stroller **10** are powered by an on-board battery that is charged as the stroller is pushed. In certain embodiments, this charging is accomplished by generators housed in the stroller wheels **46, 48** combined with circuitry used to direct the power generated by the stroller **10** back into the battery. An exemplary generator for use with a power folding stroller is disclosed in U.S. Patent

No. 8,193,650, issued on June 5, 2012, which is hereby incorporated by reference in its entirety. Optionally, the stroller may also be charged via an AC adapter, such as a wall adapter.

[0068] In one non-limiting embodiment, the above described electronics (e.g., drive mechanisms, sensors, headlights, visual displays, and odometers) are controlled by one or more microcontrollers. Although all control can be handled by a single microcontroller, it is sometimes advantageous to use multiple microcontrollers for a cost advantage. For example, one or more microcontrollers are used to control and monitor the various electronic components associated with power folding and unfolding. In one preferred embodiment, the drive mechanisms are controlled via several of the microcontroller ports which in turn control the motor drive electronics. In one embodiment, the motor drive electronics consist of an H-bridge style circuit allowing the motors to be run in a bi-directional manner and at various speeds via pulse-width modulation (PWM). The microcontroller may utilize several addition

ports to monitor various sensors which provide information about the position of the frame, the position of the latch, and whether the stroller **10** has a child onboard. Remaining microcontroller ports are dedicated to a user interface of the stroller **10**, which provides a means for the user to interact with the stroller **10** and where the stroller **10** communicates information to the user.

[0069] In certain configurations, the various electronic components of the stroller **10** are controlled by software systems responsible for utilizing the electrical system to manipulate the mechanical system in a safe and efficient manner. Sensors contained in the electrical system are routed back from the microcontroller which contains the software used to process the sensors data and determine an appropriate action. There are three major sections to the software.

[0070] The first section handles the user interface where information is communicated to the user regarding the state of the stroller's mechanical and electrical systems, and where the user can interface with the stroller **10**, for example, to request the stroller **10** to fold or unfold. The second section handles monitoring the state or condition of the stroller **10**. The software will interpret the various signals received from the sensors and determine whether the stroller **10** is in a useable state (e.g., mechanically and structurally sound), whether the stroller **10** is occupied, whether the stroller **10** is broken, etc. The third section handles the motion of the stroller **10** through the folding and unfolding process. Throughout the folding and unfolding process, the software must monitor various safety protocols to protect the occupant, the user, and the mechanics.

[0071] In one embodiment, the software for controlling folding and unfolding comprises an activation sequence controlled through an activation switch **64**. The activation sequence may include obtaining information from one or more object sensors having the ability to detect the presence of objects within the interior portion of the stroller **10** and to interrupt and/or prevent movement of the stroller **10** in the direction toward its collapsed condition when the object sensor detects the presence of an object within the interior portion of the stroller **10**. The object sensor or sensors may be of any known type such as a mechanical weight sensor, a proximity sensor, a motion sensor, a light beam sensor, or any other device having the ability to detect the presence of an object within the interior of the stroller **10**. The sensor or sensors may be electronic and may send a signal that is electrically acted upon to prevent or interrupt power to the motor, and/or the sensors may be mechanical and actuate a physical lock or a brake to prevent further collapsing or the full collapsing movement of the stroller **10**. Sensors may also be used to detect the presence of modular add-on devices

connected to the stroller **10**, such that movement of the stroller **10** to its collapsed condition is prevented when a connected add-on is detected, thereby preventing potential damage to the add-on device.

[0072] In a preferred embodiment, the activation switch **64** is a dead man switch disposed on the handles **44** of the stroller **10**. A dead man switch must be engaged (i.e., pressed downward) throughout the entire opening or closing movement. Releasing the switch pauses the folding or unfolding movement of the stroller **10**. Pressing the switch a second time continues the movement. The switch may further include a twisting element **66** for priming the activation sequence prior to initiating the opening or closing action.

[0073] With reference to **FIG. 19**, a non-limiting embodiment of the activation sequence for the stroller **10** is depicted. As indicated in the exemplary activation sequence, at most times, the stroller **10** control unit is idle. Engagement of a twisting element **66** or dial primes the control unit, essentially waking it up from idle. The activation switch **64** may include an indicator, such as a sound or light, that demonstrates that the control unit has transitioned from idle to primed. After priming, the user initiates activation (opening or closing the stroller **10**) by pressing the activation switch. In certain embodiments, the unit will only remain primed for a limited time period, after which, the unit will "timeout". At that point, the unit may include means to inform the user that the priming has timed out and the unit is returning to idle. When the activation switch **64** is engaged (i.e., depressed), the unit is configured to receive and evaluate safety data from a plurality of safety sensors disposed on the stroller **10**. Relevant safety data includes whether a child is present, whether the clutch is in the manual position, and the battery level of the power supply. The stroller **10** may also monitor external conditions such as whether the stroller is connected to an external power source, in which case folding or unfolding may be prevented. In certain embodiments, the stroller may alert the user of unsafe conditions such as by describing the condition on a visual display **62**. If the sensors indicate that the stroller **10** is safe to fold or unfold, the folding movement is started or resumed. Folding continues until folding is complete or until the activation switch **64** is released to pause the folding process. When folding is paused, the unit remains primed until either the button is pressed to resume folding or until the unit times out and returns to idle.

[0074] The software further includes a frame folding sequence integrated with sensors for determining frame position. The position sensors utilized at selective locations on the frame to send a signal indicative of the positions of one or more components or elements of the stroller **10**. The position sensors can be used for several purposes, such as sending a signal to

the display to provide a visual and/or audio indication to the user as to the current position or of the deployment or the collapsing of the stroller **10**, and/or to provide an interrupting signal (or non-signal) if a position sensor or sensors are not engaged as they would be during proper deployment and/or collapsing of the stroller **10**. Any one or more of several known types of sensors may be utilized, such as rotary encoders at any one or more frame component pivot points, and/or limit or contact switches which are engaged as selective elements of the stroller **10** move to their proper positions, or improper positions, during deployment and/or collapsing of the stroller **10**. By way of example, position sensors may be mounted to the stroller **10** at positions which provide indication that the stroller **10** has moved to its fully-deployed condition, its fully-collapsed condition, or any condition in-between; and/or position sensors may be mounted at locations to detect the engagement or lack of engagement of latches. Position sensors may operate in conjunction with electronic timer controls such that a signal to effect stoppage of power to the motor is sent if the position sensor is not engaged within a predetermined time period.

[0075] With reference to **FIG. 20**, in one preferred and non-limiting embodiment, the frame folding process begins by receiving information about whether the unit power is on, whether the manual clutch override is engaged, and whether the wall charger is plugged in. The unit controller must be turned on during folding. However, folding is prevented when the clutch is in the manual position and when the stroller is plugged into a wall charger. When folding is activated by pressing the activation button, the unit receives information from a plurality of frame sensors including the status of the parallelogram linkage **16** (latched or unlatched), the location of the sliding joint **40** (down or up), or whether the telescoping tube is extended or nested. The information from the frame sensors is used to determine whether the stroller **10** is in the open or closed position. Based on the information, actuation of the stroller **10** open or stroller **10** close functionality occurs. During actuation, the unit continues to monitor the frame sensors to determine when opening or closing is complete. If folding or unfolding is completed, the user is notified that the action was successful. Otherwise, the user is alerted that a folding error occurred. It is noted that, as described with regard to the activation sequence, the user can pause folding by releasing the dead man switch. Folding is resumed by pressing the switch to continue folding or unfolding actuation. If the unit remains paused for a period of time, folding times out and the unit returns to the idle or stop folding position until the user reactivates the system by priming the activation switch.

[0076] Although a collapsible stroller **10** has been described in detail for the purpose of illustration, it will be appreciated by those skilled in the art that various modifications and alternatives to those details could be developed in light of the overall teachings of the disclosure. Accordingly, the particular arrangements disclosed are meant to be illustrative only and not limiting as to the scope of invention which is to be given the full breadth of the claims appended and any and all equivalents thereof. Further, although the invention has been described in detail for the purpose of illustration based on what is currently considered to be the most practical and preferred embodiments, it is to be understood that such detail is solely for that purpose and that the invention is not limited to the disclosed embodiments, but, on the contrary, is intended to cover modifications and equivalent arrangements that are within the spirit and scope of the appended claims. For example, it is to be understood that the present invention contemplates that, to the extent possible, one or more features of any embodiment can be combined with one or more features of any other embodiment.

THE INVENTION CLAIMED IS

1. A stroller comprising:

a right frame and a left frame each frame comprising a front support rotatably connected to a rear support at a frame joint, the front support of each frame being a telescoping tube assembly comprising:

an outer tube extending from an end of the front support to the frame joint of the support;

an inner tube assembly partially inserted within the outer tube and protruding from the outer tube; and,

a slot extending longitudinally along at least a portion of the outer tube;

a linkage comprising at least two substantially rigid members connected between the right frame and the left frame, the rigid members being connected to the front supports at a right slideable joint and a left slidable joint, the joints being received within the slot of the outer tube; and,

a frame drive mechanism coupled to the right or left frame,

wherein the front support and the rear support of the right frame and the left frame are movable from an open position to a closed position by the drive mechanism, and

wherein transitioning the stroller from the open position to the closed position causes the slideable joints to slide downward along the slots of the outer tube.

2. The stroller of claim 1, wherein the inner tube assembly comprises:

an inner tube which is inserted partially within the outer tube and protrudes from the outer tube at the frame joint;

a tube stiffening member inserted within the outer tube and disposed below the slideable joint when the front support is in the open position, the tube stiffener having a slot which corresponds with the slot of the outer tube; and,

an extension member extending between an end of the inner tube which is inserted in the outer tube and the slidable joint.

3. The stroller of claim 2, wherein the extension member is configured to push the slideable joint longitudinally through the slot of the tube stiffener and the slot of the outer tube when the stroller transitions from the open position to the closed position and wherein the extension member is received within the slot of the tube stiffener.

4. The stroller of claim 2, wherein the tube stiffener further comprises an unbroken sidewall completely enclosing a hollow portion extending longitudinally through the tube stiffener.

5. The stroller of claim 1, wherein the frame drive mechanism comprises a cable drive, at least one spool rotated by the cable drive, and a cable received by the spool, wherein the cable is coupled to the inner tube.

6. The stroller of claim 5, wherein the cable drive is in direct rotational connection with the spool.

7. The stroller of claim 5, wherein the cable is formed of a synthetic polymer, preferably ultra high molecular weight polyethylene.

8. The stroller of claim 5, further comprising a biasing member connected in series with the cable for removing slack from the cable while the drive mechanism is engaged.

9. The stroller of claim 1, wherein the linkage is a scissor linkage configured such that the rigid members are connected between the front support of one frame and the rear support of the other frame and wherein the rigid members of the scissor linkage are connected at a rotatable center joint such that as the stroller transitions from the open position to the closed position, the rigid members rotate about the center joint bringing ends of the rigid members closer together.

10. The stroller of claim 1, wherein the drive mechanism is powered by a battery, an electrical generator, a spring, compressed air, or any combination thereof.

11. The stroller of claim 1, further comprising an activation button for engaging the drive mechanism and wherein the activation button is a dead man switch.

12. The stroller of claim 1, further comprising a screen for presenting information to a user, wherein the information includes air temperature, battery power, time, speed, or distance traveled.

13. The stroller of claim 1 further comprising a parallelogram linkage connected between the right frame and the left frame, the parallelogram linkage comprising: a foldable upper horizontal member; a foldable lower horizontal member approximately parallel to the upper horizontal member; and, a latch, which when engaged, maintains the members in an extended position and when disengaged permits the members to fold.

14. The stroller of claim 13, further comprising a parallelogram drive mechanism coupled to the parallelogram linkage for transitioning the horizontal members of the parallelogram linkage from the extended position to the folded position.

15. The stroller of claim 14, wherein the parallelogram drive mechanism and the frame drive mechanism are coupled to operate concurrently.

16. The stroller of claim 1, further comprising a storage assembly, the assembly comprising, a storage bag, at least one cable fixedly attached to the right frame and at least one cable fixedly attached to the left frame, and a flexible joint for connecting the cables to the bag, wherein the storage assembly is configured such that the bag remains in an expanded position when the frame moves from the open position to the closed position.

17. A stroller comprising:

a right frame and a left frame, each frame comprising a front support rotatably connected to a rear support at a frame joint;

a parallelogram linkage connected between the right frame and the left frame comprising a foldable upper horizontal member, a foldable lower horizontal member approximately parallel to the upper horizontal member, and, a latch, which when engaged, maintains the members in an extended position and when disengaged permits the members to move to a folded position; and,

a drive mechanism coupled to the frame or parallelogram linkage,

wherein the front support and the rear support of the right frame and the left frame are movable from an open position to a closed position,

wherein the horizontal members of the parallelogram linkage transition from the extended position to the folded position concurrently with the transition of the frame from the open position to the closed position, and

wherein movement of the frames or transition of the parallelogram linkage is effectuated by the drive mechanism.

18. The stroller of claim 17, wherein the drive mechanism comprises a drive, a gear engaged with and driven by the drive, and a locking member connected to the gear.

19. The stroller of claim 18, wherein the locking member engages the upper or lower horizontal member of the parallelogram linkage for transitioning the parallelogram linkage from the extended position to the folded position.

20. The stroller of claim 18, wherein the drive mechanism includes a manual clutch configured to selectively engage and disengage the drive from the gear.

21. The stroller of claim 20, wherein when the drive is being engaged with the gear, the drive is configured to apply a light preload pressure to align the drive and gear, before a full force of the drive is applied.

22. A stroller comprising:

a frame moveable from an open position to a closed position; and,

a drive mechanism coupled to a portion of the frame, the drive mechanism comprising:

a cable drive;

a spool rotated by and in direct rotational connection with the cable drive;

a cable received by the spool; and,

a biasing member connected in series with the cable for removing slack from the cable when the drive mechanism is engaged.

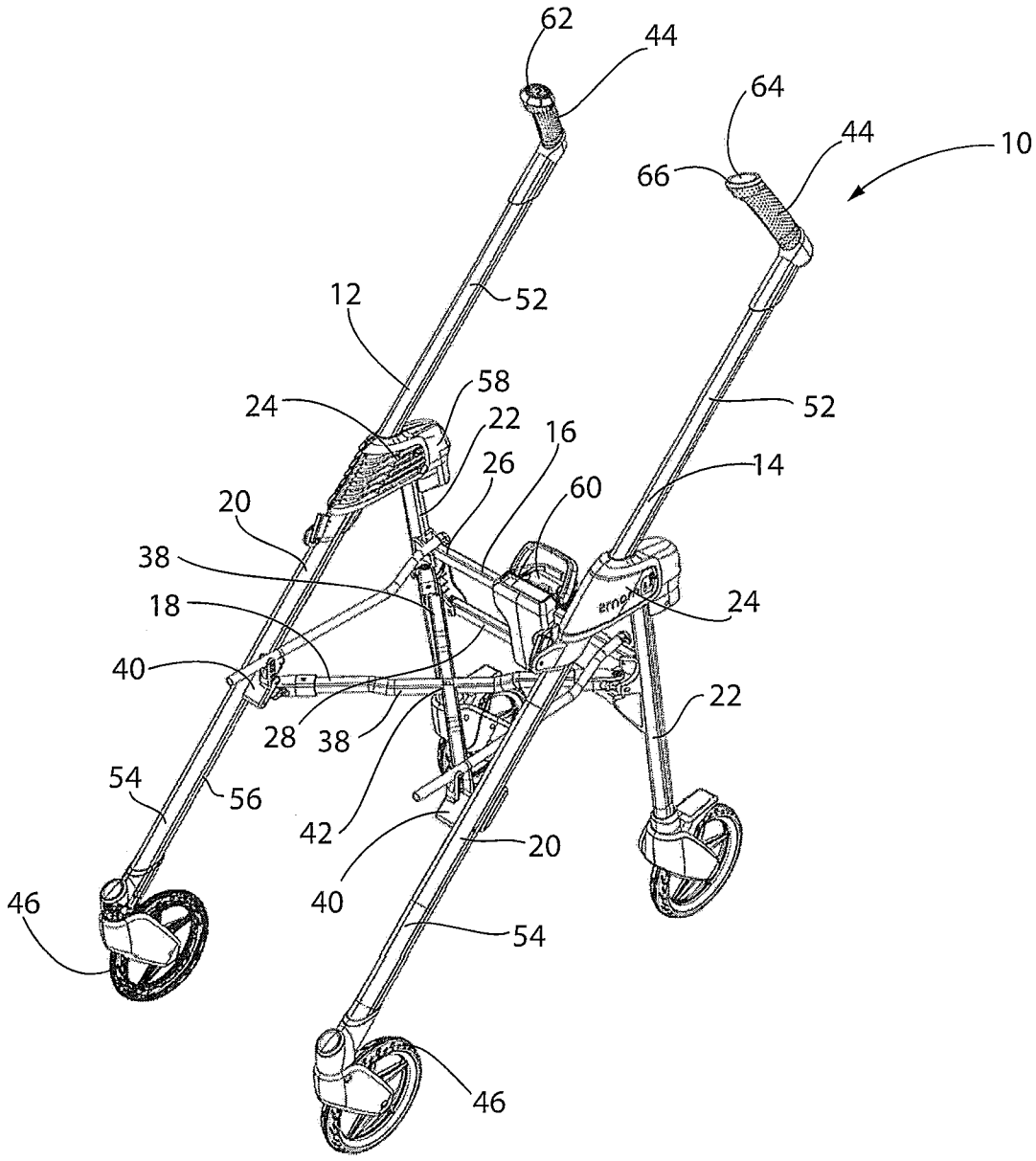

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FIG. 1

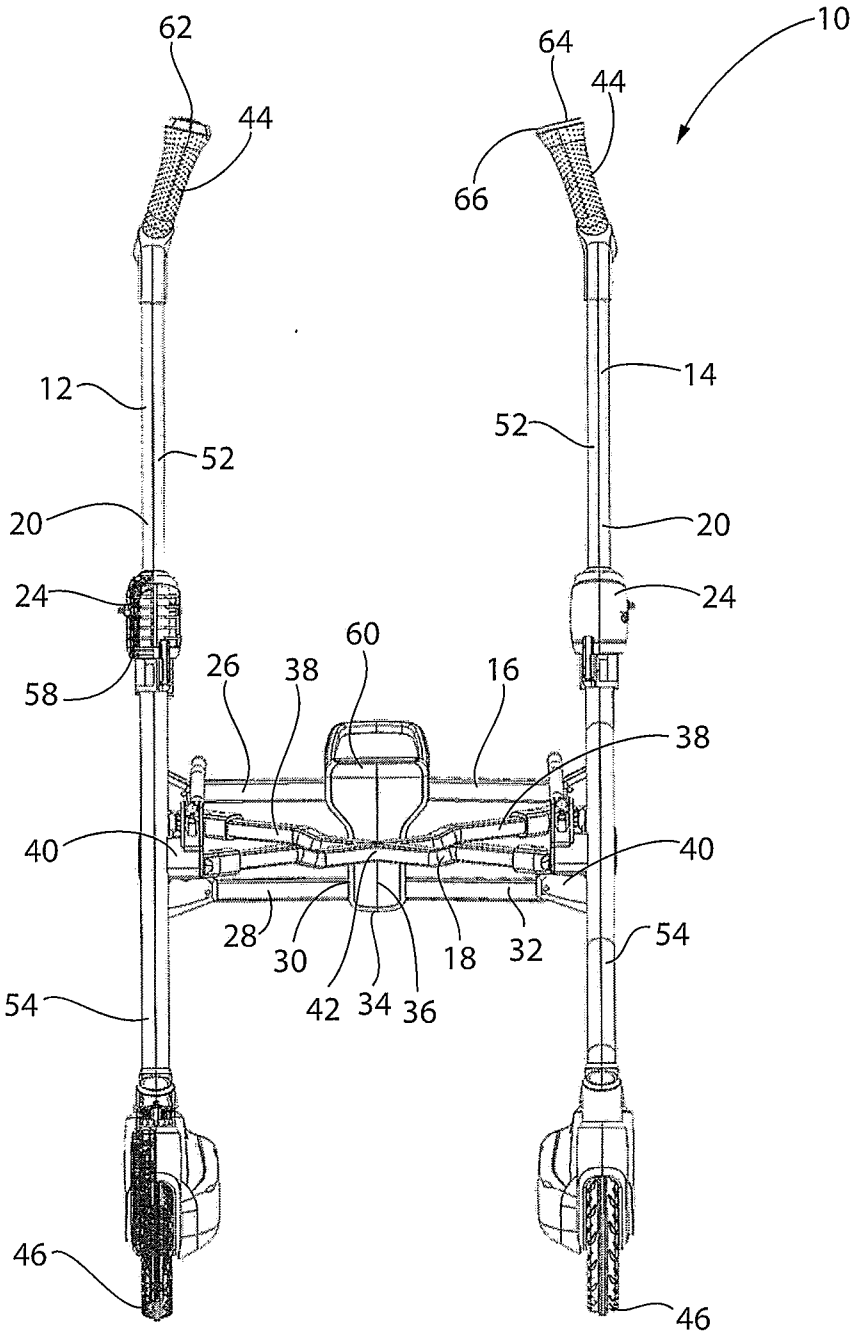

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FIG. 2

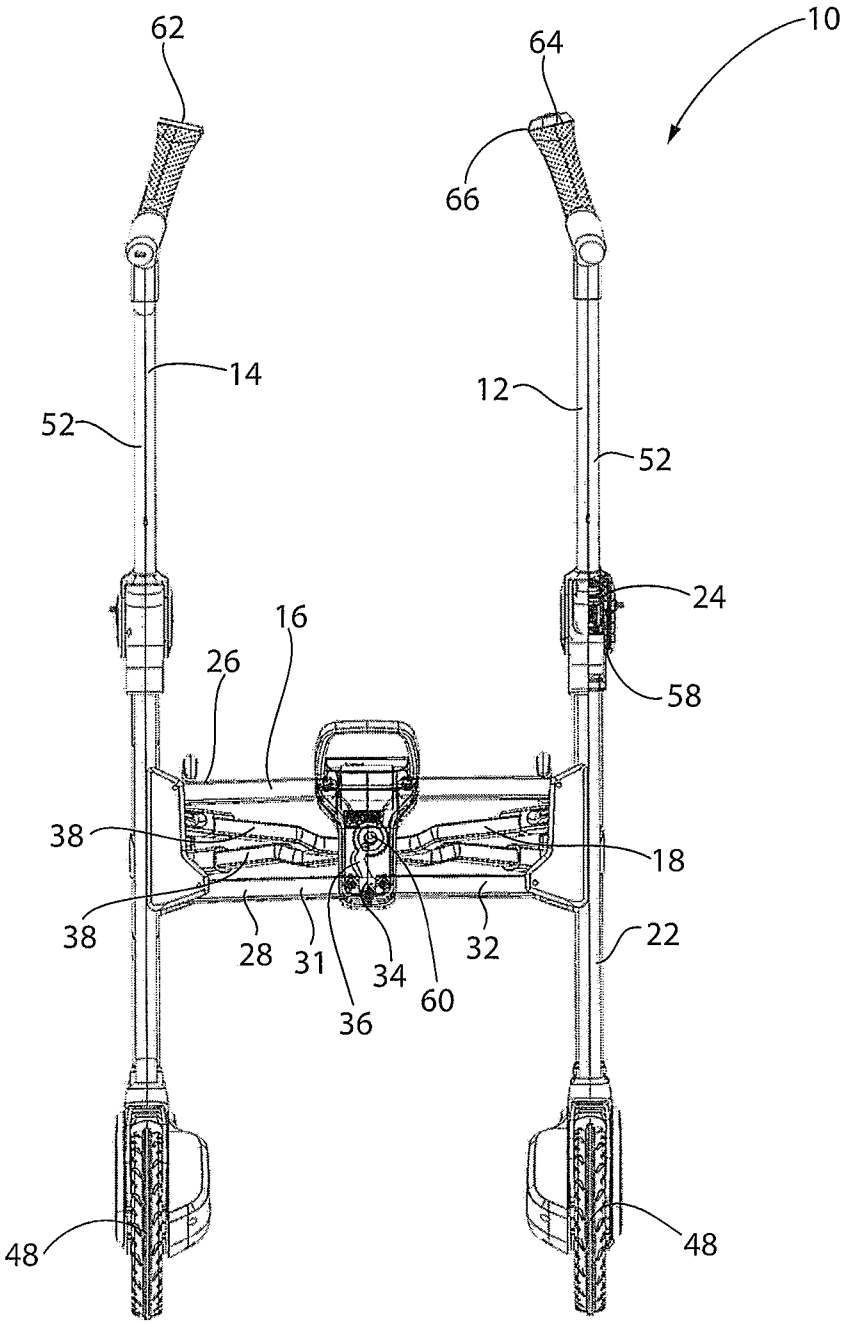


FIG. 3

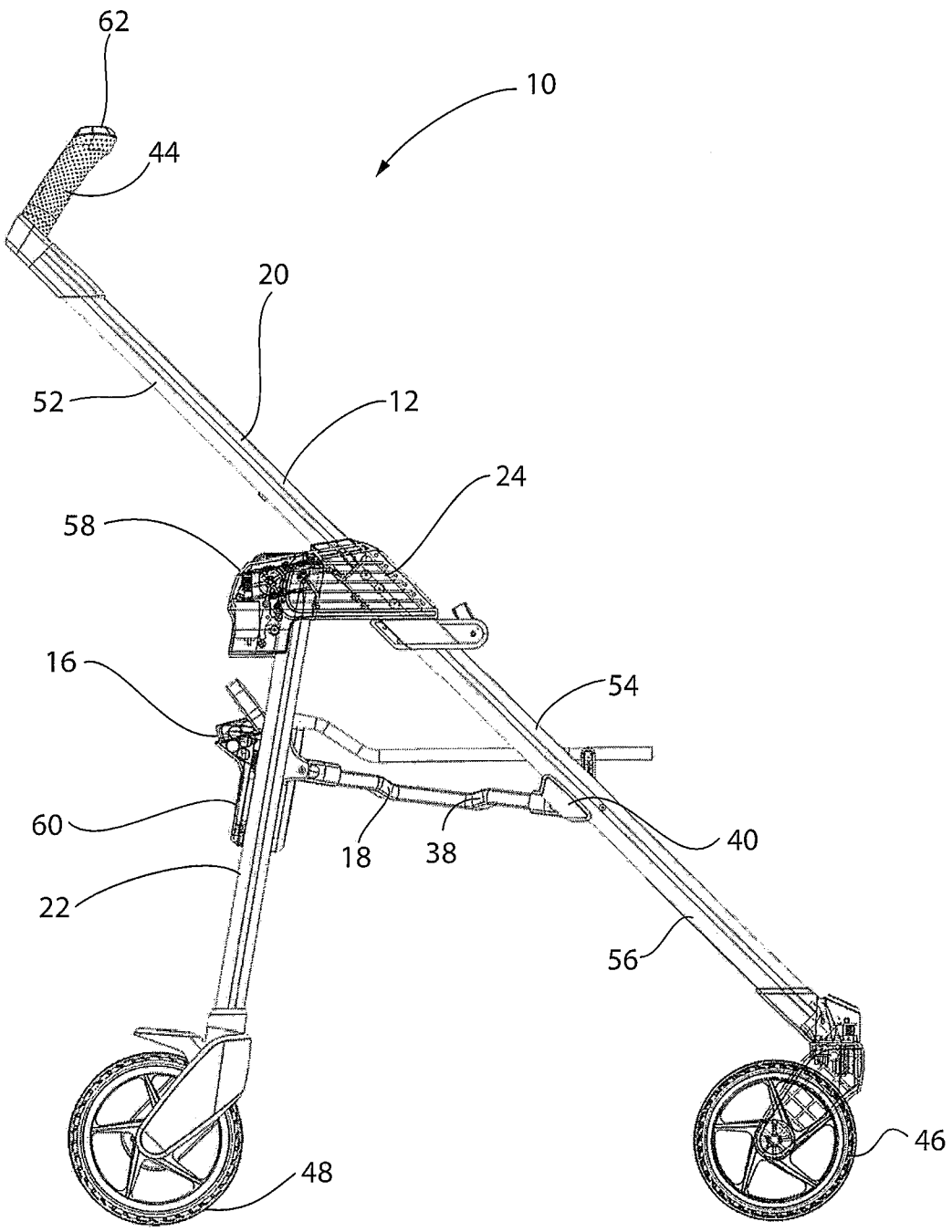


FIG. 4

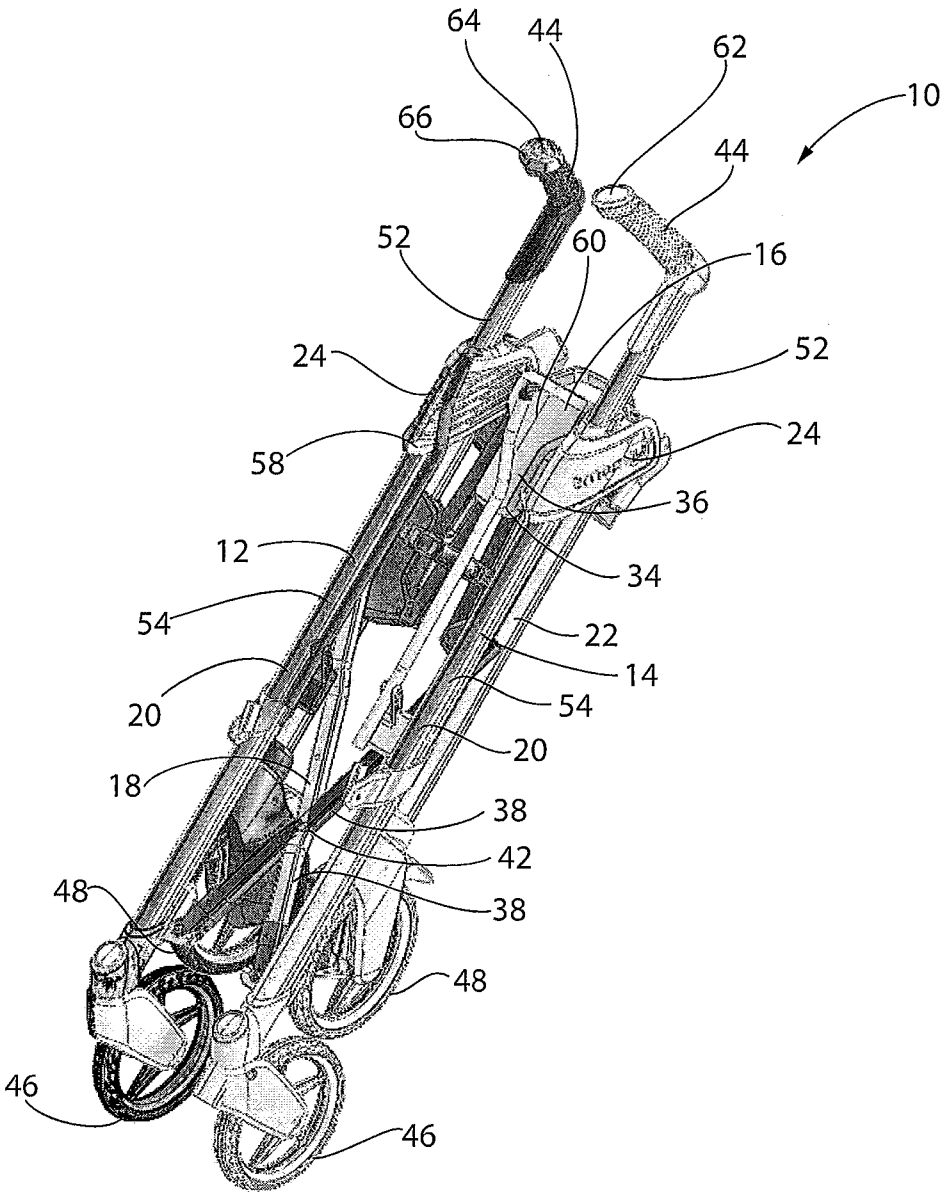

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FIG. 5

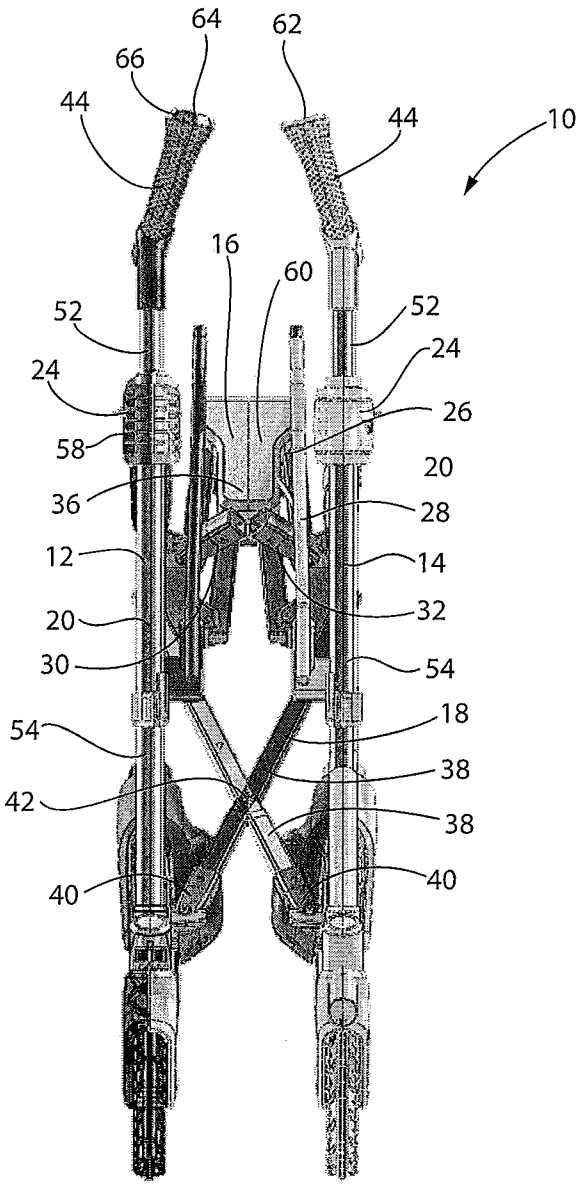

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FIG. 6

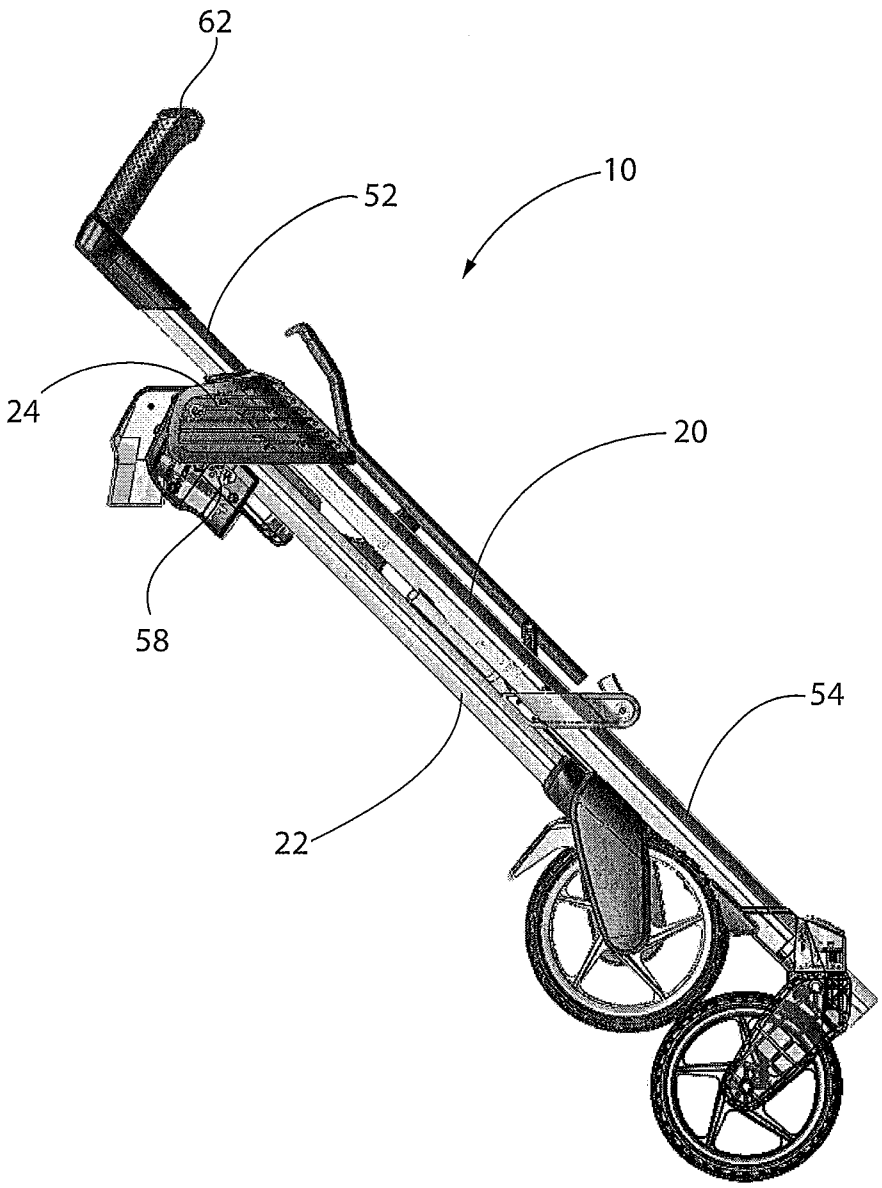


FIG. 7

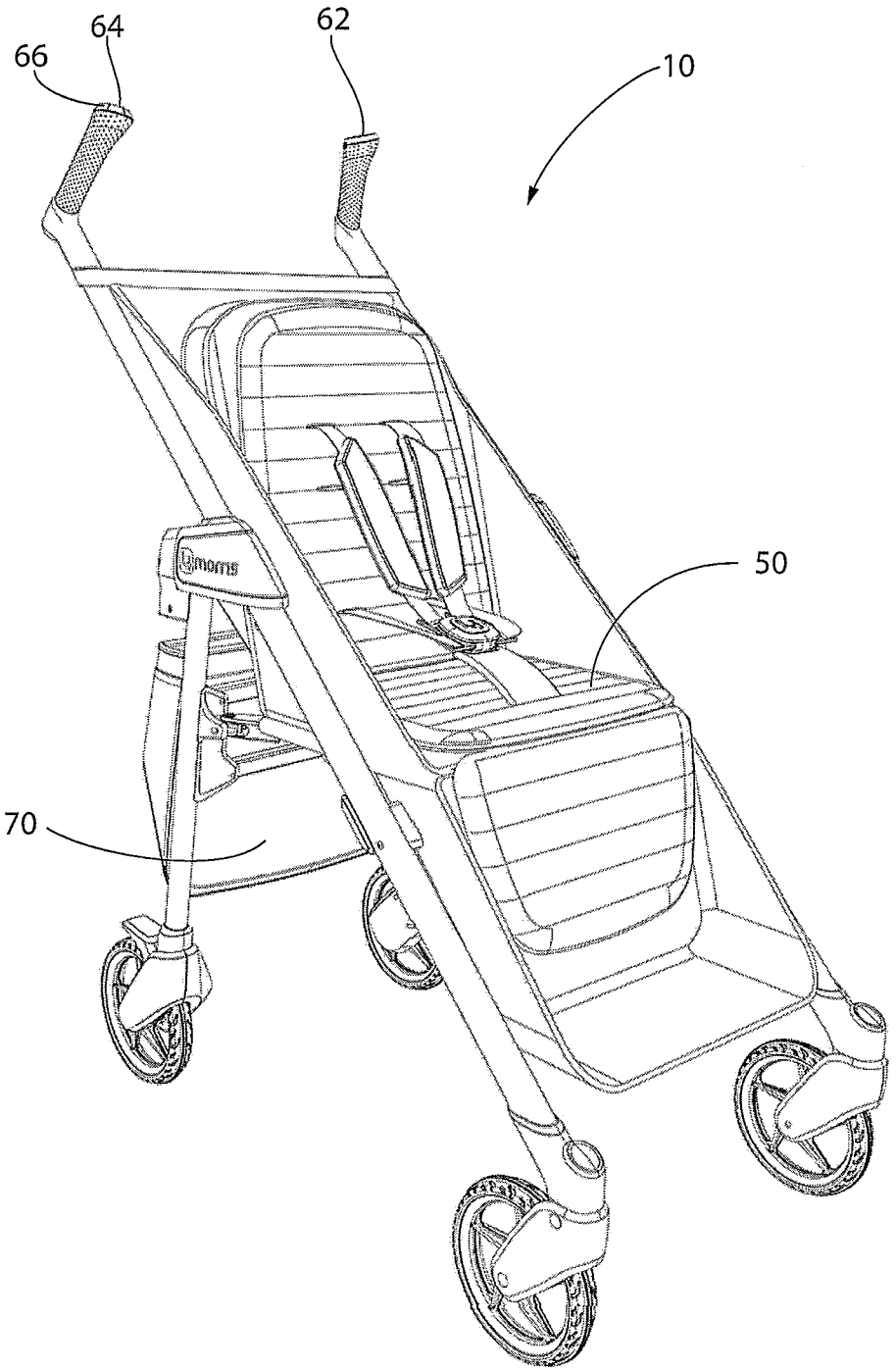


FIG. 8

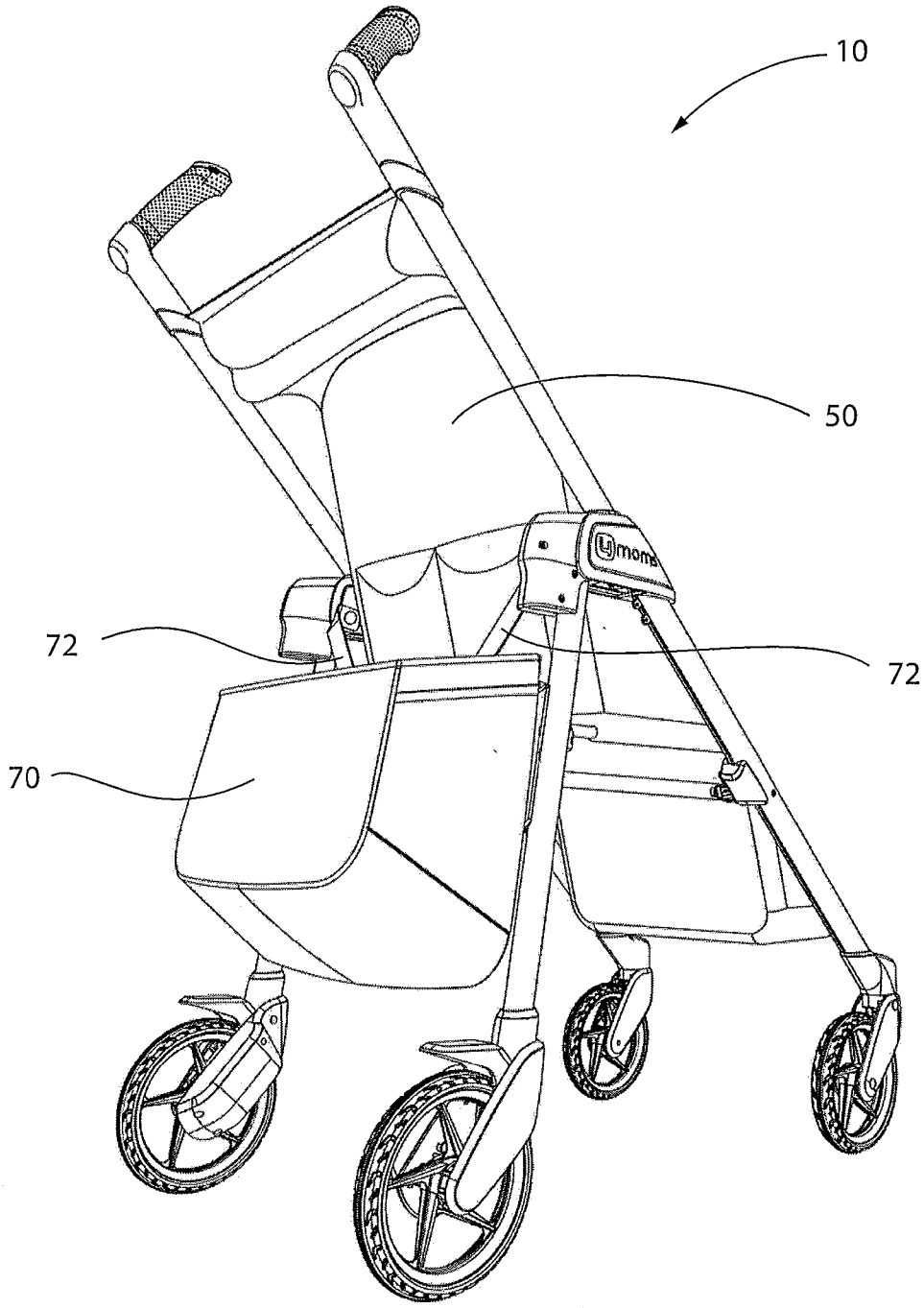


FIG. 9

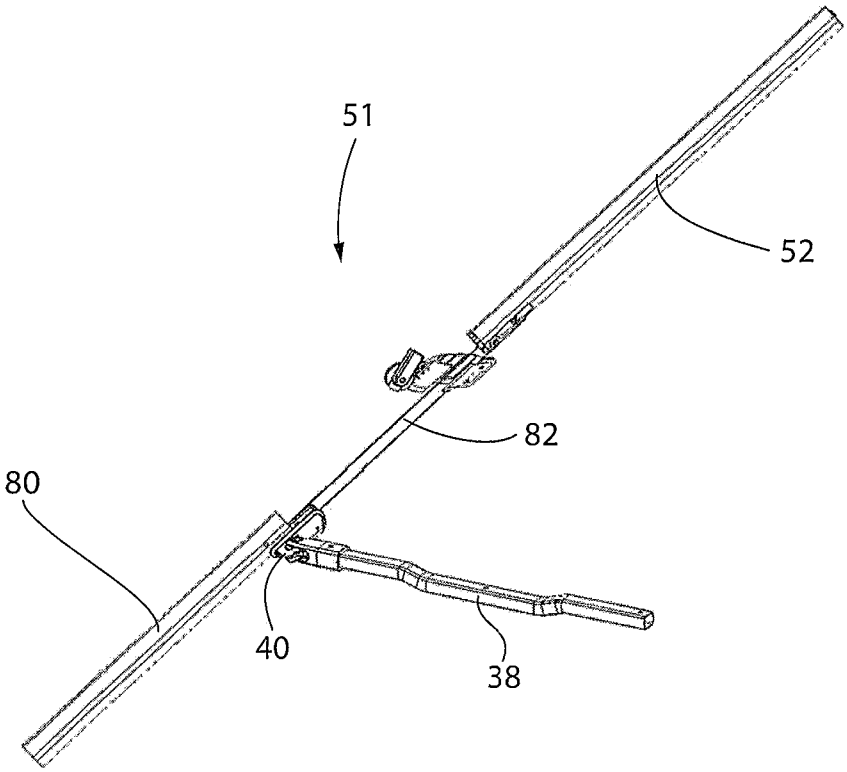


FIG. 10

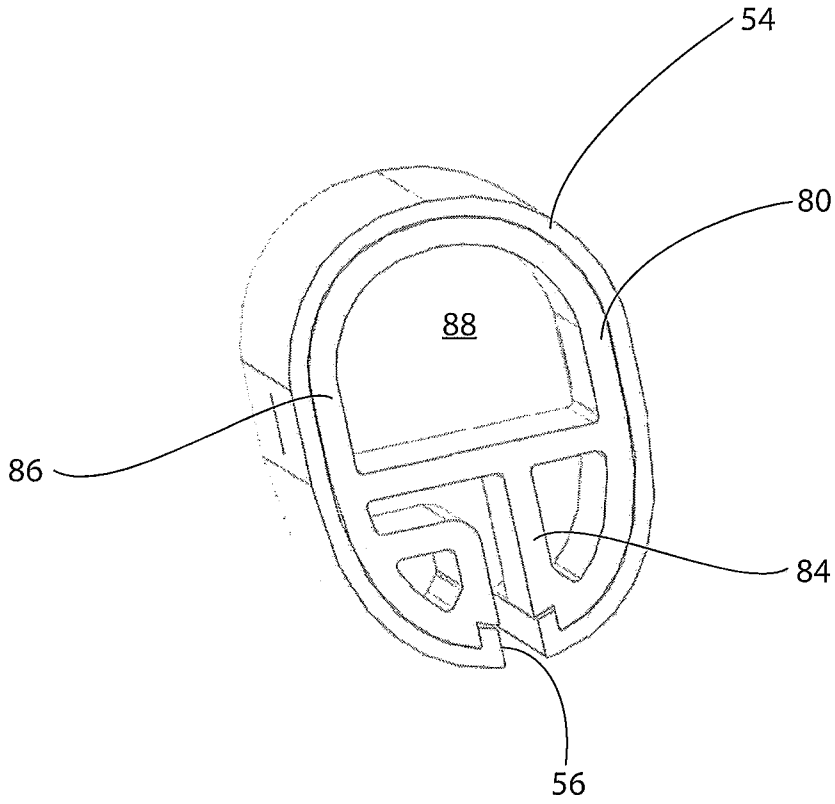


FIG. 11

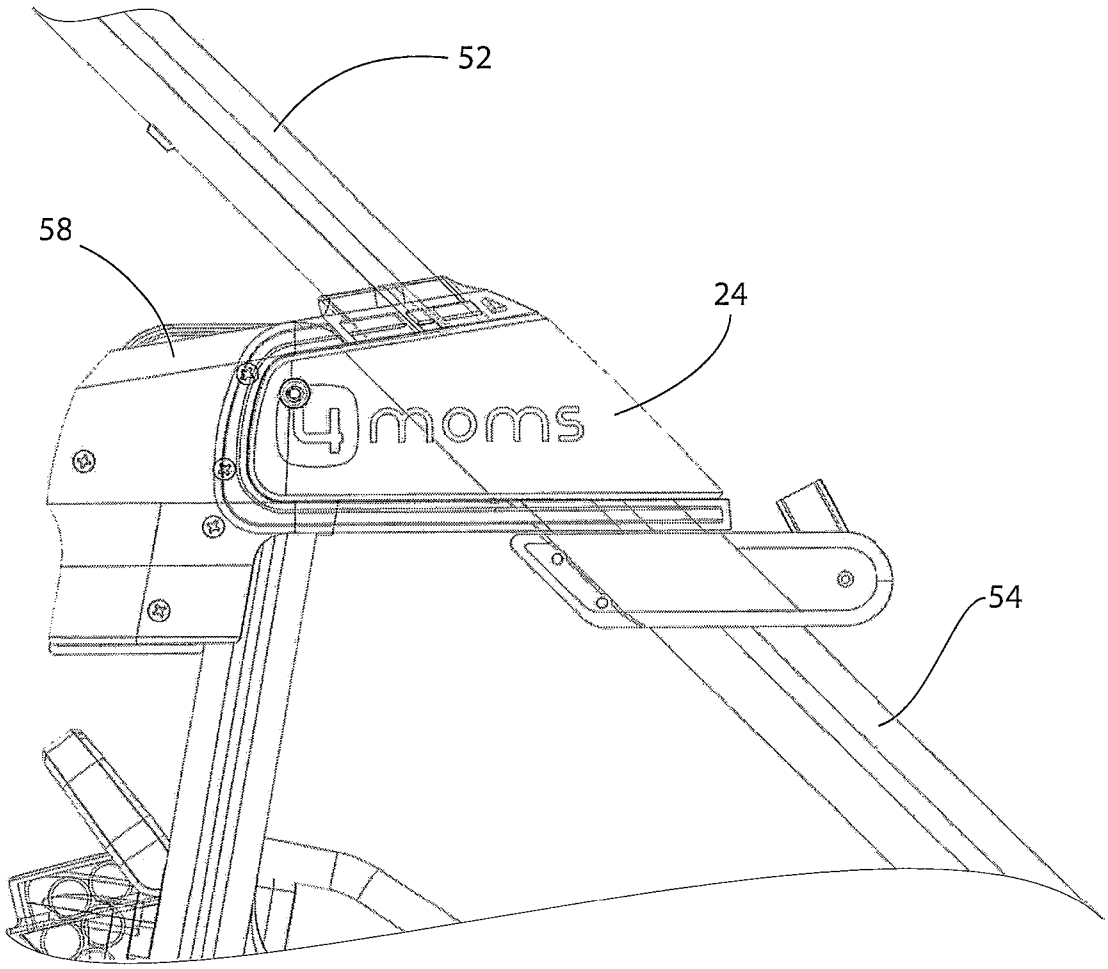


FIG. 12

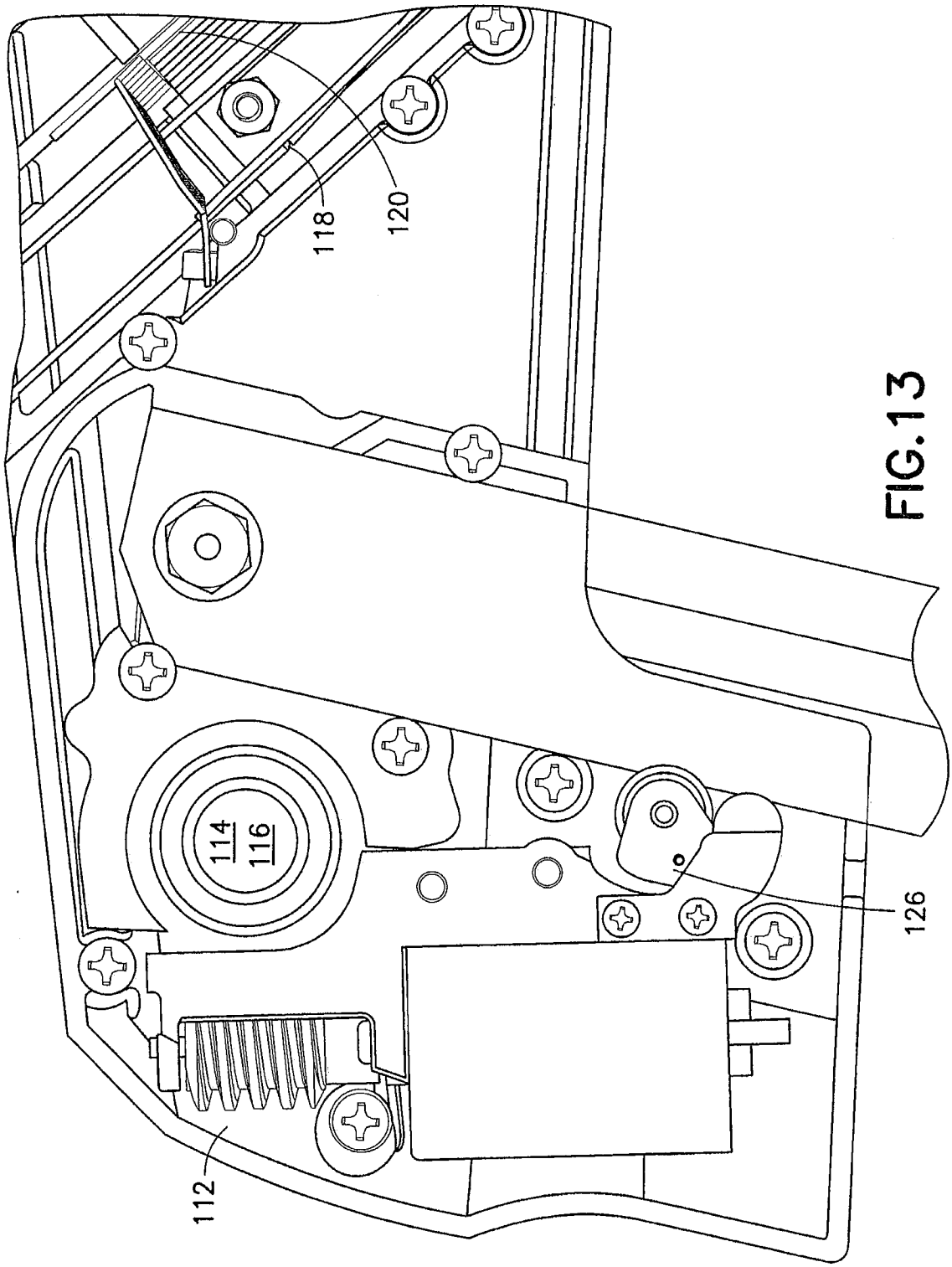


FIG.13

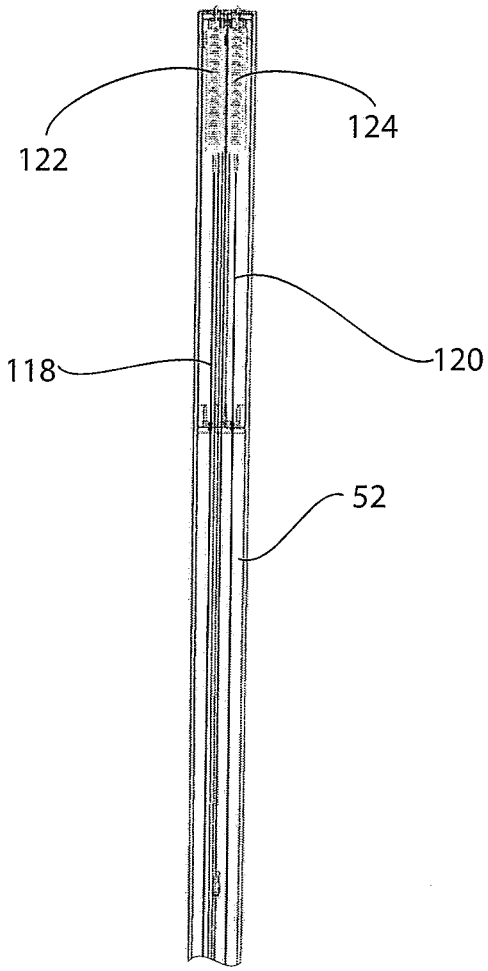


FIG. 14

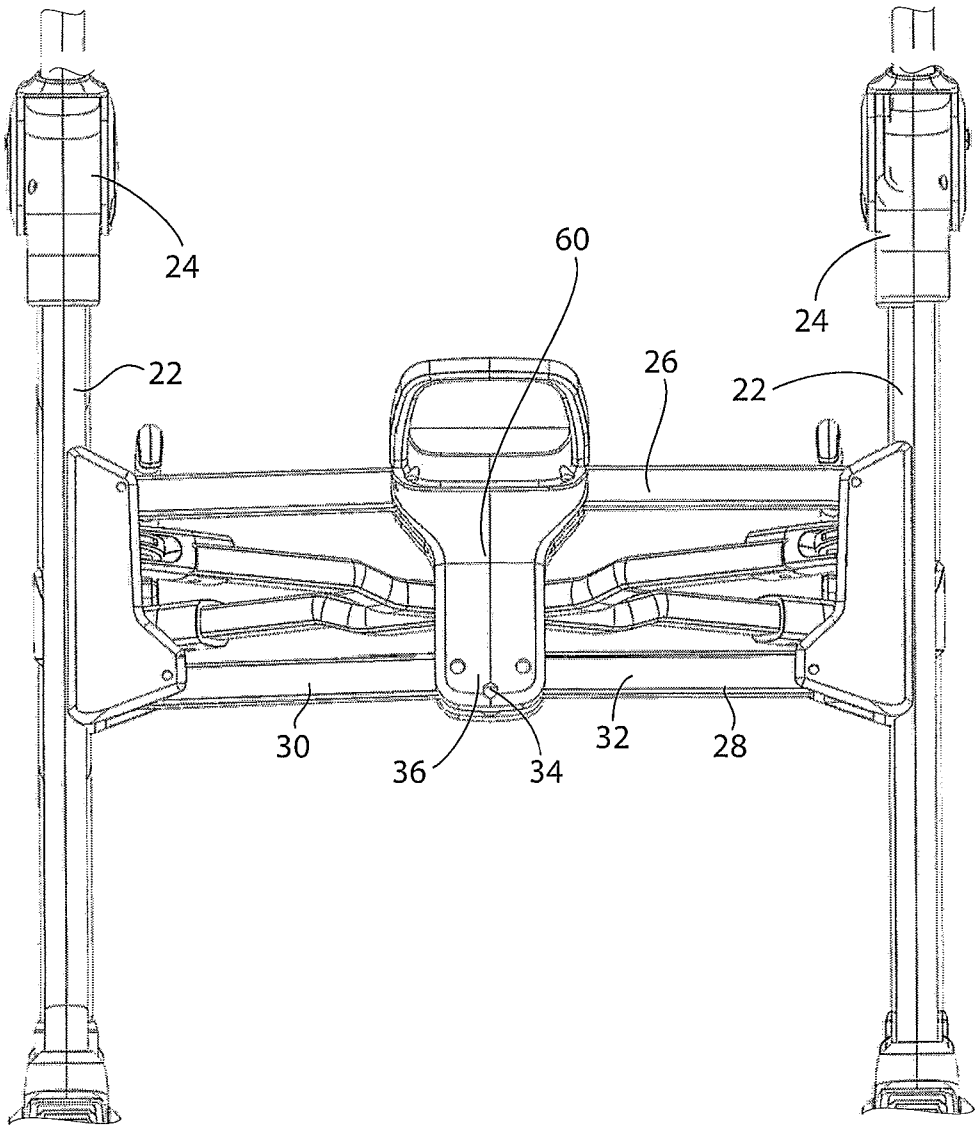


FIG. 15

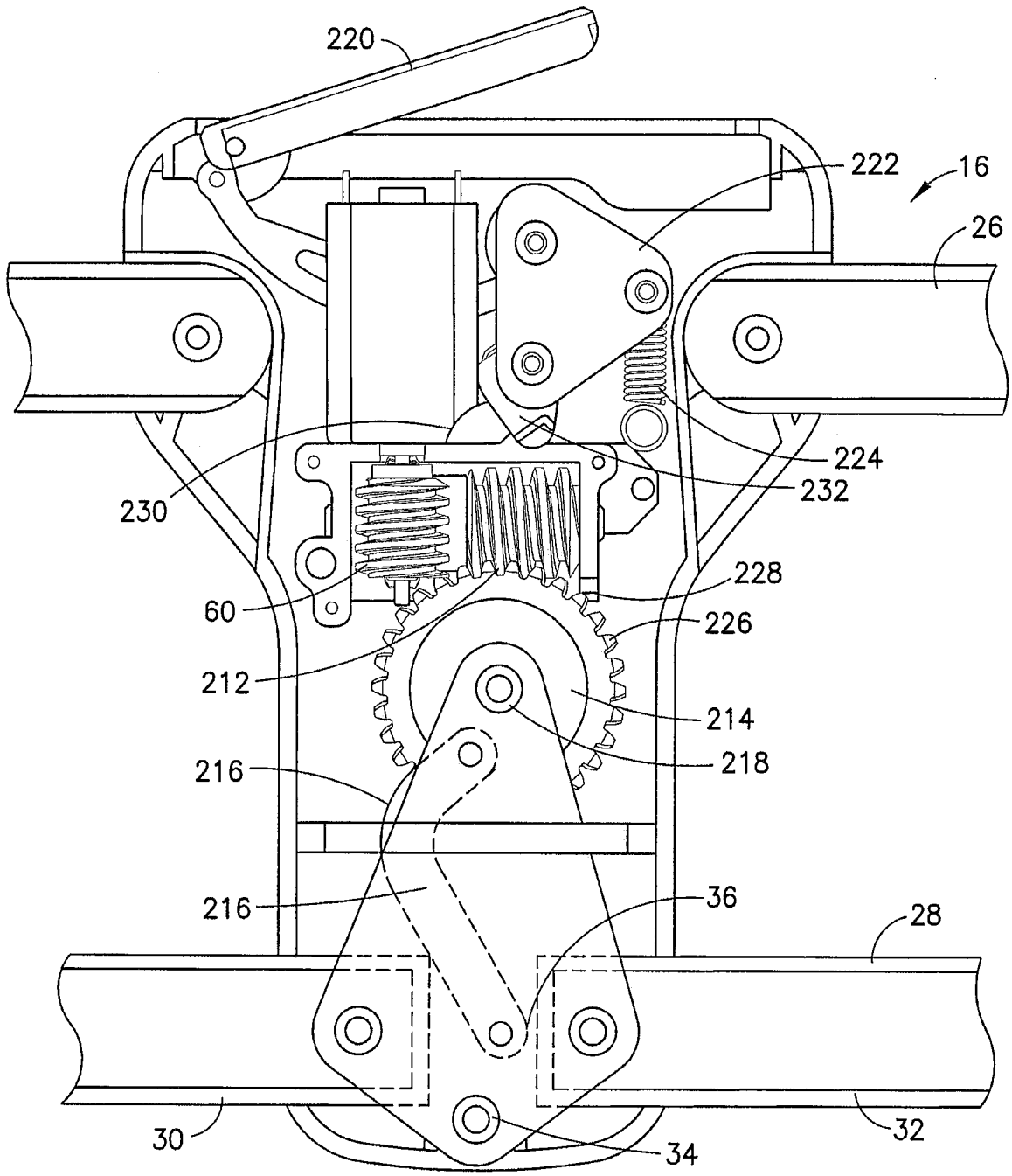

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FIG.16

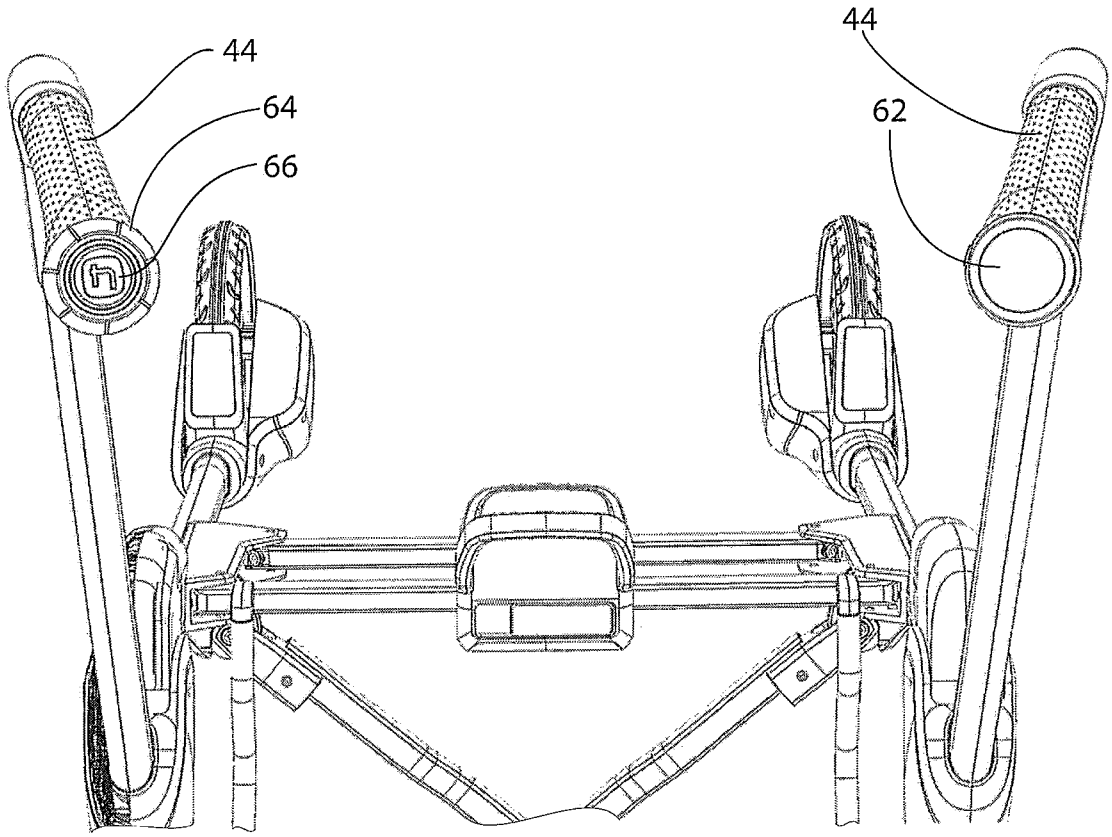


FIG. 17

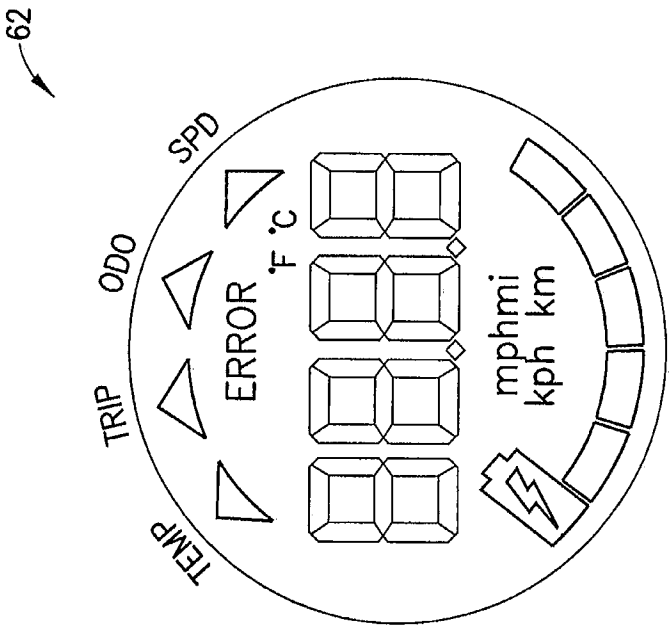


FIG. 18

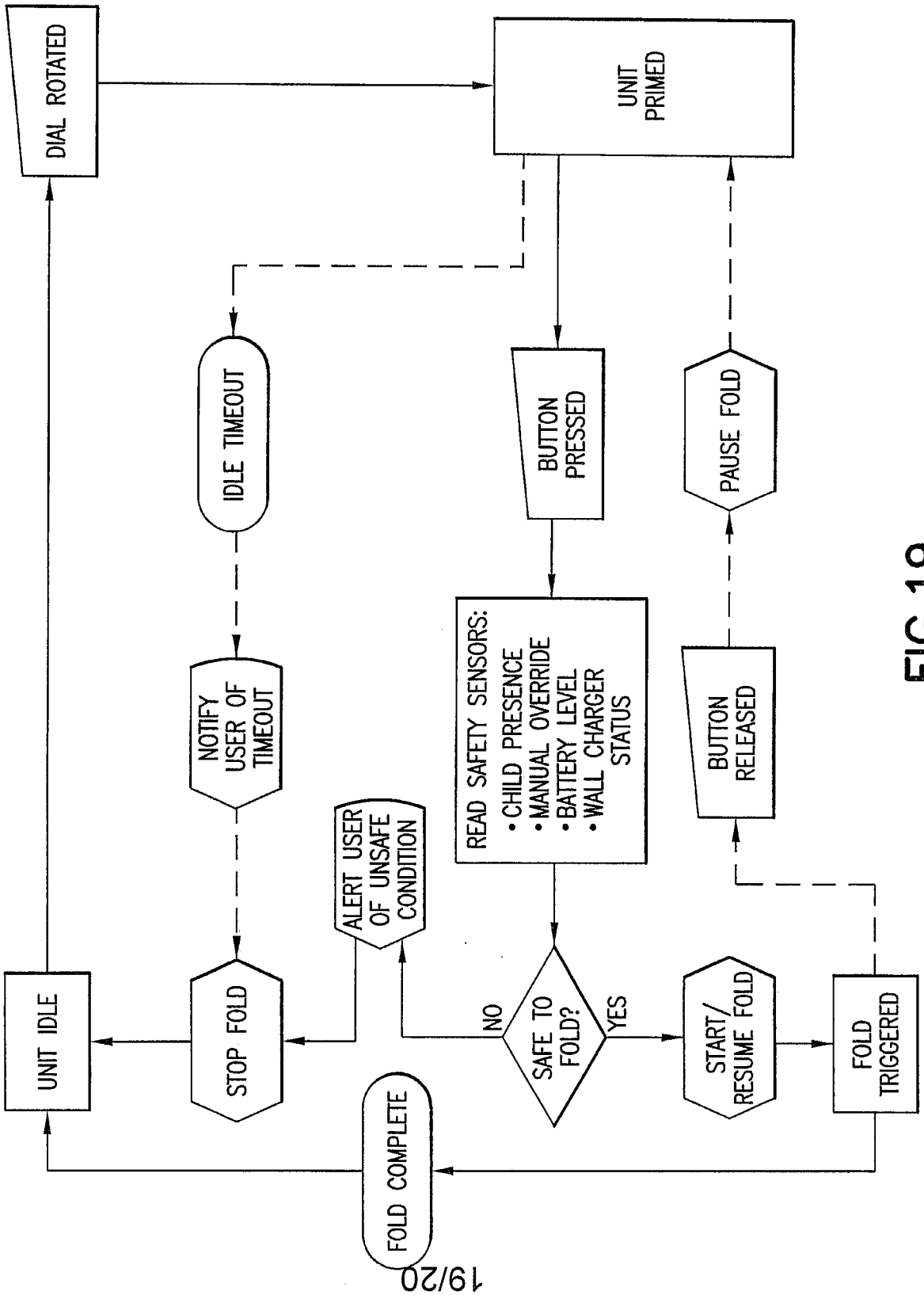

DIAL ROTATED
UNIT PRIMED
IDLE TIMEOUT
BUTTON PRESSED
PAUSE FOLD
NOTIFY USER OF TIMEOUT
READ SAFETY SENSORS:
• CHILD PRESENCE
• MANUAL OVERRIDE
• BATTERY LEVEL
• WALL CHARGER STATUS
BUTTON RELEASED
ALERT USER OF UNSAFE CONDITION
UNIT IDLE
STOP FOLD
NO
SAFE TO FOLD?
YES
START/ RESUME FOLD
FOLD TRIGGERED
FOLD COMPLETE

FIG.19

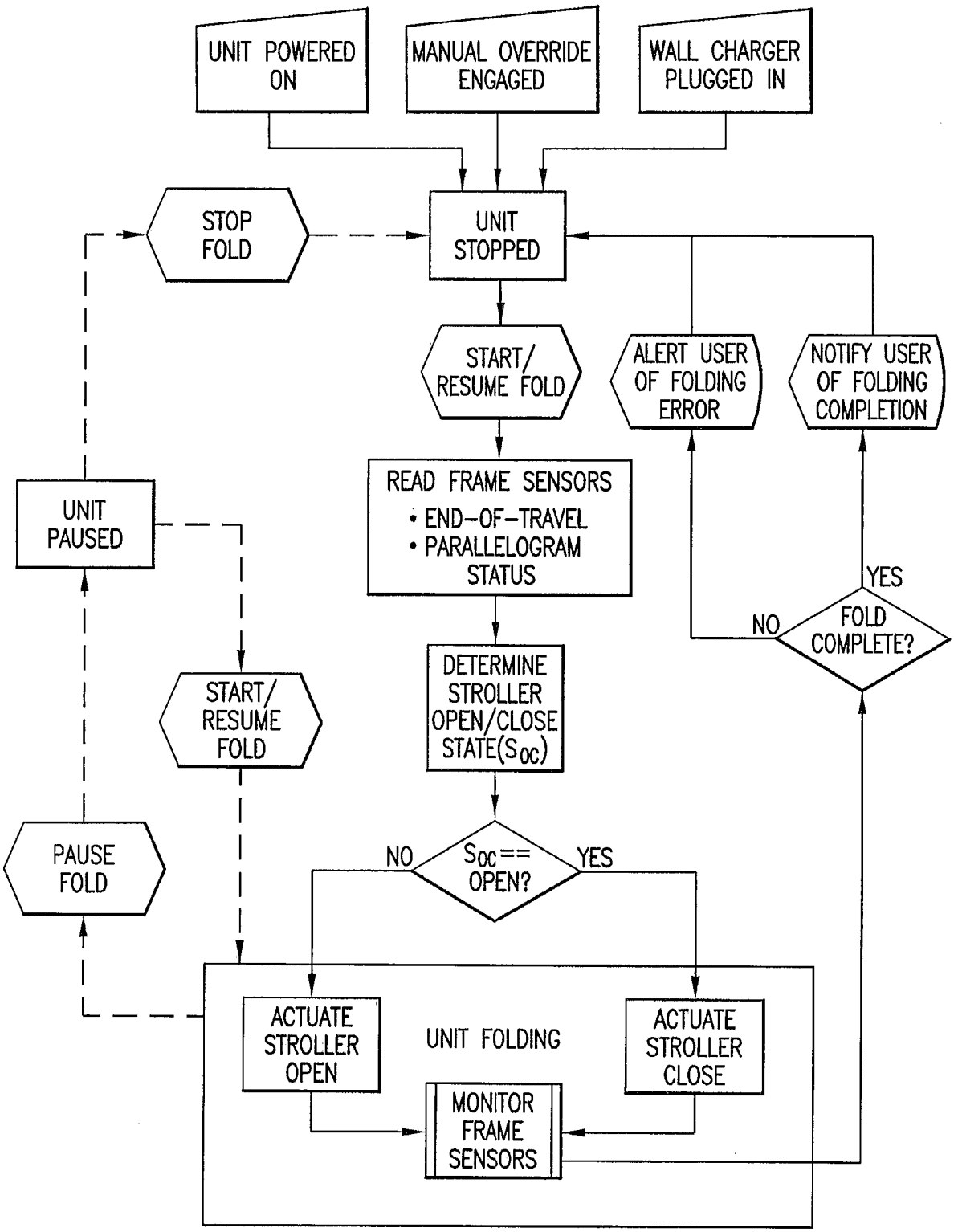

UNIT POWERED ON
MANUAL OVERRIDE ENGAGED
WALL CHARGER PLUGGED IN
STOP FOLD
UNIT STOPPED
START/ RESUME FOLD
ALERT USER OF FOLDING ERROR
NOTIFY USER OF FOLDING COMPLETION
READ FRAME SENSORS
• END-OF-TRAVEL
• PARALLELOGRAM STATUS
UNIT PAUSED
YES
NO
FOLD COMPLETE?
START/ RESUME FOLD
DETERMINE STROLLER OPEN/CLOSE STATE(S_{OC})
PAUSE FOLD
NO
S_{OC} == OPEN?
YES
ACTUATE STROLLER OPEN
UNIT FOLDING
ACTUATE STROLLER CLOSE
MONITOR FRAME SENSORS

FIG.20

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/064119

A. CLASSIFICATION OF SUBJECT MATTER

B62B 7/06(2006.01)i, B62B 9/12(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B62B 7/06; B62B 7/08; F16C 11/10; B62B 7/12; B62B 7/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: stroller, support, frame, tube, and linkage

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	US 2011-0175305 A1 (CHEN et al.) 21 July 2011 See paragraphs [0024]-[0026],[0040] and figure 1.	1,5-6,8-9,13-14,16-17 2-4,7,10-12,15,18-22
Y	US 2006-0066076 A1 (CHURCH, GRAHAM) 30 March 2006 See paragraphs [0011]-[0015] and figure 1.	1,5-6,8-9,13-14,16
X Y	US 2010-0209179 A1 (WU, SUNG-TSUN) 19 August 2010 See paragraphs [0016]-[0017] and figures 2-3,5.	22 5-6,8
Y	EP 1967439 A2 (GIOCHI, PREZIOSI S.P.A) 27 February 2008 See paragraphs [0015],[0053] and figure 2.	13-14,17
A	US 2002-0041083 A1 (BRITTON et al.) 11 April 2002 See paragraph [0065] and figures 3-4,7-8.	1-22

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 March 2013 (27.03.2013)	**29 March 2013 (29.03.2013)**
Name and mailing address of the ISA/KR Korean Intellectual Property Office 189 Cheongsa-ro, Seo-gu, Daejeon Metropolitan City, 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Authorized officer CHOI, Hyun Goo Telephone No. 82-42-481-8288

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2012/064119

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