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FOLDABLE WAGON

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(71) Applicant(s)
ZHEJIANG HENGFENG TOP LEISURE CO., LTD

(72) Inventor(s)
YANG, Baoqing

(74) Agent / Attorney
Michael Buck IP, PO Box 78, Red Hill, QLD, 4059, AU

ABSTRACT

A foldable wagon is disclosed according to the present disclosure. The foldable wagon has a frame that is collapsible in a manner such that the wagon basically has the same vertical height when in the collapsed and expanded configurations. The frame has folding bar assemblies on its sides. As the wagon is altered from the expanded to the collapsed configurations, the lower leg outer end of each of the pair of folding bar assemblies slides downward relative to the corresponding upper leg outer on the respective vertically oriented pole. The pairs of folding bar assemblies increase in height and decrease in length. As wagon is altered from the collapsed to the expanded configuration, the lower leg outer end of each of the pair of folding bar assembly slides upward relative to the corresponding upper leg outer end s on the respective vertically oriented pole, and the pairs of folding bar assemblies decrease in height and increase in length.

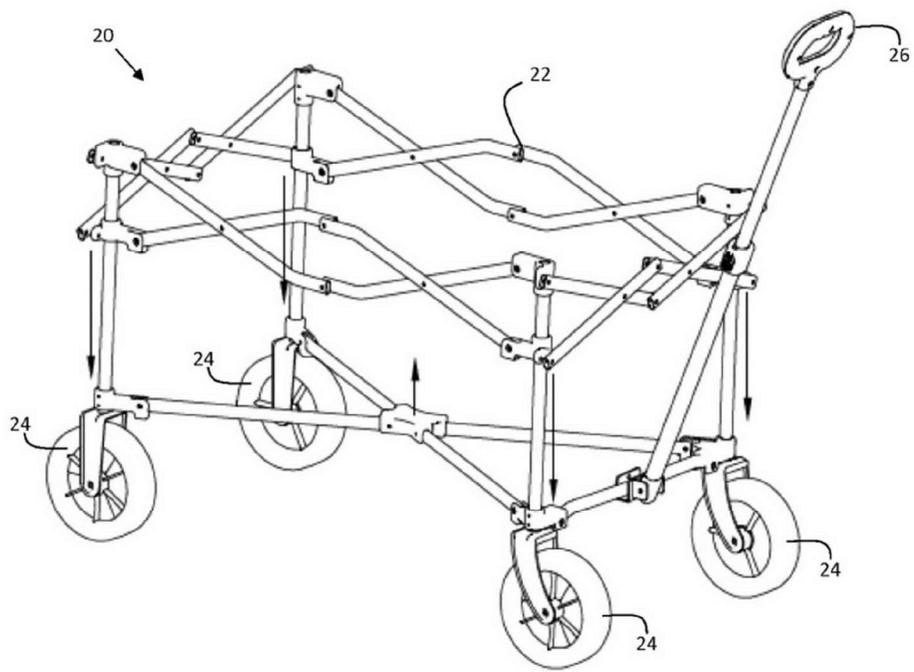


Fig. 1

FOLDABLE WAGON

FIELD

[0001] This disclosure pertains to hand-drawn wagons. More particularly, the present disclosure pertains to a foldable wagon.

BACKGROUND

[0002] The conventional wagon has a relatively large volume when in the collapsed configuration, and cannot be stored in a minimal amount of space. How to provide a wagon with a relatively small volume is currently an urgent problem to be solved by those skilled in the art.

SUMMARY

[0003] An object of the present disclosure is to provide a wagon. In order to achieve the above object, the following technical solutions are provided according to the present disclosure.

[0004] A wagon, which is adjustable between an expanded configuration and a collapsed configuration, includes:

a frame, where the frame has four sides, each side is formed by a pair of folding bar assemblies, the pair of folding bar assemblies of each side of the frame has opposite upper leg outer ends and opposite lower leg outer ends, the frame also has a vertically oriented pole at an intersection of the pair of folding bar assemblies of one side with the pair of folding bar assemblies of an adjacent transverse side, the upper leg outer end of each of the pair of folding bar assemblies is operatively connected to the vertically oriented pole, the lower leg outer end of each of the pair of folding bar assemblies is operatively slidingly connected to the vertically oriented pole, wherein when the wagon is

in the expanded configuration, each of the lower leg outer ends of the pairs of folding bar assemblies has a first distance to each of the corresponding upper leg outer ends of the pairs of folding bar assemblies along the respective vertically oriented poles, wherein when the wagon is in the collapsed configuration, each of the lower leg outer ends of the pairs of folding bar assemblies has a second distance to each of the corresponding upper leg outer ends of the pairs of folding bar assemblies along the respective vertically oriented poles, and the second distance of each of the respective upper and lower legs outer ends is greater than the first distance of each of the respective upper and lower legs outer ends;

four wheels, each of which is operatively attached to the frame adjacent to a bottom end portion of the respective vertically oriented pole;

a pliable liner that is connectable to the frame and that defines an open-top interior compartment of the wagon when the wagon is in the wagon's expanded configuration; and

a tow handle operatively connected to the frame.

[0005] Preferably, the tow handle is telescoping between an expanded configuration and a retracted configuration.

[0006] Preferably, the tow handle is connected to two of the vertically oriented poles via two connecting members, and each of the connecting members has a first end portion that is pivotally connected to the frame adjacent to the bottom end portion of the respective vertically oriented poles and an opposite second end portion that is operatively pivotally connected to the tow handle.

[0007] Preferably, each of the connecting members extends downward in a sloped manner from the bottom end portion of the respective vertically oriented poles to the tow handle when

the wagon is adjusted from the wagon's expanded configuration to the wagon's collapsed configuration.

5 [0008] Preferably, the tow handle has a top end, and the tow handle is such configured that when the wagon is in the wagon's collapsed configuration and the tow handle is vertical and in the tow handle's retracted configuration, the top end of the tow handle does not protrude substantially above the remainder of the wagon.

[0009] Preferably, each folding bar assembly in the pair of folding bar assemblies includes a single pair of crossed bars pivotally connected to each other.

0 [0010] Preferably, the wagon further includes a collapsible bottom support assembly, the bottom support assembly includes a central hub and four bars, the four bars are each operatively pivotally connected to the central hub and operatively pivotally connected to the bottom end portion of a respective one of the vertically oriented poles.

5 [0011] Preferably, the central hub allows each of the four bars of the bottom support assembly to pivot downward therefrom and prevents the four bars from pivoting upward therefrom beyond horizontal.

[0012] Preferably, the wagon further includes a shelf resting on the bottom support assembly below and spaced from the pliable liner

[0013] Preferably, the wagon further includes a removable stiffing panel that is configured and adapted to be placed at the bottom of the interior compartment of the wagon.

20 [0014] A wagon, which is adjustable between an expanded configuration and a collapsed configuration, includes:

25 a frame, where the frame has four sides, each side is formed by a pair of folding bar assemblies, the pair of folding bar assemblies of each side of the frame has opposite upper leg outer ends and opposite lower leg outer ends, the frame also has a vertically oriented pole at an intersection of the pair of folding bar assemblies of one side with the pair of folding bar assemblies of an adjacent transverse side, the upper leg outer end of each of the pair of folding bar assemblies is operatively connected to the vertically oriented pole, the lower leg outer end of each of the pair of folding bar assemblies is operatively slidingly connected to the vertically oriented pole, the frame is such
30 configured and adapted that as the wagon is altered from the wagon's expanded

configuration to the wagon's collapsed configuration, the lower leg outer end of each of the pair of folding bar assembly slides downward relative to the corresponding upper leg outer end of the pairs of folding bar assemblies on the respective vertically oriented pole, and the pairs of folding bar assemblies increase in height and decrease in length, the frame is further such configured and adapted that as the wagon is altered from the wagon's collapsed configuration to the wagon's expanded configuration the lower leg outer end of each of the pair of folding bar assembly slides upward relative to the corresponding upper leg outer end of the pairs of folding bar assemblies on the respective vertically oriented pole, and the pairs of folding bar assemblies decrease in height and increase in length;

four wheels, each of which is operatively attached to the frame adjacent to a bottom end portion of the respective vertically oriented pole;

a pliable liner that is connectable to the frame and that defines an open-top interior compartment of the wagon when the wagon is in the wagon's expanded configuration; and

a tow handle operatively connect to the frame.

[0015] Preferably, the tow handle is telescopically collapsible.

[0016] Preferably, the wagon is such configured that two of the wheels can only revolve about a fixed common axis and the other wheels revolve about axes that are able to pivot relative to the fixed common axis.

[0017] Preferably, the wagon further includes a collapsible bottom support assembly, the bottom support assembly includes a central hub and four bars, the four bars are each operatively pivotally connected to the central hub and operatively pivotally connected to the bottom end portion of a respective one of the vertically oriented poles.

[0018] Preferably, the central hub allows each of the four bars of the bottom support assembly to pivot downward therefrom and prevents the four bars from pivoting upward therefrom beyond horizontal.

[0019] Preferably, the wagon further includes a shelf resting on the bottom support assembly below and spaced from the pliable liner.

[0020] Preferably, the wagon further includes a removable stiffing panel that is configured and adapted to be placed at the bottom of the interior compartment of the wagon.

[0021] Preferably, the frame has a same vertical height when the wagon is in the collapsed configuration as when the wagon is the expanded configuration.

5 [0022] Preferably, the tow handle is connected to two of the vertically oriented poles via two connecting members, each of the connecting members has a first end portion that is operatively pivotally connected to the frame adjacent to the bottom end portion of the respective vertically oriented poles and an opposite second end portion that is operatively pivotally connected to the tow handle.

0 [0023] Preferably, each of the connecting members extends downward in a sloped manner from the bottom end portion of the respective vertically oriented poles to the tow handle when the wagon is adjusted from the wagon's expanded configuration to the wagon's collapsed configuration.

5 [0024] This disclosure pertains to hand-drawn wagons. More particularly, the present disclosure pertains to a hand-drawn wagon that is collapsible in a manner such that the wagon basically has the same vertical height when in the collapsed and expanded configurations so that the volume of the wagon when in the collapsed configuration is relatively smaller in comparison to conventional foldable wagons thereby allowing the wagon to be stored in a minimal amount of space.

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BRIEF DESCRIPTION OF THE DRAWINGS

[0025] In order to more clearly describe the technical solutions in the embodiments of the present disclosure or the conventional technology, the following will briefly introduce the drawings needed in the description of the embodiments or the conventional technology.

25 Obviously, the drawings in the following description are only the embodiments of the present disclosure. For those of ordinary skill in the art, other drawings can be obtained according to the provided drawings without creative work.

[0026] FIG. 1 is a perspective view of an exemplary wagon in its expanded configuration.

[0027] FIG. 2 is perspective view of the wagon of FIG. 1 as it is being altered from its expanded configuration to its collapsed configuration.

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- [0028] FIG. 3 is a perspective view of the wagon of FIG. 1 in its collapsed configuration.
- [0029] FIG. 4 is a side elevation view of the wagon of FIG. 1 in its expanded configuration.
- [0030] FIG. 5 is a side elevation view of the wagon of FIG. 1 as it is being altered from its expanded configuration to its collapsed configuration.
- 5 [0031] FIG. 6 is a side elevation view of the wagon of FIG. 1 in its collapsed configuration.
- [0032] FIG. 7 is a front elevation view of the wagon of FIG. 1 in its expanded configuration.
- [0033] FIG. 8 is a front elevation view of the wagon of FIG. 1 as it is being altered from its expanded configuration to its collapsed configuration.
- [0034] FIG. 9 is a front elevation view of the wagon of FIG. 1 in its collapsed configuration.
- 0 [0035] FIG. 10 is a rear elevation view of the wagon of FIG. 1 in its collapsed configuration.
- [0036] FIG. 11 is a top plan view of the wagon of FIG. 1 in its collapsed configuration.
- [0037] FIG. 12 is a bottom view of the wagon of FIG. 1 in its collapsed configuration.
- [0038] FIG. 13 is a left side view of the wagon of FIG. 1 in its expanded configuration with a liner, stiffening panel, and lower shelf shown exploded.
- 5 [0039] FIG. 14 is a front elevation view of the wagon of FIG. 13 with the liner, stiffening panel, and lower shelf assembled with a frame of the wagon.
- [0040] FIG. 15 is a rear elevation view of the wagon of FIG. 13 with the liner, stiffening panel, and lower shelf assembled with a frame of the wagon.
- [0041] FIG. 16 is a top plan view of the wagon of FIG. 13 with the liner, stiffening panel,
20 and lower shelf removed for ease of illustration.
- [0042] FIG. 17 is a bottom view of the wagon of FIG. 13 with the liner, stiffening panel, and lower shelf removed for ease of illustration.
- [0043] FIG. 18 is a perspective view of another embodiment of an exemplary wagon in its expanded configuration.
- 25 [0044] FIG. 19 is a side elevation view of the wagon of FIG. 18 in its expanded configuration.
- [0045] FIG. 20 is a front elevation view of the wagon of FIG. 18.

[0046] FIG. 21 is a perspective view of the wagon of FIG. 18 in its collapsed configuration.

[0047] Reference numerals in the written specification and in the drawing figures indicate corresponding items.

5 DETAILED DESCRIPTION OF EMBODIMENTS

[0048] One embodiment of a collapsible wagon 20 is shown in FIGS. 1-17. A second embodiment of a collapsible wagon 120 is shown in FIGS. 18-21. Referring to the wagon of FIGS. 1-17, the collapsible wagon 20 comprises a frame 22, a plurality of wheels 24, a tow handle 26. The collapsible wagon may include a pliable liner 28 with a stiffener panel 30, and
0 may include a bottom shelf or container 32 that is arranged below the pliable liner (all shown FIGS. 13-15).

[0049] The frame 22 of the wagon 20 is generally rectangular with a pair of folding bar assemblies 42 on each side of the frame, and four vertically oriented poles 40 at the intersection of one pair of folding bar assemblies of one side of the frame with another pair of
5 folding bar assemblies of an adjacent, transverse side of the frame. As shown in Figs 1-17, the folding bar assemblies may be scissor bar assemblies whereas FIGS. 18-21 show a variation of folding bar assemblies comprising the left and right sides of the frame, as will be discussed below. Each folding bar assembly 42 of the pair of folding bar assemblies of a side of the
20 frame preferably comprises a single pair of crossed bars that are pivotally joined to each other to form a scissor bar assembly. Each scissor bar assembly of the pair of folding bar assemblies 42 of a side of the frame 22 has left and right upper leg ends and left and right lower leg ends. To form a pair of scissor bar assemblies of the side of the frame, the right upper leg end of one scissor bar assembly is connected with left upper leg end of the other scissor bar assembly, and the right lower leg end of one scissor bar assembly is connected
25 with the left lower leg end of the other scissor bar assembly. Thus, one scissor bar assembly is connected end to end with another scissor bar assembly to form the pair of folding bar assemblies 42 for the side of the frame. The pair of folding bar assemblies 42 of each side of the frame have opposite upper leg outer ends 44, that is, the right upper leg end of one folding bar assembly and the left upper leg end of the other folding bar assembly in the pair of folding
30 bar assemblies of the side of the frame. The pair of folding bar assemblies 42 of each side of the frame have opposite lower leg outer ends 46, that is, the right lower leg end of one folding

bar assembly and the left lower leg end of the other folding bar assembly in the pair of folding bar assemblies of the side of the frame. As is typical with most folding bar assemblies, each folding bar assembly 42 is adjustable between an expanded configuration and a collapsed configuration. The upper leg ends of each of the folding bar assemblies 42 are closer to the corresponding lower leg end when the said folding bar assembly is in the expanded configuration (as shown in FIGS. 1,4,7) as compared to the collapsed configuration (as shown in FIGS. 3,6,9, 10). Similarly, the upper leg ends of each of the folding bar assemblies 42 are closer to each other when the folding bar assembly is in the collapsed configuration as compared to the expanded configuration.

[0050] The upper leg outer end 44 of each of the pair of folding bar assemblies may be operatively connected to the vertically oriented pole 40. For instance, a connector 48 may be fixedly mounted on the top or distal end of the vertically oriented pole, and the upper leg outer end 44 may be connected to the connector with a pivot pin. The connector 48 may be configured to connect the vertically oriented pole 40 with both the upper leg outer end 44 of a folding bar assembly of one side of the frame and the upper leg outer end of another folding bar assembly of an adjacent transverse side of the frame. The lower leg outer end 46 of each of the pair of folding bar assemblies may be operatively slidingly connected to the vertically oriented pole 40. For instance, a sliding connector 50 may be arranged below the upper leg outer end connector 48 to slide on the vertically oriented pole 40, and the lower leg outer end 46 may be connected to the sliding connector 50 with a pivot pin. The sliding connector 50 may be configured to slidingly couple the vertically oriented pole 40 with both the lower leg outer end 46 of a folding bar assembly 42 of one side of the frame and the lower leg outer end of another folding bar assembly of an adjacent transverse side of the frame.

[0051] When the wagon 20 is in the expanded configuration, each of the lower leg outer ends 46 of the pairs of folding bar assemblies 42 has a first distance D1 to each of the corresponding upper leg outer ends 44 of the pairs of folding bar assemblies along the respective vertically oriented poles 40. The first distance D1 may be different for each upper leg and lower leg outer end but is generally preferably the same. As the wagon is altered from the wagon's expanded configuration to the wagon's collapsed configuration, the lower leg outer end 46 of each of the pair of folding bar assemblies 42 slides downward (and away) relative to the corresponding upper leg outer end 44 of the pairs of folding bar assemblies on the respective vertically oriented pole 40. So, when the wagon is in the collapsed

configuration, each of the lower leg outer ends 46 of the pairs of folding bar assemblies 42 is at a second distance D2 to each of the corresponding upper leg outer end 44 of the pairs of folding bar assemblies along the respective vertically oriented poles. The second distance D2 may be different for each upper leg and lower leg outer end but is generally preferably the same. As the frame is altered from the expanded configuration to the collapsed configuration, the pairs of folding bar assemblies 42 increase in height and decrease in length. The second distance D2 of each of the respective upper and lower legs outer ends 44,46 is greater than the first distance D1 of each of the respective upper and lower legs outer ends. Similarly, as the wagon is altered from the wagon's collapsed configuration to the wagon's expanded configuration the lower leg outer end 46 of each of the pairs of folding bar assemblies 42 slides upward (and toward) relative to the corresponding upper leg outer end 46 of the pairs of folding bar assemblies on the respective vertically oriented pole 40. As the frame is altered from the collapsed configuration to the expanded configuration, the pairs of folding bar assemblies 42 decrease in height and increase in length. In view of the arrangement of the folding bar assemblies 42 on the sides of the frame, the sliding motion of each of the lower leg outer ends 46 on the vertically oriented pole 40, and the fixed positioning of each of the upper leg outer ends 44 on the vertically oriented pole, the frame has the same vertical height VH when the wagon is in the collapsed configuration as when the wagon is the expanded configuration. And as described below in greater detail, the telescopically arranged tow handle 26 and downward motion of the connecting bars 60 from the tow handle to the frame also allows the wagon as a whole to have the same vertical height when the wagon is in the collapsed configuration as when the wagon is the expanded configuration.

[0052] The frame 22 of the wagon 20 also preferably comprises a collapsible bottom support assembly 54. The bottom support assembly 54 preferably comprises four bars 56 that are each operatively pivotally connected to a central hub 58 and extend therefrom. Each of the four bars 56 is also pivotally connected to the frame 22 adjacent to a bottom end portion of a respective one of the vertically oriented poles 40. As the wagon 20 is collapsed, the central hub 58 moves upward. The central hub 58 is preferably configured to limit the extent to which the bars 56 can pivot relative to the central hub, such that central hub cannot be moved lower than being in plane with the bars 56 of the bottom support assembly 54 when in the expanded configuration of the frame. Thus, when the wagon 20 is in its expanded configuration, the bottom support assembly 54 is capable of supporting a downward acting

load. Thus, the liner 28 need not carry the entire load of cargo placed in the wagon 20. The liner 28 may be spaced from the bottom support assembly 54, and a shelf 32 or container (not shown) may be removably mounted on the bottom support assembly 54. Because the central hub 58 is preferably configured to limit the extent to which the bars 56 can pivot relative to the central hub, such that central hub cannot be moved lower than being in plane with the bars 56 of the bottom support assembly 54 when in the expanded configuration of the frame, the shelf 32 or lower container need not carry the entire load of cargo placed in the wagon.

[0053] Each of the wheels 24 of the wagon 20 is operatively attached to the lower portion of the frame 22 adjacent to a bottom portion of the respective one of the vertically oriented poles 20. Preferably, the two wheels 24 nearest the tow handle 26 are able to pivot about vertical axes that is swivel in addition to being able to rotate on their horizontal axles. The other two wheels 24 preferably do not pivot about a vertical axis (do not swivel) but rotate about their horizontal axles.

[0054] The tow handle 26 preferably comprises two telescopically attached sections. The telescoping tow handle 26 is preferably operatively connected to the lower portion of the frame adjacent two of the vertically oriented poles 20 via two connecting members 60. Each of the connecting members 60 has a first end portion that is operatively pivotally connected to the bottom end portion of the respective vertically oriented pole 40, and an opposite second end portion that is pivotally connected to the telescoping tow handle 26. Each connecting member 60 is configured to extend downward in a sloped manner from the frame adjacent to the bottom portion of the respective vertically oriented pole 40 to the telescoping tow handle 26 such that the second end portions of the connecting members move downward relative to the bottom end portions of the vertically oriented poles as the wagon 20 is collapsed. When the wagon 20 is collapsed, the telescoping tow handle 26 can also be collapsed such that it does not extend above the frame 22 of the wagon.

[0055] The pliable liner 28 of the wagon 20 rests inside the frame 22 when the wagon is expanded and forms the open-top interior compartment of the wagon. Each upper corner of the pliable liner is removably attachable to the top portion of a respective one of the vertically oriented poles 40. The pliable liner 28 may also comprises a plurality of flaps (not shown) having looped fasteners (such as Velcro®) that extend downward from the base of the pliable liner. The flaps may be used to secure the base of the pliable liner to the bars 56 and the

central hub 58 of the frame 22. The pliable liner may include a pair of inverted pockets and a pliable fabric handle. The inverted pockets may be configured to receive the top-center portion of each of the side folding bar assemblies 42 for supporting the pliable liner 28 from the frame 22. The fabric handle may be configured to allow the center portion of the pliable liner 28 to be pulled upward which may in turn cause the pliable liner to pull upward on the bottom support assembly 54 of the frame 22 of the wagon 20. The pulling force moves the central hub 58 of the bottom support assembly 54 of the frame 22 upward and collapses the wagon 20 with a minimal amount of effort.

[0056] The pliable liner 28 may include the stiffening panel 30. The stiffening panel 30 may fit at the bottom of the liner and help hold the frame in the expanded configuration. When it is desired to alter the configuration of the frame from the expanded configuration to collapsed configuration, the stiffening panel 30 may be removed. When provided, the shelf 32 or lower container below the pliable liner 28 may be similarly configured. When it is desired to alter the configuration of the frame from the expanded configuration to collapsed configuration, the stiffening panel of the lower container or the shelf 32, as applicable, may be removed.

[0057] The wagon may also be provided with a cover that is configured to protect the wagon when the wagon is in its collapsed condition. The cover may also reduce the likelihood that things will get snagged on the wagon when the wagon is in storage. The cover may include a pocket for holding the stiffening panel 30, and the bottom shelf 32 or the lower container stiffening panel, when the wagon is in its collapsed condition. The stiffening panel on the pliable liner 28, and the lower container as applicable, may be comprised of four adjacent panels that are wrapped in fabric in a manner such that the stiffening panel can be folded like an accordion. When unfolded, the stiffening panel 42 can be placed in the bottom of the interior compartment of the wagon 20. The stiffing panel 30 helps distribute loads of any cargo being carried in the wagon 20 more evenly to the bottom support assembly 54 of the frame 22 and prevents the components of the bottom support assembly from being felt by children riding in wagon. The stiffening panel of the lower container and/or the shelf may be similarly constructed.

[0058] FIGS. 18-21 show an alternate embodiment of a wagon 120 utilizing a different configuration of folding bar assemblies 142 on the left and right sides of the wagon. The embodiment of the wagon in FIGS. 18-21 may include scissor bar assemblies 42 as

previously described on the front and rear sides of the frame of the wagon. The embodiment of the wagon in FIGS. 18-21 may include a collapsible bottom support assembly 54 as previously described. The wagon of FIGS. 18-21 may include a tow handle 26, wheels 24, liner 28, shelf 32, and/or stiffening member(s) 30 as described previously.

5 **[0059]** Each of the left and right sides of the frame of the wagon of FIGS. 18-21 comprises a pair of folding bar assemblies 142 that include a pair of crossed bars 180,182 that are pivotally joined to each other, and a linkage 184. Each pair of crossed bars 180,182 of the folding bar assembly of the pair of folding bar assemblies of the left and right sides of the frame has left and right upper legs and left and right lower legs. Each pair of pivotally
0 connected crossed bars of the folding bar assembly has a long bar 180 and a short bar 182. The long bar 180 of each pair of crossed bars in the folding bar assembly has an upper leg outer end 144 operatively coupled to the vertically oriented pole 40. As described previously, the connector 148 may be fixedly mounted on the top or distal end of the vertically oriented pole 40, and the upper leg outer end 144 of the long bar 180 of the crossed bars may be
5 connected to the connector with a pivot pin. The opposite inner ends of the long bars 180 of the crossed bars of the pair of folding bar assemblies 142 may be pivotally connected together. That is, making reference to the orientation shown in Figure 19, the right lower leg end of the long bar 180 of the crossed bars of the left folding bar assembly 142L is pivotally
0 connected with the left lower leg end of the long bar 180 of the crossed bars of the right folding bar assembly 142R. The short bar 182 of each pair of crossed bars in the folding bar assembly 142 has a lower leg outer end 146 operatively coupled to the vertically oriented pole 40. As described previously, the sliding connector 150 may be arranged below the upper leg outer end 144 to slide on the vertically oriented pole 40. The opposite ends of the short bars of the pairs of pivotally connected crossed bars of the pair of folding bar assemblies may be
25 pivotally connected with the respective linkage 184. That is, making reference to the orientation shown in Figure 19, the right upper leg end of the short bar 182 of the crossed bars of the left folding bar assembly 142L is pivotally connected with linkage 184 of the left folding bar assembly, and the linkage 184 of the left folding bar assembly extends to the long bar 182 of the crossed bars of the right folding bar assembly 142R. Again, making reference
30 to the orientation shown in Figure 19, the left upper leg end of the short bar 182 of the crossed bars of the right folding bar assembly 142R is pivotally connected with linkage 184 of the

right folding bar assembly, and the linkage 184 of the right folding bar assembly 142R extends to the long bar 180 of the crossed bars of the left folding bar assembly 142L.

[0060] When the wagon 120 of FIGS.18-21 is in the expanded configuration, each of the lower leg outer ends 146 of the pairs of folding bar assemblies 142 has a first distance D1' to each of the corresponding upper leg outer ends 144 of the pairs of folding bar assemblies along the respective vertically oriented poles 40. The first distance D1' may be different for each upper leg and lower leg outer end but is generally preferably the same. As the wagon is altered from the wagon's expanded configuration to the wagon's collapsed configuration, the lower leg outer end 146 of each of the pair of folding bar assemblies 142 slides downward (and away) relative to the corresponding upper leg outer end 144 of the pairs of folding bar assemblies on the respective vertically oriented pole 140. So, when the wagon is in the collapsed configuration, each of the lower leg outer ends 146 of the pairs of folding bar assemblies 142 is at a second distance D2' to each of the corresponding upper leg outer end 144 of the pairs of folding bar assemblies along the respective vertically oriented poles. The second distance D2' may be different for each upper leg and lower leg outer end but is generally preferably the same. As the frame is altered from the expanded configuration to the collapsed configuration, the pairs of folding bar assemblies 142 increase in height and decrease in length. The second distance D2' of each of the respective upper and lower legs outer ends 144,146 is greater than the first distance D1' of each of the respective upper and lower legs outer ends. Similarly, as the wagon is altered from the wagon's collapsed configuration to the wagon's expanded configuration the lower leg outer end 146 of each of the pairs of folding bar assemblies 142 slides upward (and toward) relative to the corresponding upper leg outer end 144 of the pairs of folding bar assemblies on the respective vertically oriented pole 140. As the frame is altered from the collapsed configuration to the expanded configuration, the pairs of folding bar assemblies 142 decrease in height and increase in length. In view of the arrangement of the folding bar assemblies 142 on the sides of the frame, the sliding motion of each of the lower leg outer ends 146 on the vertically oriented pole 140, and the fixed positioning of each of the upper leg outer ends 144 on the vertically oriented pole, the frame has the same vertical height VH' when the wagon is in the collapsed configuration as when the wagon is the expanded configuration. And as described below in greater detail, the telescopically arranged tow handle 26 and downward motion of the connecting bars 60 from the tow handle to the frame also allows the wagon as a whole to

have the same vertical height when the wagon is in the collapsed configuration as when the wagon is the expanded configuration.

[0061] In a specific embodiment, a double-decker wagon is provided according to the present disclosure, which includes a vehicle body and wheels arranged at the bottom of the vehicle body. The vehicle body is composed of vertical poles 40 and other pipe fittings. The vertical poles 40 are arranged at four corners of the vehicle body, and an upper bracket 5, a sliding connector 50 and a lower bracket are sequentially arranged along each of the vertical poles 40. Two deckers of storage platforms, that is, the middle decker and the lower decker, are provided among the vertical poles 40. The middle storage platform is composed of first bottom pipes and a first bottom connecting member. The first bottom pipes are in a cross shape. Inner ends of the first bottom pipes are rotatably connected with the first bottom connecting member, and outer ends of the first bottom pipes are rotatably connected with the sliding connectors. While the first bottom connecting member is pulled upward, other components move inward accordingly along with the first bottom connecting member and are collapsed. The lower storage platform is a bottom support assembly 54 having four bars 56. The four bars 56 are each operatively pivotally connected to a central hub 58 and extend therefrom. The bars 56 are in a cross shape. Inner ends of the bars 56 are rotatably connected with the central hub 58 and outer ends of the bars 56 are rotatably connected with the lower bracket. This lower storage platform can be collapsed synchronously with the middle storage platform.

[0062] In this embodiment, the double-decker wagon has two deckers of storage platforms, which is able to store many articles. These articles can be classified and stored in the two deckers. While the first bottom connecting member is pushed downward and the vertical poles 40 move away from each other, the components extend accordingly outwards, and the two deckers of storage platforms of the double-decker wagon are collapsed. While the first bottom connecting member is lifted upwards and the vertical poles 40 approach each other, the components move inward accordingly, and the two deckers of storage platforms of the double-decker wagon are collapsed.

[0063] In order to achieve a better technical effect, and to provide enclosure and sealing for the peripheral side of the middle storage platform while the double-decker wagon is expanded, and to enhance the stability of connection and fixation of the structure of the

double-decker wagon, a folding assembly is arranged between adjacent vertical poles 40, and the folding assembly is able to be expanded or collapsed along with the movement of the vertical poles 40. Specifically, the folding assembly includes cross pipes which are intersected with each other, a first pipe and a second pipe of the crossed pipes are rotatably connected at the center of the intersection, the first pipe is rotatably connected with the upper bracket, and the second pipe is rotatably connected with the sliding connector 50.

[0064] Exemplarily, different sizes and different numbers of folding assemblies may be provided according to the length or width of the double-decker wagon to meet the collapsed effect of double-decker wagons of different sizes.

[0065] One set of folding assemblies are arranged in the width direction of the double-decker wagon, that is, one set of folding assemblies are arranged between the adjacent vertical poles 40 at the front and rear sides, and the folding assemblies include first front inclined pipes and second front inclined pipes. Specifically, at the front side of the double-decker wagon, the first front inclined pipe and the second front inclined pipe are rotatably connected at the center. One end of the first front inclined pipe is rotatably connected with the upper bracket of a first vertical pole of the adjacent vertical poles 40, and another end of the first front inclined pipe is rotatably connected with the sliding connector 50 of a second vertical pole of the adjacent vertical poles 40. One end of the second front inclined pipe is rotatably connected with the sliding connector of the first vertical pole of the adjacent vertical poles 40, and another end of the second front inclined pipe is rotatably connected with the upper bracket of the second vertical pole of the adjacent vertical poles 40. Similarly, the same arrangement is adopted at the rear side of the double-decker wagon, which will not be repeated here.

[0066] Two sets of folding assemblies are arranged in the length direction of the double-decker wagon, that is, two sets of folding assemblies are arranged between the adjacent vertical poles 40 on the left and right sides, the two sets of folding assemblies are rotatably connected with each other, and the folding assemblies include first lateral inclined pipes and second lateral inclined pipes. Specifically, the first lateral inclined pipe and the second lateral inclined pipe of the first set of folding assemblies are rotationally connected at the center, and the first lateral inclined pipe and the second lateral inclined pipe of the second set of folding assemblies are rotationally connected at the center. One end of the second

lateral inclined pipe of the first set of folding assemblies is rotatably connected with the upper bracket of the first vertical pole 40 of the adjacent vertical poles 40, and one end of the first lateral inclined pipe of the first set of folding assemblies is rotatably connected with the sliding connector 50 of the first vertical pole 40 of the adjacent vertical poles 40. Another end of the second lateral inclined pipe of the first set of folding assemblies is rotatably connected with one end of the first lateral inclined pipe of the second set of folding assemblies, and another end of the first lateral inclined pipe of the first set of folding assemblies is rotatably connected with one end of the second lateral inclined pipe of the second set of folding assemblies. Another end of the first lateral inclined pipe of the second set of folding assemblies is rotatably connected with the upper 5 of the second vertical pole of the adjacent vertical poles 40, and another end of the second lateral inclined pipe of the second set of folding assemblies is rotatably connected with the sliding connector 50 of the second vertical pole 40 of the adjacent vertical poles 40.

[0067] For better technical effects, a pull bar is provided on the front side of the vertical poles 40, and the pull bar 8 is configured to pull the vehicle body, so that the vehicle body is able to move through the rotation of the wheels. The pull bar is rotatably connected with the vertical poles 40 to facilitate adjustment of the direction of force applied to the vehicle body.

[0068] For better technical effects, a tipping bucket is provided on the rear side of the vertical poles 40, and the tipping bucket is configured to provide an additional storage platform to store long items. The tipping bucket is rotatably connected with the vertical poles 40.

[0069] In this embodiment, the four corners of the double-decker wagon are composed of four vertical poles 40, and storage platforms are formed in the middle portion and the lower portion among the four vertical poles 40. The left and right sides are in double-X shapes formed by the first lateral inclined pipes and the second lateral inclined pipes, and the front and rear sides are in single-X shapes or single-X shapes formed by the first front inclined pipes and the second front inclined pipes. The upper brackets and the lower brackets are respectively fixed at the upper and lower ends of the vertical poles 40, and the sliding connectors 50 are slidable along the vertical poles 40. A front wheel frame or a rear wheel frame for mounting wheels is connected to the lower side of the lower brackets. While the double-decker wagon is collapsed, the central hub 58 is lifted upwards, the first bottom

connecting member drives the first bottom pipes to rotate, and the sliding connectors 50 slide down, thereby driving the vertical poles 40 to approach each other, and the first bottom pipes and the second bottom pipes of the two deckers of storage platforms are automatically collapsed upwards, and the double-decker wagon is finally collapsed into a bundle. Therefore, the double-decker wagon is convenient to be expanded or collapsed.

[0070] It should also be understood that when introducing elements of the present invention in the claims or in the above description of exemplary embodiments of the invention, the terms "comprising," "including," and "having" are intended to be open-ended and mean that there may be additional elements other than the listed elements. Additionally, the term "portion" should be construed as meaning some or all of the item or element that it qualifies. Moreover, use of identifiers such as top, bottom, front, back, left, right, inner, outer, first, second, and third should not be construed in a manner imposing any relative position or time sequence between limitations. Still further, the order in which the steps of any method claim that follows are presented should not be construed in a manner limiting the order in which such steps must be performed, unless such an order is inherent.

[0071] As various modifications could be made in the constructions and methods herein described and illustrated without departing from the scope of the invention, it is intended that all matter contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative rather than limiting. Thus, the breadth and scope of the present invention should not be limited by any of the above-described exemplary embodiments, but should be defined only in accordance with the following claims appended hereto and their equivalents.

CLAIMS

1. A wagon that is adjustable between an expanded configuration and a collapsed configuration, the wagon comprising:

5 a frame, the frame having four sides, each side being formed by a pair of folding bar assemblies, the pair of folding bar assemblies of each side of the frame having opposite upper leg outer ends and opposite lower leg outer ends, the frame also having a vertically oriented pole at an intersection of the pair of folding bar assemblies of one side with the pair of folding bar assemblies of an adjacent transverse side, the upper leg outer end of each of the pair of folding bar assemblies being operatively connected to the vertically oriented pole, the lower leg outer end of each of the pair of folding bar assemblies being operatively slidingly connected to the vertically oriented pole, wherein when the wagon is in the expanded configuration, each of the lower leg outer ends of the pairs of folding bar assemblies has a first distance to each of the corresponding upper leg outer ends of the pairs of folding bar assemblies along the respective vertically oriented poles, wherein when the wagon is in the collapsed configuration, each of the lower leg outer ends of the pairs of folding bar assemblies has a second distance to each of the corresponding upper leg outer end of the pairs of folding bar assemblies along the respective vertically oriented poles, the second distance of each of the respective upper and lower legs outer ends is greater than the first distance of each of the respective upper and lower legs outer ends;

four wheels, each wheel being operatively attached to the frame adjacent to a bottom end portion of the vertically oriented pole;

a pliable liner that is connectable to the frame and that defines an open-top interior compartment of the wagon when the wagon is in the wagon's expanded configuration; and

25 a tow handle operatively connected to the frame.

2. The wagon in accordance with claim 1 wherein each folding bar assembly in the pair of folding bar assemblies comprises a single pair of crossed bars pivotally connected to each other.

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3. The wagon in accordance with claim 1 wherein the wagon further comprises a collapsible bottom support assembly, the bottom support assembly comprises a central hub and four bars, the four bars are each operatively pivotally connected to the central hub and operatively pivotally connected to the bottom end portion of a respective one of the vertically oriented poles.

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4. The wagon in accordance with claim 3 wherein the central hub allows each of the four bars of the bottom support assembly to pivot downward therefrom and prevents the four bars from pivoting upward therefrom beyond horizontal.

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5. A wagon that is adjustable between an expanded configuration and a collapsed configuration, the wagon comprising:

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a frame, the frame having four sides, each side being formed by a pair of folding bar assemblies, the pair of folding bar assemblies of each side of the frame having opposite upper leg outer ends and opposite lower leg outer ends, the frame also having a vertically oriented pole at an intersection of the pair of folding bar assemblies of one side with the pair of folding bar assemblies of an adjacent transverse side, the upper leg outer end of each of the pair of folding bar assemblies being operatively connected to the vertically oriented pole, the lower leg outer end of each of the pair of folding bar assemblies being operatively slidingly connected to the vertically oriented pole, the frame being configured and adapted such that as the wagon is altered from the wagon's expanded configuration to the wagon's collapsed configuration, the lower leg outer end of each of the pair of folding bar assembly slides downward relative to the corresponding upper leg outer end of the pairs of folding bar assemblies on the respective vertically oriented pole, and the pairs of folding bar assemblies increase in height and decrease in length, the frame being configured and adapted such that as the wagon is altered from the wagon's collapsed configuration to the wagon's expanded configuration the lower leg outer end of each of the pair of folding bar assembly slides upward relative to the corresponding upper leg outer end of the pairs of folding bar assemblies on the respective vertically oriented pole, and the pairs of folding bar assemblies decrease in height and increase in length;

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four wheels, each wheel being operatively attached to the frame adjacent to a bottom end portion of the vertically oriented pole;

a pliable liner that is connectable to the frame and that defines an open-top interior compartment of the wagon when the wagon is in the wagon's expanded configuration; and

5 a tow handle operatively connect to the frame.

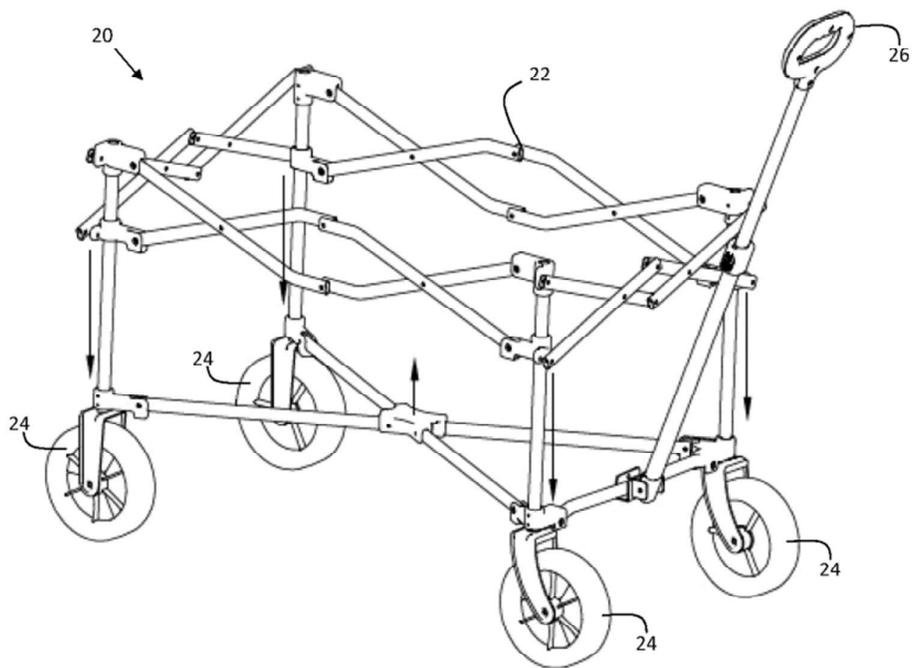


Fig. 1

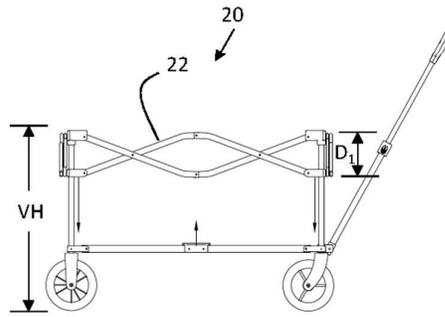


Fig. 4

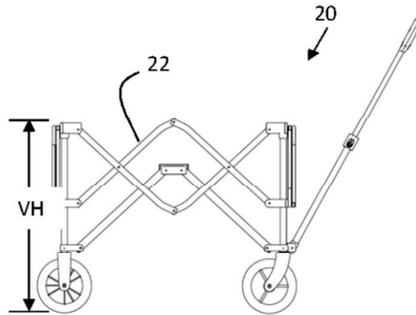


Fig. 5

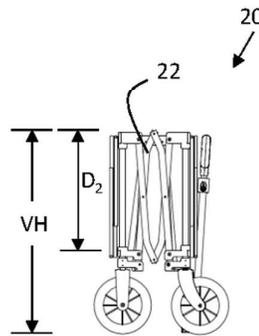


Fig. 6



Fig. 11



Fig. 12

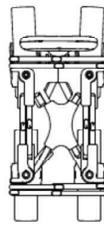


Fig. 7



Fig. 8

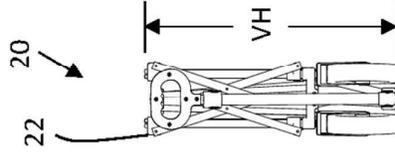


Fig. 9

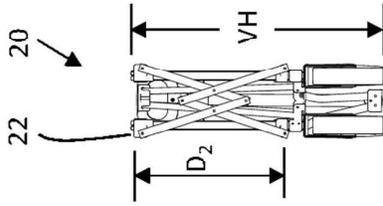


Fig. 10

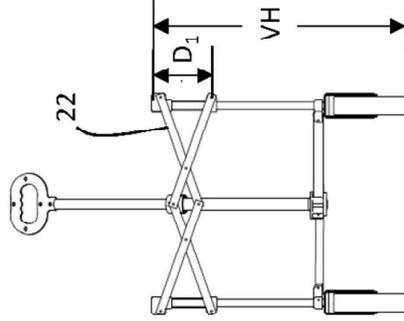


Fig. 7

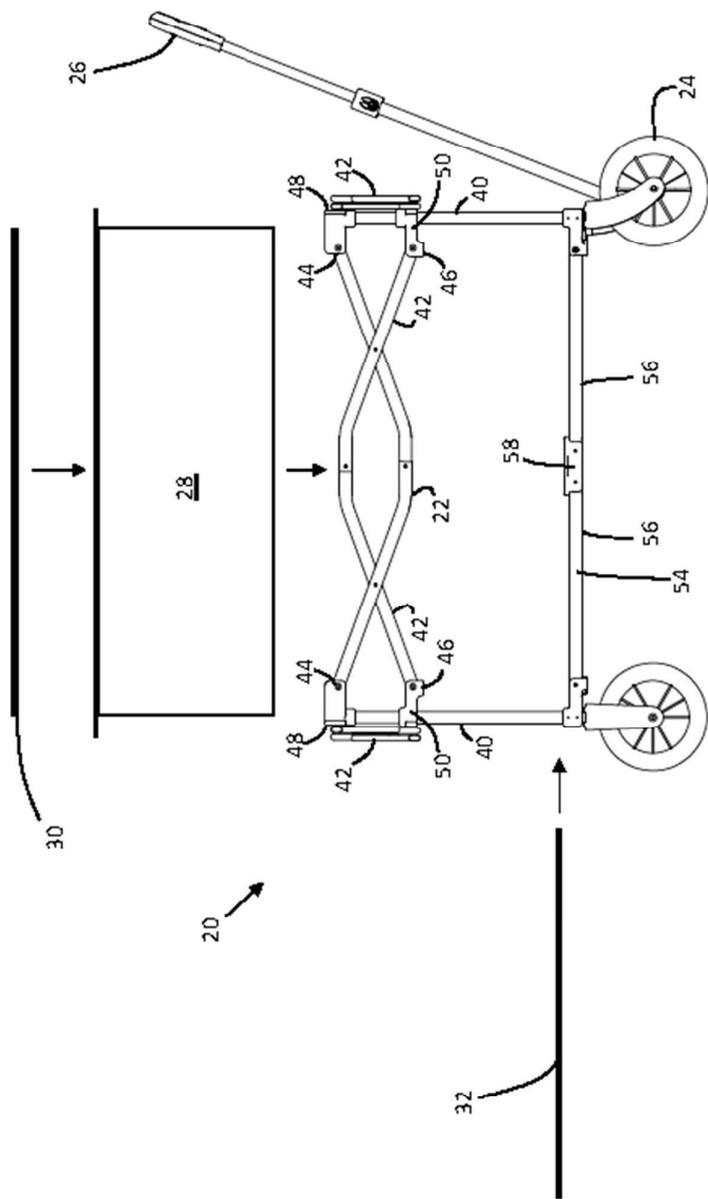


Fig. 13

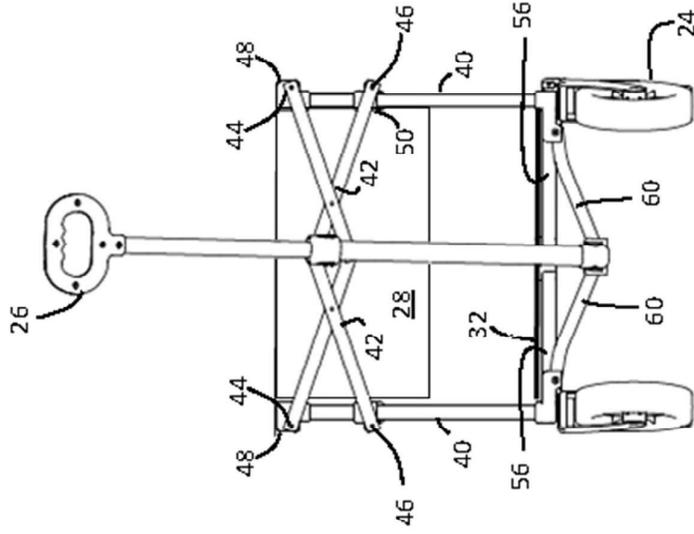


Fig. 14

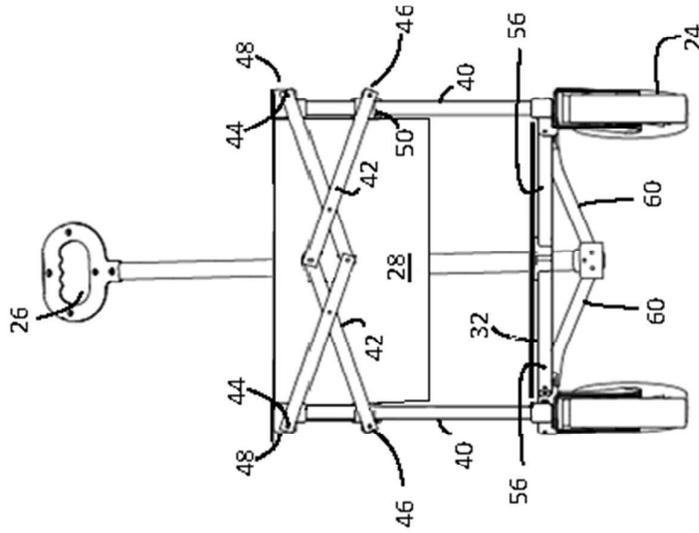


Fig. 15

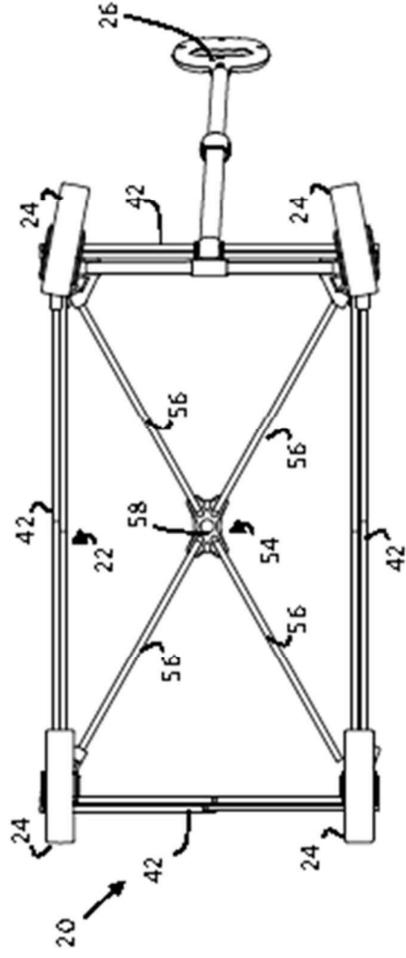


Fig. 16

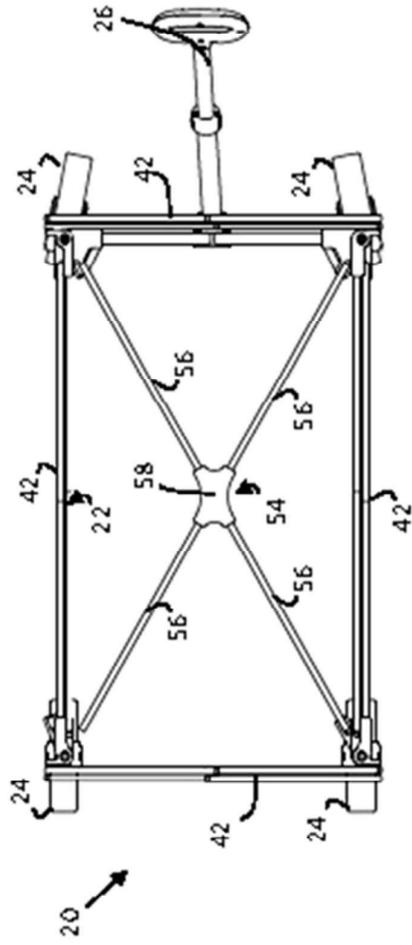


Fig. 17

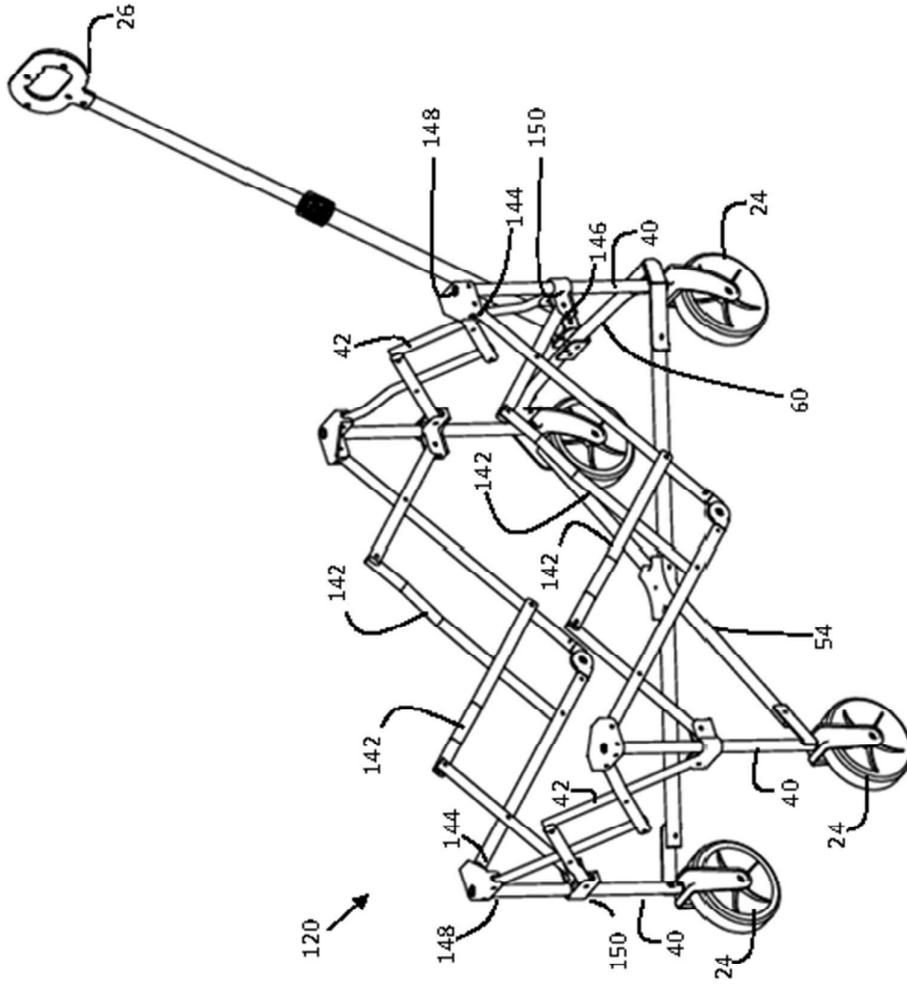


Fig. 18

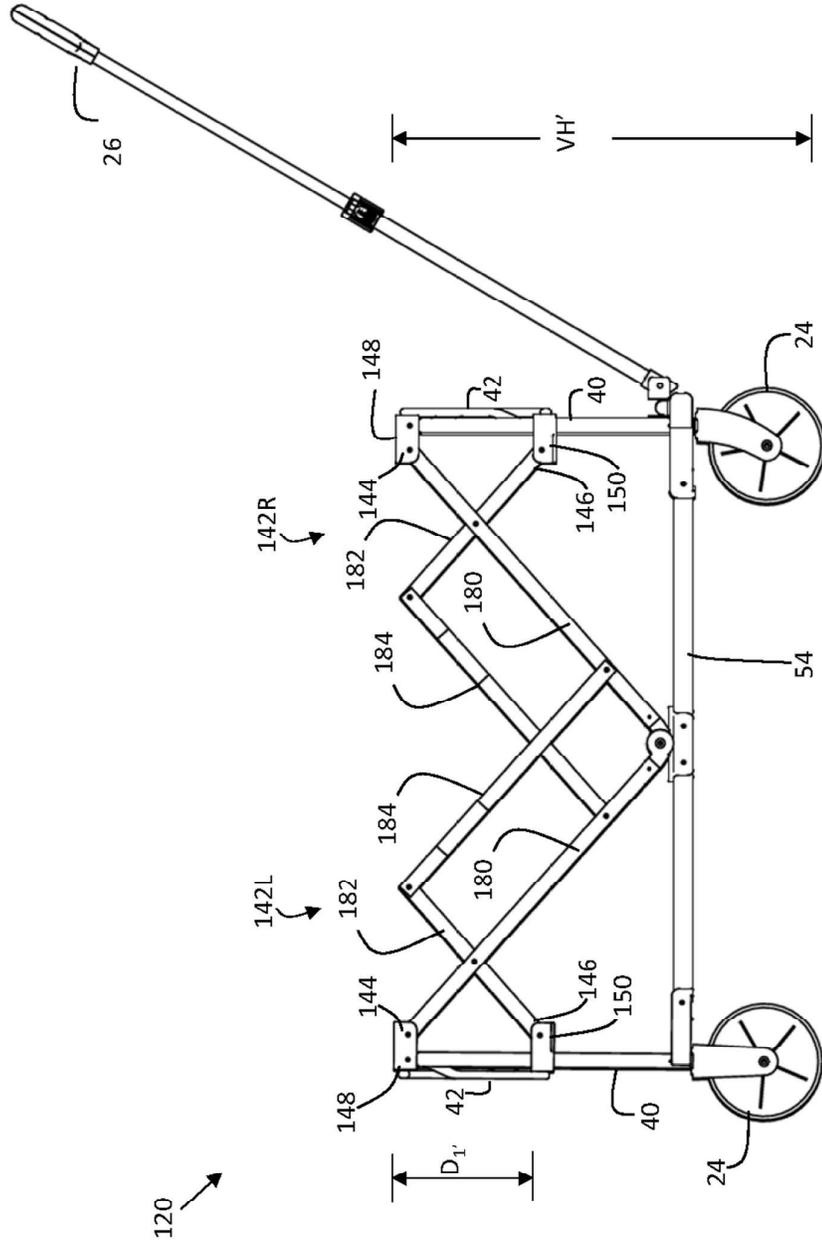


Fig. 19

