

DESCRIPTION  
MANIPULATION ASSISTIVE DEVICE FOR  
MANUALLY-OPERATED PUMP

TECHNICAL FIELD

[0001]

The present invention generally relates to a piston type manually-operated pump (it will be hereinafter abbreviated just as "manual pump" for the brevity sake throughout the specification) and in particular, relates to a manipulation assistive device for reducing an operating force necessary for a piston type manual pump.

BACKGROUND ART

[0002]

As a pump for pumping out the liquid, such as water, kerosene or chemical, from a container of large volume, such as a metallic drum or the like, a piston type resin-made manual pump of low cost as disclosed in non-patent literature 1 has been offered commercially to be in heavy usage.

This piston type manual pump is a pump having a well known structure in which a screw-threaded member of lid shape to be fitted to an opening provided for a liquid storage container is rotatably attached to an end of a suction pipe portion extending from a pump body, and this screw-threaded member is threadedly engaged with the opening of the storage container, so that the pump is mounted onto the storage container

and further, a piston within the pump body is reciprocally moved by manually reciprocating a piston rod protruding outside from the pump body, that is, by pushing in and pulling out the piston rod many times, so that the liquid is drawn out of the storage container.

Non-patent literature 1: Homepage of Koshin Ltd. > Products > for domestic use > kerosene pump > for metallic drum, [online], [retrieved on November 24, 2005] Internet

<URL: <http://www.koshin-ltd.jp/products/domestic/kerosene/pp.html>>

## DISCLOSURE OF THE INVENTION

### PROBLEMS TO BE SOLVED BY THE INVENTION

[0003]

In an exhaust emission purifying apparatus mounted on a recent diesel-powered vehicle, the urea aqueous solution is used as a liquid reducing agent for NO<sub>x</sub> purification, and also, when the urea aqueous solution is replenished from a storage container such as a metallic drum to an on-vehicle tank, such a piston type manual pump as described above is used. However, when the liquid of high specific gravity such as the urea aqueous solution or the like is to be pumped by the piston type manual pump, as an operating force for moving the piston rod of the pump must be increased, it is required for an operator to exhibit a large amount of force, resulting in a rather hard work.

[0004]

In order to reduce the operating force, an automatic pump demanding no manual force or a hand-type drum pump will desirably be

used. However, under the circumstances, a resin-made pump of this type for chemical such as the urea aqueous solution is necessarily high-priced and therefore, it is hesitated to adopt the resin-made drum pump only for the urea aqueous solution replenishment. Nevertheless, this is a problem to be urgently solved from the viewpoint of improvement in infrastructure for the recent prevalence of the exhaust emission purifying apparatus.

Therefore, in view of the described problem, it is an object of the present invention to provide a manipulation assistive device capable of reducing a manually operating force for a piston type manual pump, to thereby enable an easy replenishing work by the employment of a piston type resin-made manual pump which is easily obtained at a low cost.

## MEANS FOR SOLVING THE PROBLEMS

[0005]

In order to achieve the above object, in accordance with the present invention, a manipulation assistive device adapted for a piston type manual pump, which is, in use, mounted on a storage container by threadedly engaging a screw-threaded member that is rotatably attached to a suction pipe portion extending from a pump body, with an opening of the storage container, the piston type manual pump being operative for pumping a liquid from the storage container by reciprocally operating a piston rod protruding outside from the pump body to move a piston within the pump body, wherein the manipulation assistive device comprises: a

supporting plate having an opening portion formed therein for allowing therethrough the screw-threaded member to be threadedly engaged with the opening of the storage container thereby bringing the supporting plate to be securely fixed; a column support configured to stand upright on the supporting plate; and a rocking arm including a supporting point portion pivotally supported by the column support, a power-application portion for exerting a force and a working-point portion arranged at a position by which a length between the supporting point portion and the power-application portion is divided internally or externally, and wherein the piston rod is pivotally connected to the working point portion of the rocking arm, and the power-application portion of the rocking arm is manually grasped for permitting the rocking arm to be rocked thereby reciprocally moving the piston rod.

## EFFECTS OF THE INVENTION

[0006]

This manipulation assistive device may be operatively assembled in a commercially offered resin-made piston type manual pump after the production thereof, and the reciprocal operation of the piston rod can be performed more easily than ever before due to the principle of leverage by the rocking arm. Further, such an assembling may be achieved by a simple method of merely arranging the supporting plate between the storage container and the screw-threaded member of the manual pump which is threadedly engaged with the opening of the storage container.

In addition, this manipulation assistive device is a simple mechanically-operated mechanism including the supporting plate, the column support and the rocking arm, and therefore, can be produced at an extremely low cost compared with the conventional automatically-operated pump or drum pump.

[0007]

Namely, the manipulation assistive device for the manual pump according to the present invention can appreciably reduce the production cost thereof due to its structural and operating simplicity. Further, the manipulation assistive device according to the present invention can be simply mounted on the piston type manual pump after the production thereof through a simple mounting operation due to only manual threaded engagement. Therefore, the manipulation assistive device can enhance adoptability of the piston type manual pump much more than the expensive automatically-operated pump or the like. Further, since the pump operating force exhibited by an operator can be reduced owing to the employment of the principle of leverage, a replenishing work by the manual pump can be easily achieved even for the piston type resin-made manual pump which is easily obtained at a low cost. Consequently, if the manipulation assistive device according to the present invention is used for infrastructure improvement for the replenishing work of the urea aqueous solution, it can greatly contribute to the prevalence of an exhaust emission purifying apparatus for a diesel-powered vehicle.

## BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

Fig. 1 is a perspective view of a manipulation assistive device according to a first embodiment of the present invention, illustrating a state in which the manipulation assistive device together with a piston type manual pump is mounted on a metallic drum;

Fig. 2 is a side view of the manipulation assistive device in the first embodiment and the piston type manual pump;

Fig. 3 is a side view of the manipulation assistive device and the piston type manual pump, viewed from the X-direction in Fig. 2;

Fig. 4 is a side view of the manipulation assistive device according to a second embodiment of the present invention and the piston type manual pump; and

Fig. 5 is a side view of the manipulation assistive device and the piston type manual pump, viewed from the Y-direction in Fig. 4.

## EXPLANATION OF REFERENCE SYMBOLS

[0009]

- 1 ... piston type manual pump
- 2 ... pump body
- 3 ... suction pipe portion
- 4 ... screw-threaded member
- 5 ... piston rod
- 6 ... hose

7 ... cap  
10 ... manipulation assistive device  
11 ... supporting plate  
11a ... leg member  
11o ... opening portion  
12, 20, 21 ... column support  
13 ... rocking arm  
13a ... supporting point portion  
13b ... power-application portion  
13c ... working point portion  
14 ... pump supporting ring  
15 ... guide member  
15a ... guide groove  
16, 30 ... connecting arm  
17 ... fixing ring  
22 ... guide arm

## BEST MODE FOR CARRYING OUT THE INVENTION

[0010]

A first embodiment of the present invention will be described hereunder, referring to Figs. 1 through 3.

A piston type manual pump 1 in the first embodiment is a commercially offered resin-made pump for chemical, and is used by being mounted onto an intrinsic opening of a metallic drum D (one example of a

storage container) into which the urea aqueous solution is filled through the opening for containing. Namely, a screw-threaded member 4 is rotatably disposed around a suction pipe portion 3 extending from a pump body 2, and the suction pipe portion 3 is inserted into the metallic drum D via the opening of the metallic drum D, and then, the screw-threaded member 4 is threaded with the opening of the metallic drum D, so that the pump body 2 is mounted onto the opening of the metallic drum D. A piston rod 5 protrudes outside from the pump body 2 on an opposite side of the side from which the suction pipe portion 3 of the pump body 2 extends, that is, from a topmost end portion of the pump body 2 in a state where the piston type manual pump 1 is attached to the metallic drum D for use in pumping the urea aqueous solution. Hence, when the piston rod 5 is reciprocally moved linearly up and down, a piston in the pump body 2 is operated, so that the urea aqueous solution in the metallic drum D is drawn out of the inside of the metallic drum D through the suction pipe portion 3 to be forced to a hose 6. This piston type manual pump 1 is a well-known pump having a typical configuration in which, when a cap 7 on a tip end of the piston rod 5 is loosened after that the urea aqueous solution of predetermined amount is pumped out of the metallic drum D, the operation for taking out of the urea aqueous solution can be stopped.

[0011]

A manipulation assistive device 10 assembled to this manual pump 1 comprises: a supporting plate 11; a column support 12 formed in a columnar upstanding member disposed to stand on the supporting plate

11; and a rocking arm 13 axially supported by the column support 12.

The supporting plate 11 made of a stainless-steel plate of approximately rectangular shape, includes an opening portion 11o for allowing the screw-threaded member 4 to be brought in position suitable for being threadedly engaged with the intrinsic opening of the metallic drum D, and the screw-threaded member 4 is screw-threaded with the opening of the metallic drum D through the above-mentioned opening portion 11o, so that the supporting plate 1 is immovably fixed. Namely, the screw-threaded member 4 includes a screw-threaded portion 4a and a flange portion 4b having annularly extending wide flange larger than the diameter of the screw-threaded portion 4a, and when the screw-threaded portion 4a which is protruded through the opening portion 11o of the supporting plate 11 is screw-threaded with an inner cylindrical surface of the opening of the metallic drum D, the flange portion 4b depresses the supporting plate 11, so that the supporting plate 11 is securely fixed. In this case, the supporting plate 11 may be stationarily held between the flange portion 4b and a lip of the opening of the metallic drum D to thereby be fixed, or may alternatively be depressed against an upper surface of the metallic drum D by the depression applied by the flange portion 4b to thereby be fixed. Other than this, it can be understood needless to say that the screw-threaded member 4 is applicable to various application examples, such as the case where the female screw-threaded portion 4a of the screw-threaded member 4 is screw-threaded with an outer cylindrical wall surface arranged around the opening of the metallic drum

D. The opening portion 11o of the supporting plate 11 can be provided as a through-hole bored in the supporting plate 11 or a mechanically cut portion by, for example, stamping.

[0012]

Further, to the supporting plate 11, leg members 11a which protrude from a lower surface of the supporting plate 11 to be in contact with the upper surface of the metallic drum D are disposed at two corner portion located in the vicinity of the site at which the column support 12 stands upright on the supporting plate 11. Each of the leg members 11a which is of the shape of a screw with a finger grip at a head portion thereof, is threadedly engaged with the supporting plate 11, so that an amount of downward protrusion thereof from the supporting plate 11 may be adjusted by the screwing motion. In such a case where a relatively wide gap is left between the supporting plate 11 and the metallic drum D, such as when the height of the opening (i.e., a protrusion amount of the wall portion surrounding the opening from the drum upper surface) of the metallic drum D is large or when it is necessary to screw the screw-threaded member 4 in the opening of the metallic drum D via a spacer, the leg members 11a protruding from the supporting plate 11 are in contact with the upper surface of the metallic drum D to support the supporting plate 11, so that any unstable wobbling motion of the manipulation assistive device 10 in operation can be suppressed. Further, since the protrusion amount of the leg member 11a is made to be variably adjustable only by grasping the finger grip at the head portion to rotate the leg member 11a, even if the

gap left between the supporting plate 11 and the metallic drum D varies depending on changing of the metallic drum D from one to another, a variation in the gap can be easily adjusted by the leg member 11a. Further, particularly, since each of the leg members 11a is disposed on the corner portion apart from the opening portion 11o of the supporting plate 11, if the leg member 11a is rotated to increase the protrusion amount thereof from the lower surface of the support plate 11, it is possible to exert a force for upwardly bending the supporting plate 11, and due to a depressing force appearing as a counterforce of the bending, the suppression of the above-mentioned wobbling of the manipulation assistive device 1 can be more effectively achieved.

[0013]

The column support 12 disposed to stand upright on the supporting plate 11 is made of the stainless-steel plate of an elongate shape, and is disposed to stand on the supporting plate 11 by bolting a base flange 12a of the column support 12 to the supporting plate 11. On both sides of the column support 12, ribs 12b for reinforcement are provided to vertically extend from the base flange 12a up to the halfway height of the column support 12, and above the reinforcing ribs 12b, a pivotal support member 12c for pivotally supporting the rocking arm 13 from both sides is fixed on. Incidentally, other than the configuration in which the column support 12 is constructed by the use of a single piece of plate through application of mechanical workings and the pivotal support member 12c is fixed thereto by suitable conventional methods, it is also possible to realize the column

support 12 of two plates structure in which two pieces of metal or resin plates of same shape are disposed to stand on the supporting plate 11 in parallel, so that the rocking arm 13 is held between the two metal or resin plates.

[0014]

Further, a pump supporting ring 14 for surrounding and fixedly fastening the pump body 2 is connected by screw bolts to an intermediate site of the column support 12 to extend therefrom. The pump supporting ring 14 is comprised of semicircular dual partitioning type rings, and surrounds the pump body 2 to support it, so that the column support 12 and the pump body 2 are mutually fixed so as not to move from each other. As a result, it is possible to suppress any displacement which might occur when the piston rod 5 is reciprocally moved, so that a reciprocal operation can be performed smoothly.

[0015]

To the intermediate site of the column support 12, a guide member 15 is also bolted together with the axial support member 12c to extend, and a guide groove 15a along a moving direction of the piston rod 5 is formed on the guide member 15.

On upper end site of such a column support 12, the rocking arm 13 is pivotally held from both sides by the column support 12 and the pivotal supporting member 12c, to be pivotally supported for rocking around a screw bolt as best shown in Fig. 1. The rocking arm 13 includes a supporting point portion 13a pivotally supported by the column support 12,

a power-application portion 13b exerting a force and a working point portion 13c disposed at a position internally (or externally) dividing a length of arm (a segment of linear line) between the supporting point portion 13a and the power-application portion 13b. To the working point portion 13c, the piston rod 5 is connected via a link mechanism, and by manually holding the power-application portion 13b to thereby apply a force to rock the rocking arm 13 about the pivotal axis of the supporting point portion 13a, the piston rod 5 can be reciprocally moved in easy operation with the principle of leverage. Since the rocking arm 13 is a lever type in which a power-application point and a working point are in the same side relative to a supporting point (that is, internal division), the working point portion 13c of the rocking arm 13 is disposed on arched intermediate site between the supporting point portion 13a and the power-application portion 13b. On the other hand, if the rocking arm 13 is in a lever type in which the power-application point and the working point are positioned on opposite sides with respect to the supporting point therebetween (that is, external division), the working point portion 13c of the rocking arm 13 is disposed to extend to an opposite side of the power-application portion 13b with respect to the supporting point portion 13a positioned therebetween. If an arrangement in which the working point portion 13c comes closer to the supporting point portion 13a than the power-application portion 13b, either of the above-mentioned lever types (the internal and external division types) are available. However, the internal division type as in the first embodiment is more advantageous

inform the viewpoint of down-sizing of the entire manipulation assistive device 1.

[0016]

To the working-point portion 13c of the rocking arm 13, a connecting arm 16 is pivotally connected by means of a pivotal pin around which the latter (the connecting arm 16) can perform a rocking motion. Further, to this connecting arm 16, a fixing ring 17 for surrounding and fixedly fastening the piston rod 5 is pivotally connected. Specifically, one connecting pin 16a laterally passes through a lower end portion of the connecting arm 16 hanging from the rocking arm 13, and two supporting arms 16b of L-shape are pivotally supported on both end portions of the connecting pin 16a, and further, side faces of the fixing ring 17 are welded to extreme end portions of the supporting arms 16b. By providing the link mechanism configured by the connecting arm 16 and the fixing ring 17, a rotating motion of the rocking arm 13 about the axis of the supporting point portion 13a is converted into a linear motion of the fixing ring 17, so that the piston rod 5 being reciprocally moved can be smoothly naturally manipulated.

[0017]

Further, the connecting pin 16a of the connecting arm 16 is arranged to slide within the guide groove 15a formed on the guide member 15, so that the connecting arm 16 is guided into the guide groove 15a to be reciprocally moved. By guiding the connecting arm 16 within the guide groove 15a along the moving direction of the piston rod 5, a moving

direction of the connecting arm 16 is controlled, and therefore, the displacement is suppressed, so that the reciprocal operation can be performed smoothly without imposing any extra load except for the pumping load on the piston rod 5.

[0018]

The manipulation assistive device 10 of the above-mentioned configuration can be combined with the commercially offered manual pump 1 after the production thereof, and the reciprocal operation of the piston rod can be performed more easily than ever before with the principle of leverage by the rocking arm 13. Further, such a combination may be made by a simple method of merely holding the supporting plate 11 between the intrinsic opening of the metallic drum D, and the screw-threaded member 4, which is threaded with the opening of the metallic drum D, of the manual pump 1. Also, this manipulation assistive device 10 has a simple mechanism including the supporting plate 11, the column support 12 and the rocking arm 13, which can be made by press molding. Therefore, the manipulation assistive device 10 can be produced at an extremely low cost compared with an automatic pump or a drum pump.

[0019]

For assembling the manual pump 1 with the manipulation assistive device 10, firstly, the manipulation assistive device 10 is arranged so that the opening portion 11o of the supporting plate 11 meets the opening of the metallic drum D. Then, the suction pipe portion 3 is inserted into the

opening of the metallic drum D via the opening portion 11o of the supporting plate 11, and the screw-threaded member 4 is threaded with the opening of the metallic drum D. When the screw-threaded member 4 is threadedly engaged with the opening of the metallic drum D, the supporting plate 11 is depressed to the metallic drum D and also the leg members 11a are in contact with the upper surface of the metallic drum D to support the supporting plate 11. A contacting condition of each of the leg members 11a can be adjusted by grasping the finger grip at the head portion to rotate the leg member 11a.

[0020]

Thereafter, the pump supporting ring 14 surrounding the pump body 2 is bolted to the column support 12, and then, the piston rod 5 is surrounded by the fixing ring 17 to be connected to the rocking arm 13 via the connecting arm 16. When the connecting pin 16a of the connecting arm 16 is accommodated within the guide groove 15a, so that the guide member 15 is bolted to the column support 12, the manual pump 1 and the manipulation assistive device 10 are assembled together. After the assembling, when the power-application portion 13b of the rocking arm 13 of the manipulation assistive device 10 is held 'by hand to apply a vertical rocking motion, the piston rod 5 is reciprocally operated through from the working point portion 13c to the connecting arm 16, so that the urea aqueous solution in the metallic drum D can be taken out easily with the principle of leverage. When a necessary amount of the urea aqueous solution is taken out, if the cap 7 is loosened, the taking out of the urea

aqueous solution can be stopped.

[0021]

Fig. 4 and Fig. 5 show a second embodiment of the present invention. In Figs. 4 and 5, parts and elements identical to those in the first embodiment shown in Fig. 1 to Fig. 3 are denoted by same reference symbols and, the overlap description thereof is omitted.

The manipulation assistive device 10 comprises: the supporting plate 11; a column support (20, 21) disposed to stand upright on the supporting plate 11; and the rocking arm 13 axially supported by the column supports (20, 21).

In the second embodiment, on the supporting plate 11 disposed with the leg members 11a similarly to the first embodiment, two stainless-steel plates 20 and 21 of elongated shape are disposed to stand upright and in parallel with one another, so that an integral column support is configured. The plates 20 and 21 in the same shape for making up the column support are disposed to stand in parallel while facing each other at a predetermined interval, by bolting base flanges 20a and 21a thereof to the supporting plate 11, to thereby hold the rocking arm 13 therebetween. On both side portions of the plates 20 and 21, ribs 20b and 21b for reinforcement are disposed over the total lengths of the respective plates 20 and 21. On intermediate site of the column support (20, 21) of such configuration, the pump supporting ring 14 as in the first embodiment for surrounding to fixedly fasten the pump body 2 may be disposed as required. Further, onto the intermediate site of the one plate 20 of the

column support, a guide arm 22 is pivotally supported while being prevented from being detached by a snap pin 22a so as to be mounted to carry out a rocking motion about a pivotal axis. Incidentally, the guide arm 22 may be provided on both of the plates 20 and 21, respectively.

[0022]

On upper end site of this column support (20, 21), the rocking arm 13 is pivotally supported to be rocked about an axis of a screw bolt via which the rocking arm 13 is held between the two plates 20 and 21. To the working point portion 13c of the rocking arm 13, a connecting arm 30 is connected to be rocked. The connecting arm 30 is configured by axially supporting two arm members of same shape at both sides of the rocking arm 13. The connecting arm 30 is formed to be bent at an intermediate portion thereof, and therefore, has a shape in which the supporting arm 16b in the first embodiment is integrally formed. Then, to a tip end portion of the connecting arm 30 which is formed to be bent, the fixing ring 17 for surrounding and fixedly fastening the piston rod 5 are connected by the welding.

[0023]

To an intermediate portion of the connecting arm 30, the guide arm 22 is pivotally connected to be rocked while being prevented from being detached by a snap pin 22b. The guide arm 22 is rocked according to the movement of the rocking arm 13, and supports the connecting arm 30 so that the intermediate portion thereof does not displace back and forth, or in a lateral direction. Namely, the guide arm 22 suppresses any

non-preferable play of the connecting arm 30 when a force is exerted on the connecting arm 30 by the rocking arm 13, and restricts a moving direction of the connecting arm 30, so that the piston rod 5 can be reciprocally moved without applying any extra load to the piston rod 5.

[0024]

The guide arm 22 is rocked in a large arc trajectory, and therefore, there occurs a bulge of several millimeters relative to a linear trajectory in the reciprocal movement. However, the piston rod 5 originally has a certain amount of play or clearance (movement margin) of several millimeters or more, and therefore, can be moved smoothly by assembling it while taking into consideration this clearance.

Similarly to the first embodiment, the manipulation assistive device 10 in the second embodiment can be combined with the commercially offered manual pump 1 after the production thereof, and the reciprocal operation of the piston rod can be performed more easily than ever before due to the principle of leverage by the rocking arm 13. Further, such a combination may be made by a simple method of merely holding the supporting plate 11 between the opening of the metallic drum D, and the screw-threaded member 4, which is threaded with the opening of the metallic drum D, of the manual pump 1. Also, this manipulation assistive device 10 has a simple mechanism including the supporting plate 11, the column support (20, 21) and the rocking arm 13, which can be made by press molding, and therefore, can be produced at an extremely low cost compared with the automatic pump or the drum pump.

[0025]

For assembling the manual pump 1 with the manipulation assistive device 10, firstly, similarly to the first embodiment, the manipulation assistive device 10 is arranged so that the opening portion 11o of the supporting plate 11 meets the opening of the metallic drum D. Then, the suction pipe portion 3 is inserted into the opening of the metallic drum D via the opening portion 11o of the supporting plate 11, and the screw-threaded member 4 is threadedly engaged with the opening of the metallic drum D. When the screw-threaded member 4 is threadedly engaged with the opening of the metallic drum D, the supporting plate 11 is depressed to the metallic drum D and also the leg members 11a are in contact with the upper surface of the metallic drum D to rigidly support the supporting plate 11. The contact degree of the leg members 11a can be adjusted by grasping the finger grip at the head portion to rotate the leg member 11a.

[0026]

Thereafter, the piston rod 5 is surrounded by the fixing ring 17 to be connected to the rocking arm 13 via the connecting arm 30. When the guide arm 22 is connected to the connecting arm 30 with the snap pin 22b, the manual pump 1 and the manipulation assistive device 10 are assembled together. After the assembling, when the power-application portion 13b on the rocking arm 13 of the manipulation assistive device 10 is held by hand to apply a vertical rocking motion, the piston rod 5 is reciprocally operated through from the working point portion 13c to the

connecting arm 30, so that the urea aqueous solution in the metallic drum D can be easily pumped out owing to the employment of the principle of leverage. When a necessary amount of the urea aqueous solution is drawn out of the container D, if the cap 7 is loosened, the pumping of the urea aqueous solution can be stopped.

## CLAIMS

[1] An manipulation assistive device adapted for a piston type manual pump, which is, in use, mounted on a storage container by threadedly engaging a screw-threaded member that is rotatably attached to a suction pipe portion extending from a pump body, with an opening of the storage container, the piston type manual pump being operative for pumping a liquid from the storage container by reciprocally operating a piston rod protruding outside from the pump body to move a piston within the pump body, wherein the manipulation assistive device comprises:

- a supporting plate configured to have an opening portion formed therein for allowing therethrough the screw-threaded member to be threadedly engaged with the opening of the storage container, thereby bringing the supporting plate to be securely fixed;

- a column support configured to stand upright on the supporting plate; and

- a rocking arm including a supporting point portion pivotally supported by the column support, a power-application portion exerting a force and a working point portion arranged at a position by which a length between the supporting point portion and the power-application portion is divided internally or externally, and wherein

- the piston rod is pivotally connected to the working point portion of the rocking arm, and the power-application portion of the rocking arm is manually grasped for permitting the rocking arm to be rocked thereby reciprocally move the piston rod.

[2] The manipulation assistive device according to claim 1, further comprising:

a connecting arm configured to be pivotally connected to the working point portion of the rocking arm; and

a fixing ring configured to surround and to fixedly fasten the piston rod and to be pivotally connected to the connecting arm.

[3] The manipulation assistive device according to claim 2, further comprising:

a guide member configured to extend from the column support, the guide member being provided therein with a guide groove formed along a moving direction of the piston rod for permitting the connecting arm to reciprocally move therein by a guide of the guide groove.

[4] The manipulation assistive device according to claim 1, further comprising:

a connecting arm configured to be pivotally connected to the working point portion of the rocking arm;

a fixing ring configured to surround and to fixedly fasten the piston rod and to be pivotally connected to an extreme end portion of the connecting arm; and

a guide arm configured to be pivotally supported by the column support and to be pivotally connected to an intermediate portion of the connecting arm.

[5] The manipulation assistive device according to claim 1, further

comprising a pump support ring configured to surround and to fixedly fasten the pump body, the pump support ring being disposed to extend from the column support.

[6] The manipulation assistive device according to claim 1, further comprising leg members configured to protrude from a lower surface of the supporting plate to be in contact with the storage container are disposed.

[7] The manipulation assistive device according to claim 6, wherein the leg members are threadedly engaged with the supporting plate so that a protrusion amount of each of the leg members is adjustable.