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⑤④ **Apparatus for operating and transferring manhole cover.**

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⑦③ Proprietor: **MOCHIZUKI MOTOR CO., LTD.,**
811-1 Oshikiri, Shimizu-shi Shizuoka-ken(JP)

⑦② Inventor: **Mochizuki, Otohiko, 791 Oshikiri, Shimizu-shi**
Shizuoka-ken(JP)
Inventor: **Mochizuki, Susumu, 791 Oshikiri, Shimizu-shi**
Shizuoka-ken(JP)

⑦④ Representative: **Eisenführ, Spelser & Strasse,**
Martinistrasse 24, D-2800 Bremen 1(DE)

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Description

The invention relates to an apparatus for opening, transferring and closing a manhole cover, comprising a lever body (32) having one end (40) which defines a point (40) of force application, a number of wheels (34) rotatably mounted on the other end of said lever body (32) so as to form a fulcrum support, at least a pair of operating arms (52, 52) mounted on said lever body (32) so as to extend in the direction away from the point (40) of force application, and a hanging hook (36, 36) pivotally mounted on the distal end of each of said operating arms (52, 52).

In general, manhole covers are formed with various kinds of operating holes which are adapted to be engaged with a distal end of a lifting means, such as a lifting lever, to lift it. An operating hole provided at a manhole cover will be described with reference to Fig. 1. As shown in Fig. 1, various kinds of operating holes are formed at a manhole cover depending upon the type of manhole cover. In Fig. 1, reference numeral 20 designates a manhole cover and 22a to 22f designate operating holes formed at the manhole cover 20. In general, such operating holes are each typically arranged in the circumferential direction of a manhole cover 20 and in the vicinity of a periphery of the cover 20. In Fig. 1, a single manhole cover 20 is provided with all kinds of operating holes 22 for the sake of brevity. It should be noted that normally one or two such types of operating holes are selectively provided at a manhole cover 20 depending upon the type of a manhole cover 20. Operating holes designated by reference numerals 22a and 22b in Fig. 1 are of the type defined by the British Standards and are typically used in Japan. The operating holes 22a and 22b are each formed to have a central circular portion and a pair of extensions outwardly radially extending in the opposite directions therefrom, so that such a hanging hook as generally indicated by reference numeral 24 in Fig. 1, which is constructed to have projections 26 provided on both sides of a lower end thereof, may be engagedly fitted at a lower portion thereof in the operating hole. More particularly, the operating holes 22a and 22b are each operated by means of the hanging hook 24 in such a manner that the hanging hook 24 is inserted through the operating hole 12a or 12b and rotated about 90 degrees to securely support a lower side of the manhole cover 20 on the projections 26, and then the hanging hook 24 is upwardly moved to lift the manhole cover 20.

An operating hole of such type as designated by reference numeral 22c is formed to include a blind hole portion having a round bottom and a rectangular planar shape and a rod portion provided in a manner to be laid access the blind hole portion to separate the surface of the blind hole portion into two sections, so that a hanging hook as generally designated by reference numeral 28 in Fig. 1 may be operated with respect to the manhole cover 20 in a manner such that a hook portion 30 of the hanging hook 28 is engaged with the rod portion of the operating hole 22c to scoop the manhole cover 20 there-

through and then the hanging hook 28 is elevated to lift the manhole cover 20.

An operating hole designated by reference numeral 22d is of the so-called hatch-type and comprises a blind hole portion and a handle provided in a manner to be retractable with respect to the manhole cover 20. The operating hole 22d is likewise operated by a hanging hook of such type as indicated by reference numeral 28.

Operating holes indicated by reference numerals 22e and 22f in Fig. 1 are of the so-called pick-hole type and comprise through-holes formed into substantially circular and square shapes, respectively. An operating hole of the pick-hole type is generally provided at a manhole cover placed on a road onto which the weight motor vehicles is directly applied, because the other type of operating hole of a larger size reduces the strength of the manhole cover, often resulting in damage of the manhole cover due to the weight of passing cars.

A conventional manhole opening, transferring and closing apparatus of the initially mentioned kind is disclosed in JP-U 48 060 353. This apparatus is constructed in such a manner as shown in Figs. 2A and 2B. The apparatus includes a lever body 100 comprising a pair of lever members 102 which are pivotally connected together at one end thereof acting as a point of force so as to be pivotally moved with respect to each other and a wheel 106 rotatably mounted at the other end of each of the lever members 102. The apparatus also includes an operating arm 108 provided integral with each of the lever members 102 on an inside of the lever member 102 in a manner to project in the direction opposite to that in which the lever body 100 carries out the operation of opening a manhole cover 20. Each of the operating arms 108 has a hanging hook member 112 pivotally mounted on a distal end thereof. The hanging hook member 112 is adapted to be engaged with an operating hole 22 of the manhole cover 20 to operate the manhole cover through the operating hole 22.

The manner of operation of the apparatus of Fig. 2 constructed as set forth above will be described now.

First, the hanging hook members 112 are each inserted into the operating hole 22 which is an operating hole defined in the British Standards of the manhole cover 20 and then turned 90 degrees to engage projections provided at a lower end of the hanging hook member 112 with a lower surface of the manhole cover 20 to support the manhole cover 20 on the projections so that it may be prevented from being released from the operating hole 22. Then, the one end of the lever body 100 defining the point of force 104 is pushed down to cause the lever body 100 to carry out a lever action in which the wheels 106 act as a point of support, resulting in a distal end of each of the operating arms 108 being upwardly moved. Thereafter, the manhole cover 20 held on the hanging hook members 112 is lifted and then transferred by means of the wheels 106.

However, the conventional manhole cover opening transferring and closing apparatus shown in Fig. 2 has a disadvantage in that it fails to securely

hold a manhole cover 20 during the operation because the hanging hook members 112 are each engaged with the manhole cover 20 by merely abutting the projections of the hanging hook member 112 against the lower surface of the manhole cover 20, so that there is a likelihood that the manhole cover 20 could be released and fall down from the apparatus due to a swing phenomenon of the manhole cover 20 or the oscillation of the manhole cover 20 during the lifting and transferring operation.

Also, the conventional apparatus causes the weight of the manhole cover 20 applied to the hanging hook members 112 to generate inward moment, as indicated at arrows A in Fig. 2B, which acts on the whole lever body 100, resulting in the connection 104 between the lever members 102 being substantially torsionally loaded. As a result, the connection 104 between the lever members 102 must have sufficient strength to resist such torsional load. However, this renders the provision of an operating knob means which is in parallel with operating holes of a manhole cover 20 at the other end of the lever body 100 highly difficult. If such an operating knob means is not provided, the apparatus cannot be operated safely or efficiently. This is especially the case when the operating holes 22 are arranged away from an outer periphery of the manhole cover 20, because such an arrangement of the operating holes significantly increases the torsion moment.

Further, in the conventional manhole cover opening, transferring and closing apparatus, the operation of a manhole cover 20 having operating holes 22 provided away from an outer periphery thereof requires the inner arrangement the hanging hook members 112 away from the wheels 106. This causes members for supporting the hanging hook members 112 to project substantially inwardly from the lever body 100, thereby making compact folding of the apparatus impossible. Another conventional apparatus for opening, transferring and closing a manhole cover formed with any one of various kinds of operating holes is disclosed in the US 4 126 297. However, the apparatus disclosed therein is restricted in its usefulness to limited manhole covers provided with an operating hole in the vicinity of the periphery and is not always used for operating and transferring a manhole cover having an operating hole in the center of the cover, which cannot perfectly remove the problems of the prior art.

The object of the present invention is to provide an apparatus for opening, transferring and closing a manhole cover which is capable of being effectively applicable to a manhole cover formed with any through-hole type operating hole including that of the pick-hole type.

This object is solved by a manhole opening, transferring and closing apparatus of the initially mentioned kind which is characterized in that press means is provided on one of said operating arms or lever body at a position thereof away from said distal end of each of said operating arms so as to be abutted against the upper surface of said manhole cover during the operation of lifting it, said hanging hook comprises a vertical support member pivotally mounted at an upper end thereof on said distal end

of the appropriate operating arm so as to be pivotally movable in the longitudinal direction of said apparatus and a hanging member pivotally mounted at one end thereof on the lower end of said vertical support member so as to inwardly extend therefrom in a direction inclined to the pivotal axis of said vertical support member on said operating arm in the direction away from said point of force application, said hanging member includes an insertion insertable into an operating hole of said manhole cover in a manner to be eccentric with respect to an apparent manhole cover lifting point of said apparatus, said insertion being provided at a lower end thereof with a projection which projects toward said vertical support member and that said apparent manhole cover lifting point of said apparatus is positioned beyond a line connecting the operating holes, on the same side as the point of force application.

The manhole cover opening, transferring and closing apparatus of the present invention is widely applicable to a manhole cover having any through-hole type operating hole including a pick-hole type one.

Furthermore the apparatus of the present invention ensures secure engagement between the hanging hooks and a manhole cover, thus effectively preventing the manhole cover from being released therefrom during the operation.

Further, the present invention is constructed in such a manner that the position at which the hanging hooks are engagedly inserted into the operating holes of a manhole cover is deviated from the position at which the hanging hook lifts the manhole cover, so that the manhole cover may be lifted at a position deviated from its gravity; and the manhole cover is stably held on the side of the deviated position in a downwardly forced manner. Thus, the present invention effectively prevents a swing phenomenon of the manhole cover during the manhole cover lifting and transferring operation.

Such construction also prevents the application of torsion stress to the lever body. This requires the lever body to have only enough strength to resist flexural load applied thereto during the manhole cover lifting operation. Thus, the lever body in the present invention may be formed of a material of low strength and cost as compared with that in the conventional apparatus. This also permits the provision of a grip means at the lever body which is impossible in the conventional apparatus. Furthermore, this allows the lever body to be constructed so as to be foldable as described above. Thus, the apparatus of the present invention has significantly improved workability and may be readily stored in a compact manner.

Advantageous developments of the present invention are characterized by the subordinate claims.

Preferably said lever body comprises a pair of lever members pivotally connected together at one ends thereof on the side of said point of force application to permit the other ends thereof on the side of a point of application of said lever body to be closely movable to each other and, further, said pivotal connection between said lever members is

positioned in a manner to be inclined to said line connecting the operating holes in the lateral direction.

Furthermore it is preferred that said lever members are each formed to be foldable at a suitable position thereof in the direction opposite to that of force applied to said point of force application.

By these advantageous developments the apparatus for opening, transferring and closing a manhole cover is capable of being folded in a compact manner to facilitate the storing.

A preferred embodiment of an apparatus for opening, transferring and closing a manhole cover according to the present invention will be described hereinafter with reference to the accompanying drawings 3 to 25.

The Figs. showing:

Fig. 1 is a schematic view showing various types of operating holes provided at a manhole cover and hanging hooks for operating the manhole cover through the operating holes;

Fig. 2A is a perspective view showing a conventional apparatus for lifting and transferring a manhole cover;

Fig. 2B is a front view of the manhole cover lifting and transferring apparatus shown in Fig. 2A;

Fig. 3 is a perspective view showing an embodiment of an apparatus for operating and transferring a manhole cover according to the present invention;

Fig. 4 is a side elevation view of the manhole cover operating and transferring apparatus shown in Fig. 3;

Fig. 5 is a plan view of the manhole cover operating and transferring apparatus shown in Fig. 3;

Fig. 6 is an enlarged perspective view showing a structure on the side of a point of application in the apparatus shown in Fig. 3;

Fig. 7 is a side elevation view of the structure shown in Fig. 6;

Fig. 8 is a rear view of the structure shown in Fig. 6;

Fig. 9 is a perspective view showing a hanging hook;

Fig. 10 is an exploded view of the hanging hook shown in Fig. 9;

Fig. 11 is a side elevation view of the hanging hook shown in Fig. 9;

Fig. 12 is a plan view of the hanging hook shown in Fig. 9;

Figs. 13A to 13E show the manner of operation of the manhole cover operating and transferring apparatus shown in Figs. 3 to 5;

Figs. 14A and 14B each show the operation of the eccentric hanging hook shown in Figs. 9 to 12;

Fig. 15 is a schematic plan view showing the engagement between the hanging hook shown in Figs. 9 to 12 and various operating holes of the through-hole type;

Fig. 16 is an exploded perspective view showing a modification of a vertical support member of a hanging hook;

Fig. 17 is an exploded perspective view showing another modification of a vertical support member;

Fig. 18A is a partly enlarged perspective view showing a modification of a lever body;

Figs. 18B and 18C are perspective views showing the steps of folding the lever body shown in Fig. 18A;

Fig. 19A is a partly enlarged perspective view showing another modification of a lever body;

Fig. 19B is a plan view showing an example of use of the manhole cover operating and transferring apparatus having the lever body shown in Fig. 19A;

Fig. 20 is a perspective view showing another embodiment of an apparatus according to the present invention;

Fig. 21 is an enlarged perspective view showing a pivotal structure of an elongated support frame mounted on an operating arm;

Fig. 22 is an enlarged-perspective view showing a structure for mounting the support frame on a lever member;

Fig. 23 is a perspective view showing a further embodiment of an apparatus according to the present invention;

Fig. 24 shows the manner of operation of the apparatus shown in Figs. 20 and 23; and

Fig. 25 is a perspective view showing a modification of a hanging hook.

Figs. 3 to 5 illustrate an embodiment of a manhole cover operating and transferring apparatus according to the present invention, wherein a manhole cover operating and transferring apparatus of the illustrated embodiment is generally designated by reference numeral 30. The apparatus generally comprises a lever body 32, a wheel means 34 defining a point of support and a pair of eccentric hanging hooks 36 adapted to directly hook and raise a manhole cover 20.

The lever body 32 includes two lever members 38 which, in the illustrated embodiment, are horizontally pivotally connected at one end thereof to each other on the side of a point of force 40 of the lever body 32 so that the other ends or free ends of the lever members 38 may be accessible to each other. In the illustrated embodiment, the connection between both lever members 38 on the side of the point of force 40 is carried out by pivotally connecting a grip portion 42 formed by a L-shaped one end of one of the lever members 38 with one end of the other lever member to form a pivotal connection 44 therebetween. Thus, the so-formed pivotal connection 44 is positioned at one end of the grip portion 42. The lever body 32 may be formed of a suitable material such as, for example, a steel pipe or the like, so long as it has sufficient strength to act as a lever means capable of lifting the manhole cover 20.

The wheel means 34 is mounted on an end of the lever body 32 opposite to the point of force 40. In the illustrated embodiment, the wheel means 34 comprises a pair of wheels 46 one each of which is rotatably mounted on a distal end 15 of a support fork member 48 connected at one end thereof to the other end of each of the lever members 38 so as to extend therefrom at an angle in the longitudinal direction with respect to the lever member 38. The support fork members 48, as shown in Figs. 4 to 8,

each have an extension 50 provided at the one end thereof so as to inwardly extend therefrom. The extensions 50 are provided at a distal end thereof with a pair of operating arms 52 of a forked shape. A pair of the operating arms 52 are arranged in a manner to be opposite to each other and project in the forward direction of the manhole cover operating and transferring apparatus of the illustrated embodiment. The operating arms 52 are each spaced from the associated wheel 46 by a distance sufficient to allow the hanging hook 36 mounted on a distal end of each of the operating arms 52 to be engaged with an operating hole 22 of the manhole cover 20 to lift the manhole cover in such a state that the wheels are positioned at the outside of the manhole cover 20. The operating arms 52 may be arranged at positions spaced from the corresponding wheels 46 by a distance sufficient to handle a manhole cover having operating holes arranged at an innermost position thereof, for example, at a position inwardly spaced by a distance of about 250mm from an outer periphery of the manhole cover. In the illustrated embodiment, the lever members 38 and extensions 50 may be formed of a steel pipe and the support fork members 48 and operating arms 52 may be formed of a relatively flat metal material such as steel plate or the like.

Now, the eccentric hanging hooks 36 will be described hereinafter with reference to the drawings, particularly, Figs. 1 and 9 to 12.

The eccentric hanging hooks 36 are each mounted through a connection pin 54 on a distal end of the operating arm 52. In the illustrated embodiment, each of the eccentric hanging hooks 36, as shown in Figs. 9 to 12, comprises a vertical support member or connection member 56 of a block-like shape pivotally connected at an upper end thereof through the pin 54 to the operating arm 52 and a hanging member 58 movably mounted at an upper end thereof on a lower end of the support member 56. The vertical support members 56 are each somewhat twisted about the longitudinal axis to render a distal end of the hanging member 58 eccentric with respect to the position of the pin 54 provided at the operating arm 52, as shown in Fig. 11. More particularly, the vertical support member 56 is formed to permit the pin 54 positioned on the upper end thereof to be pointed in a direction substantially parallel to the extension 50 and a pin 60 for connecting the lower end of the support member 56 to the hanging member 58 to be pointed in a direction somewhat deviated from that perpendicular to the pin 54. This, as shown in Figs. 5 and 12, causes the hanging members 58 to be deflected by a distance indicated at reference character D ahead from a line formed by connecting both support members 56 together. The hanging members 58 are each generally formed into a substantially L-shape so as to have an extension arm 62 connected at one end thereof to the lower end of the support member 56 and an insertion 64 mounted at an upper end thereof on the other end of the extension arm 62 so as to downwardly extend therefrom. In the illustrated embodiment, the extension arm 62 and insertion 64 are formed integrally with each other. Reference numeral 66 designates a

hanger mounted on the upper end of the insertion 64 through which the hanging member 58 is lifted. The hanging member 58 also includes a compressed spring 68 arranged between the extension arm 62 and a spring support member 70 mounted at an inner side surface of the vertical support member 56 so as to extend in parallel to the extension arm 62, so that the extension arm 62 may be downwardly biased by the spring 68 to extend in a direction somewhat downwardly slanted with respect to the direction perpendicular to the vertical support member 56. Also, the insertion 64 is formed on the side of a lower end thereof facing the vertical support member 56 with a holding projection 72, corresponding to the holding projection 72, the operating arm 52 or lever member 38 is provided with a press member 74 for pressing the manhole cover 20 lifted during the lifting operation, as shown in Figs. 6 and 7. In the illustrated embodiment, the press member 74 comprises a bolt which has an adjustable length and is provided on a lower portion of the distal end of the extension member 50 to which the operating arm 52 is connected. The bolt constituting the press member 74 is preferably covered at a head portion thereof with an elastic material such as rubber or the like.

Now, the manner of operation of the manhole cover operating and transferring apparatus of the above-described embodiment illustrated in Figs. 3 to 12 will be described with reference to Figs. 13 and 14.

Insertion of eccentric hanging hook into manhole cover:

First, the operation of moving the manhole cover operating and transferring apparatus 30 to a position at which a manhole cover 20 to be lifted is placed and inserting the insertion 64 of each of the hanging members 58 into an operating hole 22 of the manhole cover 20 takes place. The operation is carried out by inverting the apparatus 30 to cause the insertion 64 to be hung and then inserting it into the operating hole 22 of the manhole cover as shown in Figs. 13A and 14A. Fig. 15 shows the shape of the insertion 64, being inserted into all kinds of operating holes as indicated by reference numerals 22a, 22b, 22e and 22f.

Engagement between eccentric hanging hook and manhole cover:

Then, the inverted apparatus is raised up as shown in Fig. 13B. This is carried out by rotating the lever body 32 about the pin 54 in a clockwise direction shown in Fig. 13A. This causes the wheels 46 acting as the point of support to be contacted with the ground and the distal end of each of the operating arms 52 to be raised about the point of support. This, as shown in Fig. 14B, results in the extension arm 62 of each of the hanging members 58 being raised at the one end thereof at which the pin 60 is provided, so that the insertion 64 may be somewhat slanted while it is inserted into the operating hole 22 of the manhole cover 20 to securely abut both sides thereof against upper end lower edges of the manhole cover 20, to thereby fixedly engage the hanging member 58 and the manhole cover 20 together. Such secure engagement between the both is promoted by the compressed spring 68, because it acts

to force the extension arm 62 to press down the distal end of the arm. The above-described operation which is carried out by raising up the lever body 32 is convenient; however, the operation may be carried out using another procedure. For example, it may be carried out by inserting the insertion 64 of each of the hanging members 58 into the operating hole 22 of the manhole cover 20 while keeping the lever body 32 in a vertical state.

Drawing-up of manhole cover:

Then, the point of force 40 is further pressed down as shown in Fig. 13C, so that the operating arms 52 may be drawn up due to a lever action in which the wheels 46 serve as a point of support. In the illustrated embodiment, the lever body 32 and operating arms 52 may be formed to be, for example, about 1000mm and 100mm in length, respectively. Such dimensions allow the force applied to point of force 40 to be increased by eight to ten times due to the lever action, thereby more facilitating the starting of drawing-up or lifting of the manhole cover 20. When the drawing-up of the manhole cover starts, it is generally lifted not horizontally but obliquely, as shown in Fig. 13C. This is because the insertion 64 of each of the hanging members 58 is kept substantially integral with the manhole cover 20 during the lifting operation, so that the apparent central point for lifting the manhole cover, which is a manhole cover lifting position of the apparatus 30, is not on a line obtained by connecting the operating holes 22 of the manhole cover 20 together but at a position on the manhole cover somewhat aside to the point of force 40 of the lever body 32. Such a featured action is uniquely obtained by the eccentric hanging hooks 36 provided in the apparatus of the present invention. Thus, the eccentric hanging hooks 36 lift only one side of the manhole cover, causing the other side of the manhole cover to be on a support frame of a manhole, so that the weight on the other side of the manhole cover may be applied to the support frame. Thus, the manhole cover operating and transferring apparatus of the illustrated embodiment is not required to support the overall weight of the manhole cover. Subsequently, when the point of force 40 of the lever body 32 is further downwardly moved, the press member 74 provided at the base portion of each of the operating arms 52 is caused to be abutted against the upper surface of the manhole cover 20 to downwardly force the manhole cover 20. This results in the portion of the manhole cover placed on the support frame of the manhole cover 20 to be lifted due to a lever action wherein the vertical support members 56 of the eccentric hanging hooks 36 serve as a point of support, so that the manhole cover 20 may be horizontally lifted as shown in Fig. 13D. In this instance, the manhole cover 20 is lifted about a position which is somewhat deviated from a line obtained by connecting the vertical support members 56 together or the gravity of the manhole cover 20, so that the manhole cover may be apt to be generally obliquely lifted. However, in the illustrated embodiment, this is effectively prevented by a pair of the press members 74, as

described above. Thus, the manhole cover 20 is lifted in such a manner as to be substantially integral with the apparatus 30 to a degree sufficient to prevent the above-described swing phenomenon encountered with the prior art. Also, in the illustrated embodiment, the wheels 46 act as a point of support and a position of each lever member 38 at which the vertical support member 56 is provided bears the weight of the manhole cover therefore generating momentum which causes the lever member 38 to be inwardly twisted. However, the press members 74 are abutted against the upper surface of the manhole cover to effectively suppress the moment as described above, to thereby prevent the application of forcible torsion stress to the lever members 38.

Transferring of manhole cover:

Subsequent to the drawing-up of the manhole cover from the support frame of the manhole, the apparatus 30 is moved so as to transfer the manhole cover horizontally to another place away from the manhole. Such movement of the apparatus is smoothly carried out by means of the wheels 46.

Storing of apparatus:

The storing of the apparatus after use is readily accomplished by folding it at the pivotal connection 44 between the lever members 38 as shown in Fig. 13E. In this instance, the pivotal connection 44 is provided at the distal end of the grip portion 42 integrally connected to one of the lever members 38 so as to be biased on one side of the lever body 32. Accordingly, the folding of the lever body 32 permits the wheel 46 and the eccentric hanging hook 36 mounted on the distal end of the lever member 38 free of the grip portion 42 to be positioned on the inside of the wheel 46 and eccentric hanging hook 36 of the other lever member 38 without abutting against them. Thus, the apparatus of the illustrated embodiment may be stored in a compact manner.

In the illustrated embodiment described above, the vertical support member 56 of each of the eccentric hanging hooks 36 may be constructed in such a manner as shown in Fig. 16. The vertical support member 56 shown in Fig. 16 is adapted to be mounted on the distal end of the operating arm 52 through a pin block 76 fitted on the support member 56 via a through-hole 78. The direction of fitting between the support member 56 and the pin block 76 is regulated by a key groove 80 formed on the support member 56 and a projection 82 formed on the through-hole 78 of the pin block 76. Also, the pin block 76 is provided so as to be adjustable in the vertical direction with respect to the support member 56. More particularly, the vertical support member 56 is formed on an outer periphery thereof with a thread, so that a nut 84 may be threadably engaged with a portion of the support member 56 projecting from the pin block 76 and vertically adjusted with respect to the support member 56.

Alternatively, the vertical support member may be constructed as shown in Fig. 17. The vertical

support member 56 shown in Fig. 17 is formed at a portion thereof on which a pin block 76 is fitted into a semi-cylindrical shape corresponding to the through-hole 78 of the pin block 76, so that the direction of engagement between the both may be regulated. The remaining part of the support member 56 shown in Fig. 17 is constructed in substantially the same manner as that shown in Fig. 16.

In the illustrated embodiment, the lever body 32 may be modified in such a manner as shown in Figs. 18 or 19.

A lever body 32 shown in Fig. 18 is constructed to more facilitate the storing of the apparatus. More particularly, in the lever body 32, lever members 38 constituting the lever body 32 are each provided at a suitable position thereof with a bendable portion 86 which is formed to be bent in the direction opposite to that in which force is applied to the point of force 40 during the operation of lifting a manhole cover, to thereby be foldable toward the wheel means side as shown in Figs. 18B and 18C. Also, the bendable portion 86 is constructed so as to be rotatable 180 degrees from the position of Fig. 18C at which the lever member is fully folded to that shown in Fig. 18A. Reference numeral 87 designates a set pin for keeping the posture of the lever member 38 horizontally extended.

A lever body 32 shown in Fig. 19A is formed of a single lever member 38 provided at one end thereof with a hook member 88 and an extendable shaft member 90 for supporting wheels 46 at both ends thereof in a substantially T shape. The shaft 90 is connected at a middle portion thereof to one end of the lever member 38. For this purpose, the shaft 90 is provided at the middle portion thereof with a tubular connecting member 92 having a holding means 94 mounted thereon which is adapted to be engaged with the inner recessed surface of the hook member 88 when the lever member 38 is inserted at the one end thereof on the connecting member 92, to thereby securely connect the one end of the lever member 38 therethrough with respect to the shaft member 90. In the illustrated embodiment, the shaft member 90 comprises a shaft body 96 on which the connecting member 92 is securely fitted and a pair of adjustable rods 98 nestedly connected relative to both ends of the shaft body 96 so as to be extendable relative to the shaft body 96, as shown in Fig. 19B. The wheels 46 are each mounted on an outer end of the adjustable rods 98 and the eccentric hanging hooks 36 are each arranged at a position on the rod 98 inside the wheel 46 so as to be slidable on the shaft member 90.

The manhole cover operating and transferring apparatus including the lever body 32 shown in Fig. 19A is effectively applicable to a manhole cover of a special form which has, for example, a single through-hole or operating hole 22' formed at a suitable position thereof, such as a central position or the like as shown in Fig. 19B, as well as the above-described one having two operating holes formed thereon opposite to each other. More particularly, the apparatus 30, as shown in Fig. 19B, is operated in such a manner that the connecting member 92 fit-

ted on the shaft member 90 is moved together with the shaft body 96 to the left direction in Fig. 19B and the hanging hook 36 on the right side in Fig. 19B is slidably moved in close proximity to the center of the shaft member 90, so that the insertion 64 of the hanging hook 36 is inserted into the operating hole 22'. Since the hanging hook 36 on the left side in Fig. 19B is not used, it is placed on the manhole in a such manner that the lower end thereof faces forwardly. Alternatively, the hanging hook 36 which is not used may be removed from the shaft member 90.

Further, other embodiments of an apparatus for operating and transferring a manhole cover according to the present invention, which is effectively applicable to the manhole cover 20 having the operating hole 22' in its center, will now be described with reference to Figs. 20 - 25.

In Figs. 20 - 22, a manhole cover operating and transferring apparatus 30 having a similar construction to the one shown in Figs. 3 - 6, includes a lever body 32 comprising a pair of lever members 38. In this embodiment, an elongated support frame 150 of a pipe form is provided with an eccentric hanging hook 36 on its central portion via an operating arm 52a. One end of the support frame 150 is pivotally mounted to one operating arm 52 through a pivot mount 151 secured thereto, as clearly shown in Fig. 21, and the other end of the support frame 150 is detachably mounted to the other operating arm 52 by fastening a mount plate 152 provided to the other end of the support frame 150 to the other operating arm 52 by means of a bolt 153.

When the eccentric hanging hook 36 of the support frame 150 is not used, as shown by two-dotted lines of Fig. 20, the support frame 150 is pivoted up to the lever member 38 around the pivot mount 151 to be situated beside the lever member 38 and then the mount plate 152 of the support frame 150 is fixed to a bracket 154 attached to the lever member 38 by a bolt 155, as shown in Fig. 22, to mount the frame 150 onto the lever member 38 in its storing position.

In Fig. 23, there is shown another manhole cover operating and transferring apparatus having a similar structure to the apparatus shown in Fig. 20. In this case, an elongated support frame 150 is separably mounted to the operating arms 52 at its opposite ends. That is, the support frame 150 is provided with mount plates 156 on its opposite ends and the mount plates 156 are detachably fixed to the respective operating arms 52 by bolts 157.

The apparatus of these two embodiments shown in Figs. 20 and 23 are operated, as shown in Fig. 24, in the same manner as that of the aforementioned embodiment of the apparatus, which is described in connection with Fig. 13.

In Fig. 20, a pair of eccentric hanging hooks 36' mounted to the respective operating arms 52 have the same construction as those of Fig. 3, except that free ends of insertions 164 are rounded at an angle of approximate 90 degree, as shown in Fig. 25, instead of providing with holding projections 72 shown in Fig. 3. Such insertions 164 may be effectively applicable when the manhole cover 20 is provided with engaging grooves in its peripheral side portion.

Claims

1. An apparatus for opening, transferring and closing a manhole cover, comprising a lever body (32) having one end (40) which defines a point (40) of force application, a number of wheels (34) rotatably mounted on the other end of said lever body (32) so as to form a fulcrum support, at least a pair of operating arms (52, 52) mounted on said lever body (32) so as to extend in the direction away from the point (40) of force application, and a hanging hook (36, 36) pivotally mounted on the distal end of each of said operating arms (52, 52), characterized in that

a) press means (74, 74) is provided on one of said operating arms (52, 52) or lever body (32) at a position thereof away from said distal end of each of said operating arms (52, 52) so as to be abutted against the upper surface of said manhole cover (20) during the operation of lifting it

b) said hanging hook (36, 36) comprises a vertical support member (56, 56) pivotally mounted at an upper end thereof on said distal end of the appropriate operating arm (52, 52) so as to be pivotally movable in the longitudinal direction of said apparatus (30) and a hanging member (58, 58) pivotally mounted at one end thereof on the lower end of said vertical support member (56, 56) so as to inwardly extend therefrom in a direction inclined to the pivotal axis (54, 54) of said vertical support member (56, 56) on said operating arm (52, 52) in the direction away from said point (40) of force application,

c) said hanging member (58, 58) includes an insertion (64, 64) insertable into an operating hole (22) of said manhole cover (20) in a manner to be eccentric with respect to an apparent manhole cover lifting point of said apparatus, said insertion (64, 64) being provided at a lower end thereof with a projection (72, 72) which projects toward said vertical support member (56, 56), and that

d) said apparent manhole cover lifting point of said apparatus (30) is positioned beyond a line connecting the operating holes (22), on the same side as the point (40) of force application.

2. An apparatus as defined in Claim 1, wherein said deviation of said hanging member (58, 58) is effected by twisting said vertical support member (56, 56) about its longitudinal axis.

3. An apparatus as defined in Claim 1, wherein said vertical support member (56) is connected through a pin block (76) to said operating arm (52) so that the deviation of said hanging member (58) is effected.

4. An apparatus as defined in Claim 1, wherein said press means (74) comprises a bolt mounted on a lower surface of said operating arm (52), said bolt being vertically adjustable.

5. An apparatus as defined in Claim 2 or 3, wherein said hanging member (58, 58) comprises an extension arm (62) connected at one end thereof to the lower end of said vertical support member (56) so as to laterally inwardly extend therefrom and an insertion (64) connected at an upper end thereof to the other end of said extension arm (62) so as to downwardly extend therefrom and adapted to be in-

serted into an operating hole (22) of said manhole cover (20).

6. An apparatus as defined in Claim 5, wherein said extension arm (62) is biased by means of an elastic means (68) so that the other end thereof may be downwardly forced.

7. An apparatus as defined in Claim 6, wherein elastic means (68) comprises a compressed spring (68) interposed between an upper surface of said extension arm (62) and said vertical support member (56).

8. An apparatus as defined in Claim 1, further includes the third hanging hook (36a) of substantially the same construction of said hanging hook (36, 36), the said third hanging hook (36a) is pivotally mounted on the third operating arm (52a) which is mounted on said lever body (32) at a position between said pair of operating arms (52, 52) by means of an elongated support frame (150) interposed between said pair of operating arms (52, 52).

9. An apparatus as defined in Claim 8, wherein said elongated support frame (150) is pivotally mounted at one end thereof on one of said operating arms (52, 52) and is detachably attached at the other end thereof to the other of said operating arms (52, 52) so that said elongated support frame (150) is capable of being mounted on said lever body (32) when it is not in use.

10. An apparatus as defined in Claim 8, wherein said elongated support frame (150) is detachably mounted at both ends thereof on said operating arms (52, 52).

11. An apparatus as defined in Claim 1, wherein said lever body (32) comprises a pair of lever members (38, 38) pivotally connected together at one ends thereof on the side of said point of force (40) to permit the other ends thereof on the side of a point of application of said lever body (32) to be closely movable to each other.

12. An apparatus as defined in Claim 11, wherein said pivotal connection (44) between said lever members (38, 38) is positioned in a manner to be deviated in the lateral direction from said gravity line of said manhole cover (20).

13. An apparatus as defined in Claim 12, wherein said lever members (38, 38) are each formed to be foldable at a suitable position thereof in the direction opposite to that of force applied to said point of force (40).

14. An apparatus as defined in Claim 1, wherein said lever body (32) comprises a single lever member (38) and a pair of rods (98, 98) releasably connected to both ends of said lever member (38) so that said lever body (32) is generally formed into a T-shape, said rods (98, 98) being arranged to be extendable with respect to said lever member (38).

Patentansprüche

1. Vorrichtung zum Öffnen, Transportieren und Verschließen eines Schachtdeckels mit einem Hebelrahmen (32), der an einem Ende (40) einen Krafteintragungspunkt (40) bildet, mit mehreren Rädern (34), die drehbar am anderen Ende des Hebelrahmens (32) montiert sind und Drehlager bilden, mit we-

nigstens einem Paar Betätigungsarme (52), die an dem Hebelrahmen (32) derart angebracht sind, daß sie vom Krafteintragungspunkt (40) fort verlaufen, mit einem herabhängenden Haken (36, 36), der drehbar an dem distalen Ende eines jeden Betätigungsarmes (52, 52) angebracht ist, dadurch gekennzeichnet, daß

a) ein Druckmittel (74, 74) an einem der Betätigungsarme (52, 52) oder am Hebelrahmen (32) in einer vom distalen Ende der Betätigungsarme (52, 52) entfernten Position vorgesehen ist und das während des Anhebens gegen die Oberseite des Schachtdeckels (20) drückt,

b) daß die herabhängenden Haken (36, 36) vertikal verlaufende Halteelemente (56, 56) umfassen, die an einem oberen Ende drehbar an den distalen Enden der entsprechend ausgebildeten Betätigungsarme (52, 52) befestigt sind, so daß sie in Längsrichtung der Vorrichtung (30) gedreht werden können, sowie ein herabhängendes Element (58, 58), das mit einem seiner Enden drehbar an dem unteren Ende des vertikalen Halteelementes (56, 56) derart angebracht ist, daß es von dort nach innen gerichtet und vom Krafteintragungspunkt (40) fort mit einer Neigung zur Drehachse (54, 54) des vertikalen Halteelementes (56, 56) des Betätigungsarmes (52, 52) verläuft,

c) daß das herabhängende Element (58, 58) einen Einsatz (64, 64) beinhaltet, der in die Arbeitsöffnung (22) des Schachtdeckels (20) exzentrisch zu einem an der Vorrichtung sichtbaren Schachtdeckel-Hebepunkt eingesetzt werden kann, und der an einem unteren Ende mit einem Vorsprung (72, 72) versehen ist, der zu dem vertikalen Halteelement (56, 56) weist, und

d) daß der sichtbare Schachtdeckel-Hebepunkt der Vorrichtung (30) sich über einer Linie befindet, die auf der Seite des Krafteintragungspunktes (40) liegt und die die Arbeitsöffnungen (22) miteinander verbindet.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Auslenkung der herabhängenden Elemente (58, 58) durch eine Drehung der vertikalen Halteelemente (56, 56) um ihre Längsachse bewirkt wird.

3. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß das vertikale Halteelement (56) durch ein mit Drehstiften versehenes Paßelement (76) mit dem Betätigungsarm (52) verbunden ist, so daß eine Auslenkung des herabhängenden Elementes (58) bewirkt werden kann.

4. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß das Druckmittel (74) einen Bolzen umfaßt, der an einer Unterseite des Betätigungsarmes (52) angebracht ist und der in vertikaler Richtung justiert werden kann.

5. Vorrichtung nach Anspruch 2 oder 3, dadurch gekennzeichnet, daß das herabhängende Element (58, 58) einen einseitigen, einwärts verlaufenden Querträger (62) umfaßt, der an einem Ende mit dem unteren Ende des vertikalen Halteelementes (56) verbunden ist und der an seinem anderen Ende an der Oberseite mit einem Einsatz (64) verbunden ist, der von dem einseitigen Querträger (62) nach unten verläuft und so ausgebildet ist, daß er in eine Ar-

beitsöffnung (22) des Schachtdeckels (20) eingeführt werden kann.

6. Vorrichtung nach Anspruch 5, dadurch gekennzeichnet, daß der einseitige Querträger (62) durch ein elastisches Element (68) vorgespannt wird, so daß sein anderes Ende heruntergedrückt wird.

7. Vorrichtung nach Anspruch 6, dadurch gekennzeichnet, daß das elastische Element (68) eine zusammengedrückte Feder (68) umfaßt, die zwischen der Oberfläche des einseitigen Querträgers (62) und dem vertikalen Halteelement (56) angeordnet ist.

8. Vorrichtung nach Anspruch 1 mit einem dritten herabhängenden Haken (36a), dessen Konstruktion im wesentlichen der der anderen herabhängenden Haken (36, 36) entspricht und der drehbar an einem dritten Betätigungsarm (52a) angebracht ist, welcher an dem Hebelrahmen (32) zwischen dem Paar Betätigungsarme (52, 52) mit einem länglichen Stützrahmen (150), der zwischen dem Paar Betätigungsarme (52, 52) angeordnet ist, angebracht ist.

9. Vorrichtung nach Anspruch 8, dadurch gekennzeichnet, daß der längliche Stützrahmen (150) an einem seiner Enden drehbar mit einem der Betätigungsarme (52, 52) verbunden ist und daß der längliche Stützrahmen (150) an seinem anderen Ende mit dem anderen Betätigungsarm (52, 52) lösbar verbunden ist, so daß er an dem Hebelrahmen (32) befestigt werden kann, wenn er nicht benötigt wird.

10. Vorrichtung nach Anspruch 8, dadurch gekennzeichnet, daß der längliche Stützrahmen (150) mit seinen beiden Enden lösbar an den Betätigungsarmen (52, 52) montiert ist.

11. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß der Hebelrahmen (32) ein Paar Hebelelemente (38, 38) umfaßt, die an ihrem einen Ende an der Seite des Krafteintragungspunktes (40) drehbar miteinander verbunden sind und dadurch eine Bewegung ihrer anderen Enden am Arbeitspunkt des Hebelrahmens (32) zueinander gestatten.

12. Vorrichtung nach Anspruch 11, dadurch gekennzeichnet, daß die drehbare Verbindung (44) zwischen den Hebelelementen (38, 38) so angeordnet ist, daß sie seitlich von der Schwerpunktlinie des Schachtdeckels (20) abweicht.

13. Vorrichtung nach Anspruch 12, dadurch gekennzeichnet, daß jedes Hebelelement (38, 38) so ausgebildet ist, daß es an einer geeigneten Position in einer Richtung zusammengelegt werden kann, die der Richtung der am Krafteintragungspunkt (40) einwirkenden Kraft entgegengesetzt ist.

14. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß der Hebelrahmen (32) ein einzelnes Hebelelement (38) und ein Paar Stäbe (98, 98) aufweist, die lösbar an beiden Seiten des Hebelelementes (38) angebracht sind, so daß der Hebelrahmen (32) im wesentlichen T-förmig erscheint, und die Stäbe derart ausgebildet sind, daß sie sich ausziehen lassen.

Revendications

1. Appareil pour ouvrir, transporter et fermer un couvercle de trou d'homme, comportant un corps de levier (32) pourvu d'une extrémité (40) qui définit un point (40) d'application de force, un certain nombre de roues (34) montées de façon rotative à l'autre extrémité du dit corps de levier (32) de façon à former un support pour le point d'appui du levier, au moins une paire de bras d'actionnement (52, 52) montés sur le dit corps de levier (32) de façon à s'étendre dans la direction à l'écart du point (40) d'application de force, et un crochet de levage (36, 36) monté de façon pivotante à l'extrémité libre de chacun des dits bras d'actionnement (52, 52), caractérisé en ce que

a) des moyens d'appui (74, 74) sont prévus sur l'un des dits bras d'actionnement (52, 52) ou corps de levier (32) à un endroit à l'écart de la dite extrémité libre de chacun des dits bras d'actionnement (52, 52) de façon à venir en butée contre la surface supérieure du dit couvercle de trou d'homme (20) au cours de l'opération de levage de ce dernier,

b) ledit crochet de levage (36, 36) comporte un élément de support vertical (56, 56) monté de façon pivotante à une extrémité supérieure sur la dite extrémité libre du bras d'actionnement approprié (52, 52) afin d'être mobile de façon pivotante dans la direction longitudinale du dit appareil (30) et un élément de levage (58, 58) monté de façon pivotante à une extrémité sur l'extrémité inférieure du dit élément de support vertical (56, 56) afin de s'étendre de là vers l'intérieur dans une direction inclinée par rapport à l'axe de pivotement (54, 54) du dit élément de support vertical (56, 56) sur le dit bras d'actionnement (52, 52) dans la direction à l'écart du dit point (40) d'application de force,

c) le dit élément de levage (58, 58) comporte une pièce rapportée (64, 64) pouvant être insérée dans un trou d'actionnement (22) du dit couvercle de trou d'homme (20) de façon à être excentrée par rapport à un point de levage de couvercle de trou d'homme apparent du dit appareil, la dite pièce rapportée (64, 64) étant pourvue à une extrémité inférieure d'une saillie (72, 72) qui se projette en direction du dit élément de support vertical (56, 56), et en ce que

d) le dit point de levage de couvercle de trou d'homme apparent du dit appareil (30) est positionné au-delà d'une ligne reliant les trous d'actionnement (22), du même côté que le point (40) d'application de force.

2. Appareil selon la revendication 1, dans lequel la dite déviation du dit élément de levage (58, 58) est effectuée par torsion du dit élément de support (56, 56) autour de son axe longitudinal.

3. Appareil selon la revendication 1, dans lequel le dit élément de support vertical (56) est relié par l'intermédiaire d'une chape (76) au dit bras d'actionnement (52) de telle sorte que la déviation du dit élément de levage (58) est effectuée.

4. Appareil selon la revendication 1, dans lequel les dits moyens d'appui (74) comportent un boulon monté sur une surface inférieure du dit bras d'actionnement (52), le dit boulon étant réglable verticalement.

5. Appareil selon la revendication 2 ou 3, dans lequel le dit élément de levage (58, 58) comporte un bras d'extension (62) relié à une extrémité à l'extrémité inférieure du dit élément de support vertical (56) de façon à s'étendre latéralement vers l'intérieur et une pièce rapportée (64) reliée à une extrémité supérieure à l'autre extrémité du dit bras d'extension (62) de façon à s'étendre de là vers le bas et prévue pour être insérée dans un trou d'actionnement (22) du dit couvercle de trou d'homme (20).

6. Appareil selon la revendication 5, dans lequel le dit bras d'extension (62) est rappelé à l'aide de moyens élastiques (68) de telle sorte que l'autre extrémité peut être forcée vers le bas.

7. Appareil selon la revendication 6, dans lequel les dits moyens élastiques (68) comportent un ressort comprimé (68) interposé entre une surface supérieure du dit bras d'extension (62) et le dit élément de support vertical (56).

8. Appareil selon la revendication 1, comportant en outre un troisième crochet de levage (36a) de construction sensiblement identique au dit crochet de levage (36, 36), le dit troisième crochet de levage (36a) étant monté de façon pivotante sur le troisième bras d'actionnement (52a) qui est monté sur le dit corps de levier (32) à un endroit situé entre la dite paire de bras d'actionnement (52, 52) au moyen d'un cadre de support allongé (150) interposé entre la dite paire de bras d'actionnement (52, 52).

9. Appareil selon la revendication 8, dans lequel le dit cadre de support allongé (150) est monté de façon pivotante à une extrémité sur un des dits bras d'actionnement (52, 52) et est fixé de façon détachable à l'autre extrémité à l'autre bras d'actionnement (52, 52) de telle sorte que le dit cadre de support allongé (150) peut être monté sur le dit corps de levier (32) lorsqu'il n'est pas utilisé.

10. Appareil selon la revendication 8, dans lequel le dit cadre de support allongé (150) est monté de façon détachable aux deux extrémités sur les dits bras d'actionnement (52, 52).

11. Appareil selon la revendication 1, dans lequel le dit levier (32) comporte une paire d'éléments de levier (38, 38) reliés ensemble de façon pivotante à une extrémité sur le côté du dit point d'application de force (40) afin de permettre aux autres extrémités sur le côté d'un point d'application du dit corps de levier d'être déplacés très près l'un de l'autre.

12. Appareil selon la revendication 11, dans lequel la dite liaison pivotante (44) entre les dits éléments de levier (38, 38) est positionnée de manière à être déviée dans la direction latérale par rapport à la dite ligne de gravité du dit couvercle de trou d'homme (20).

13. Appareil selon la revendication 12, dans lequel les dits éléments de levier (38, 38) sont formés chacun de façon à être repliable à un endroit approprié dans la direction opposée à celle de la force appliquée au dit point d'application de force (40).

14. Appareil selon la revendication 1, dans lequel le dit corps de levier (32) comporte un simple élément de levier (38) et une paire de tiges (98, 98) reliée de façon détachable aux deux extrémités du dit élément de levier (38) de telle sorte que le dit corps de levier (32) a une forme générale en T, les dites ti-

ges (98, 98) étant disposées de façon à pouvoir être extensibles par rapport au dit élément de levier (38).

5

10

15

20

25

30

35

40

45

50

55

60

65

11

FIG. 1

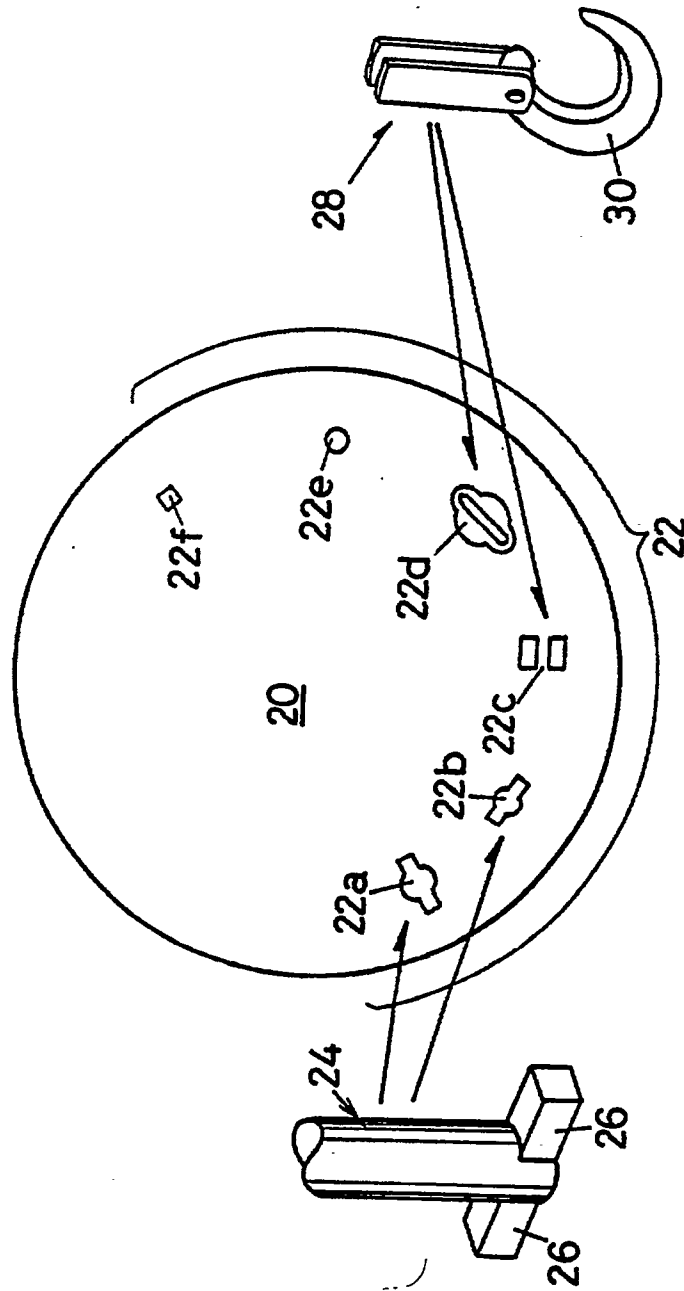


FIG. 2A

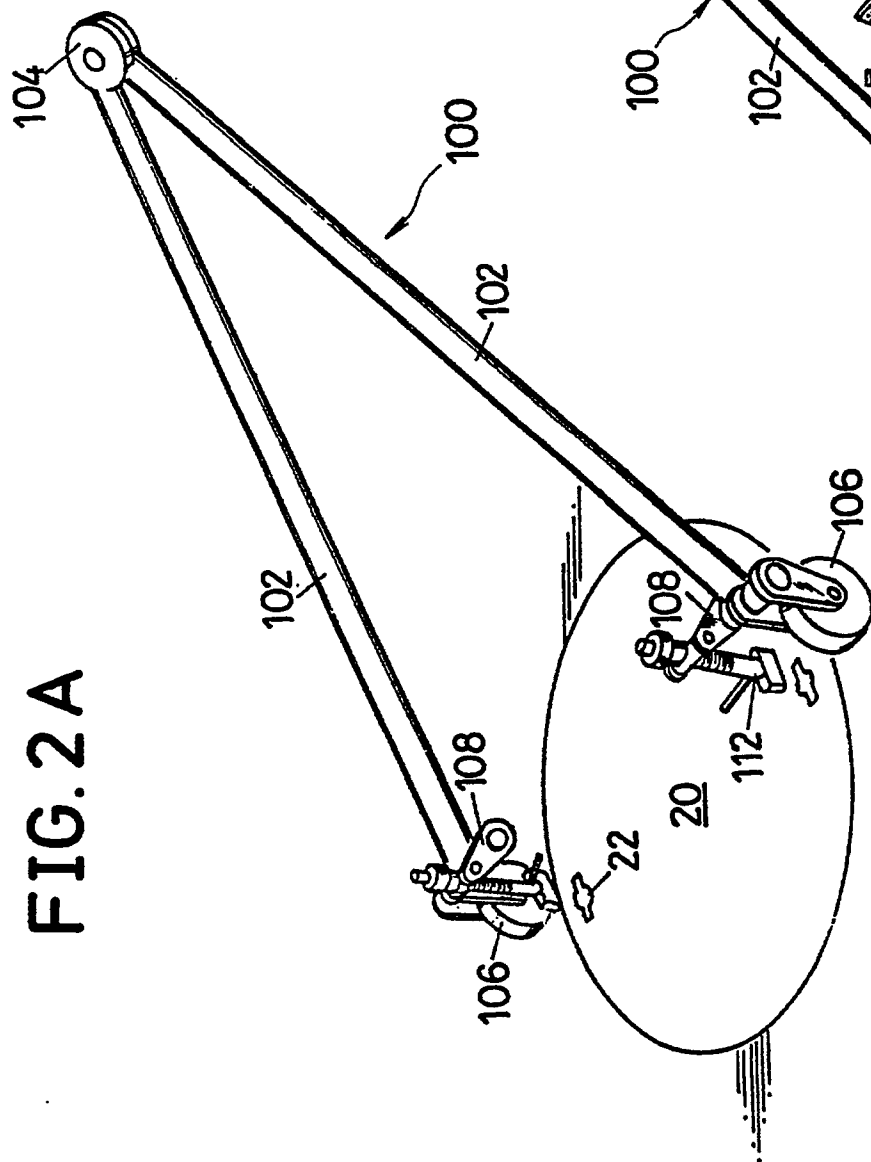


FIG. 2B

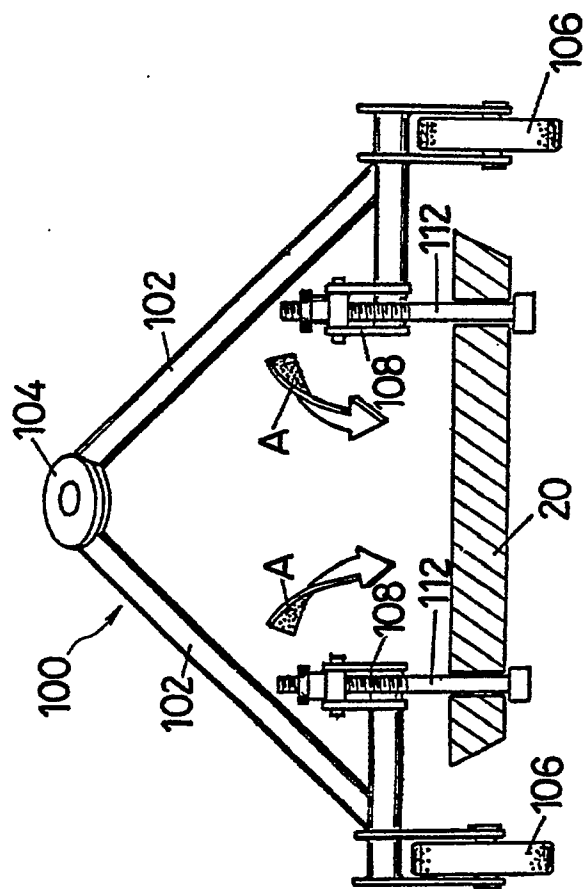


FIG. 4

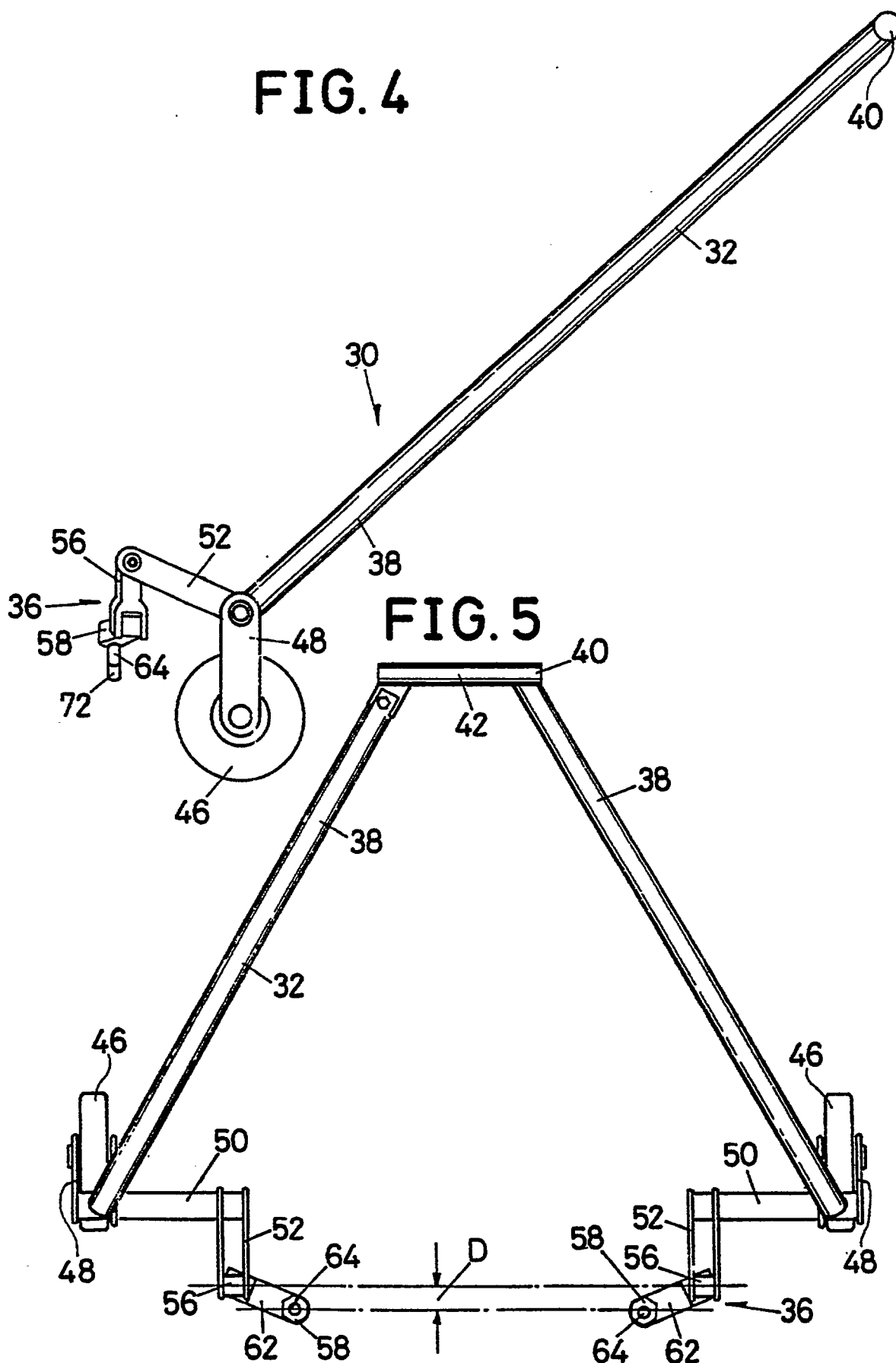


FIG. 6

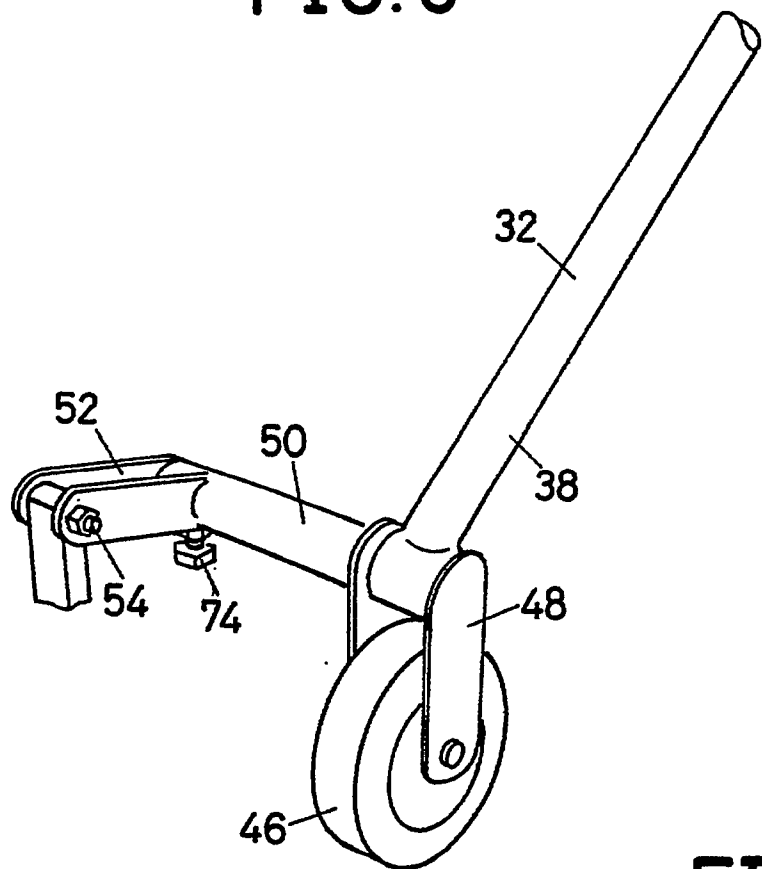


FIG. 7

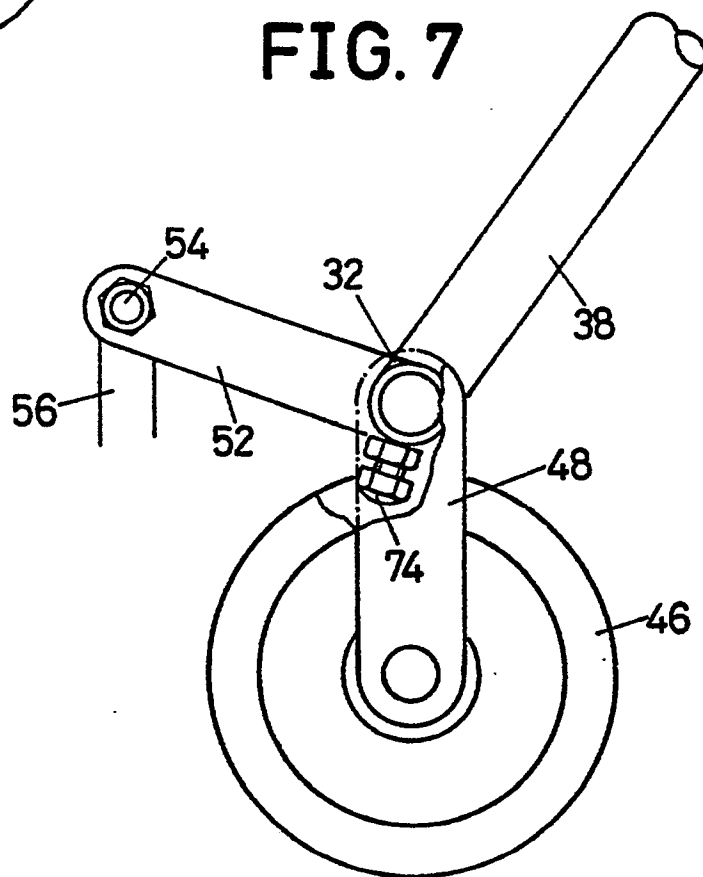


FIG. 8

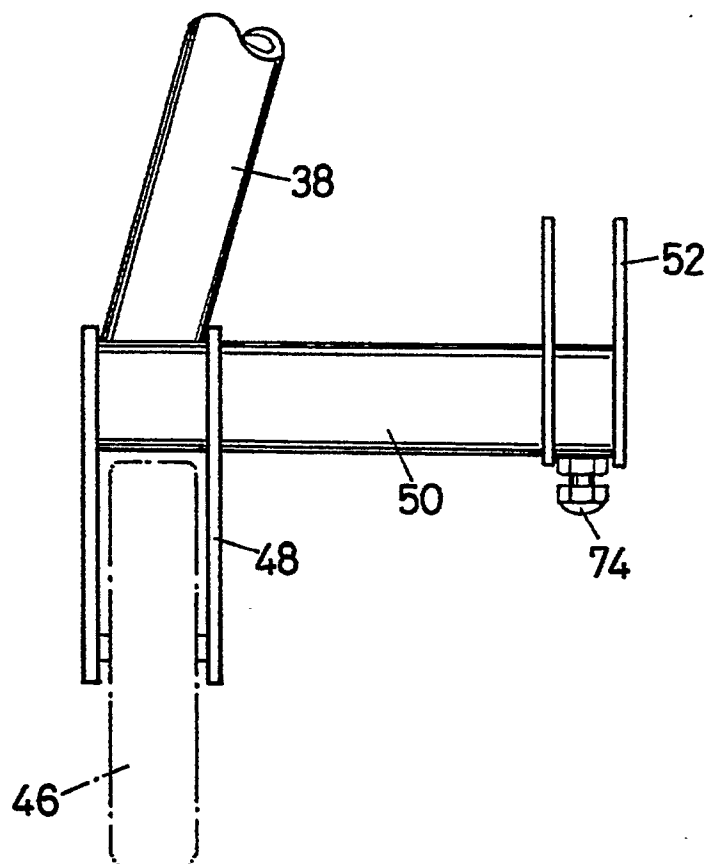


FIG. 9

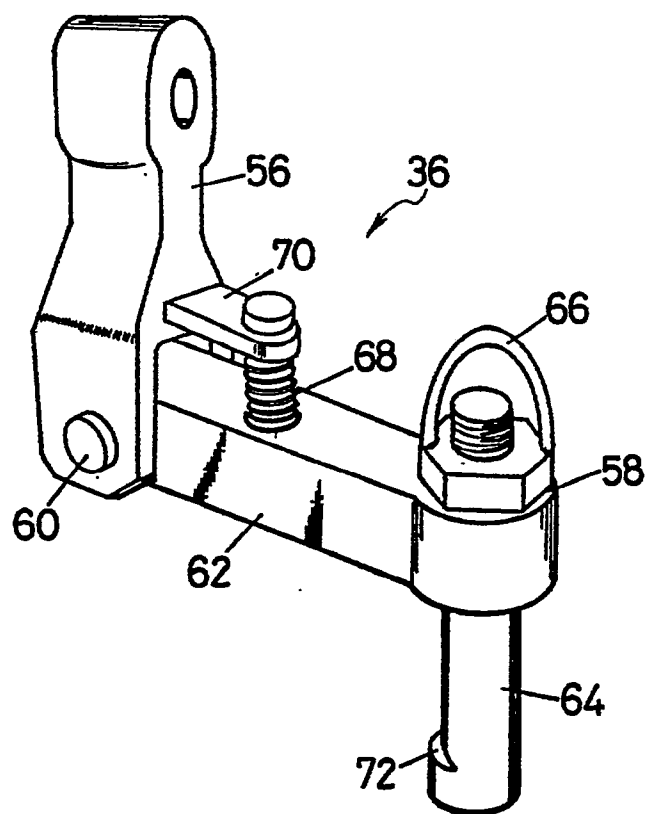


FIG.10

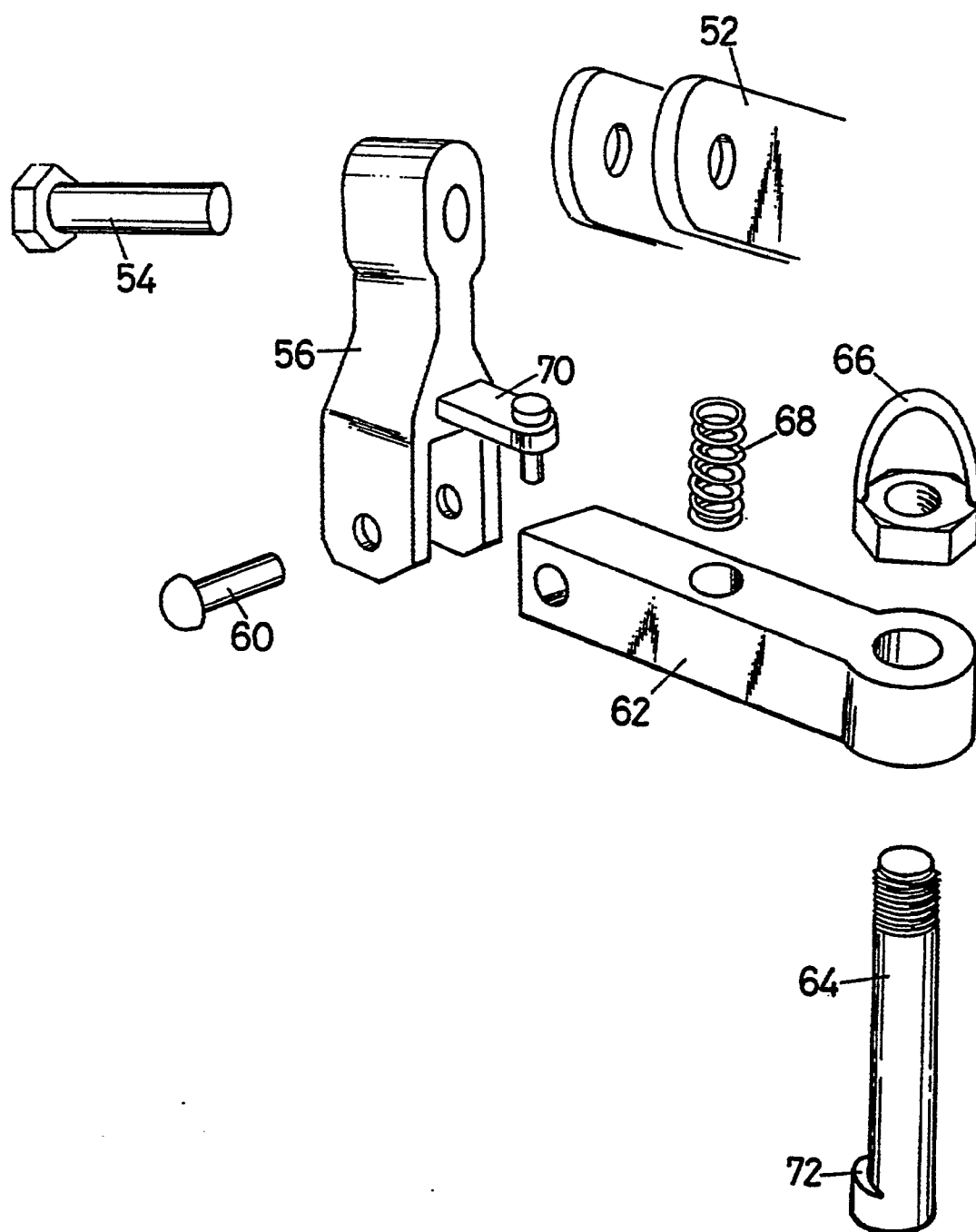


FIG.11

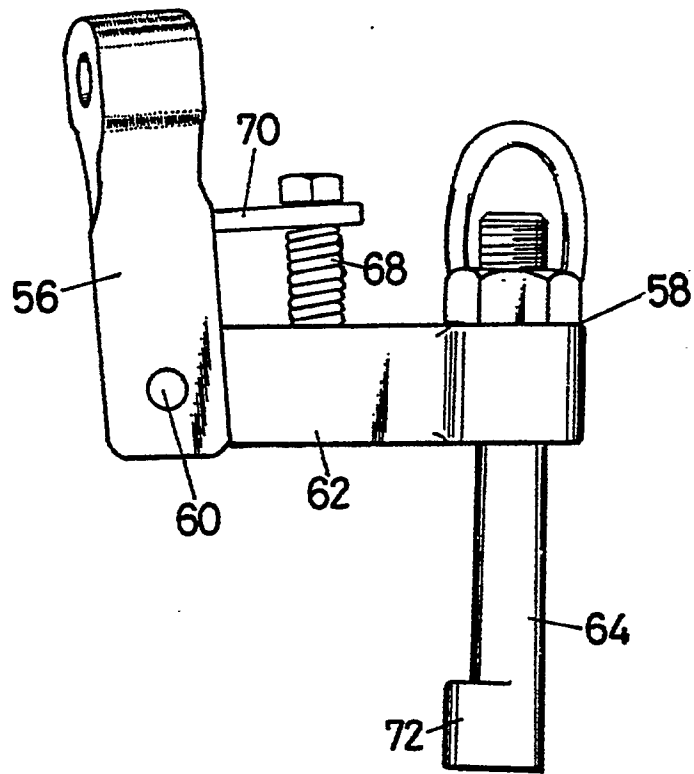


FIG.12

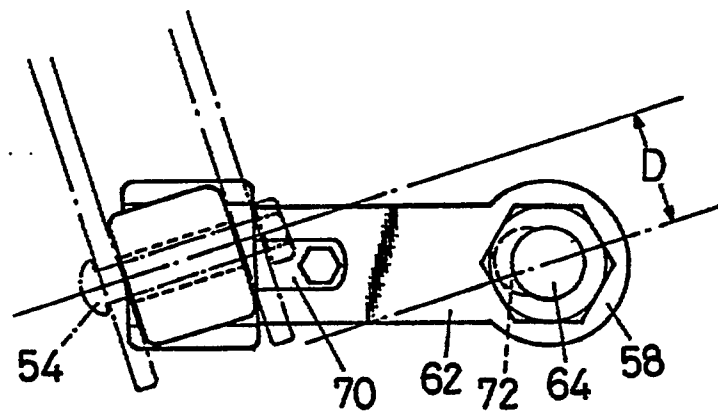


FIG.13A

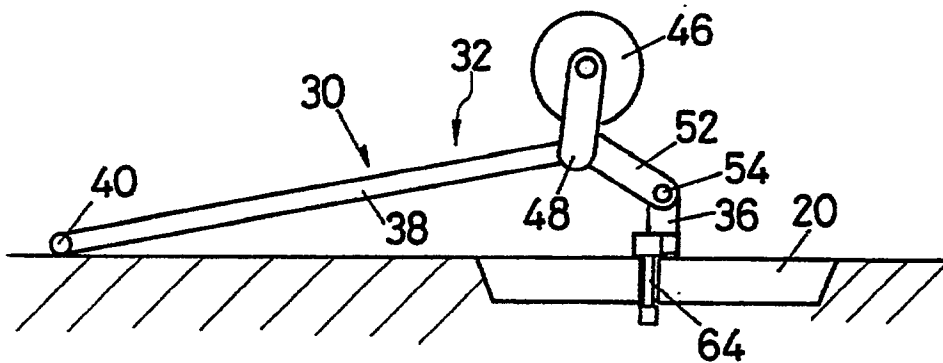


FIG.13B

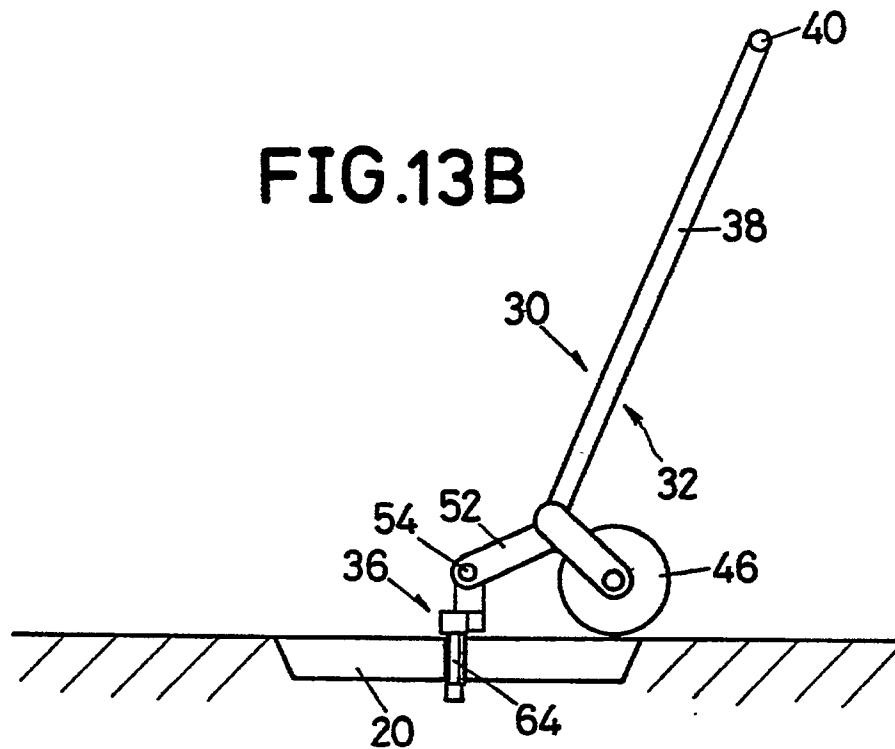


FIG.13C

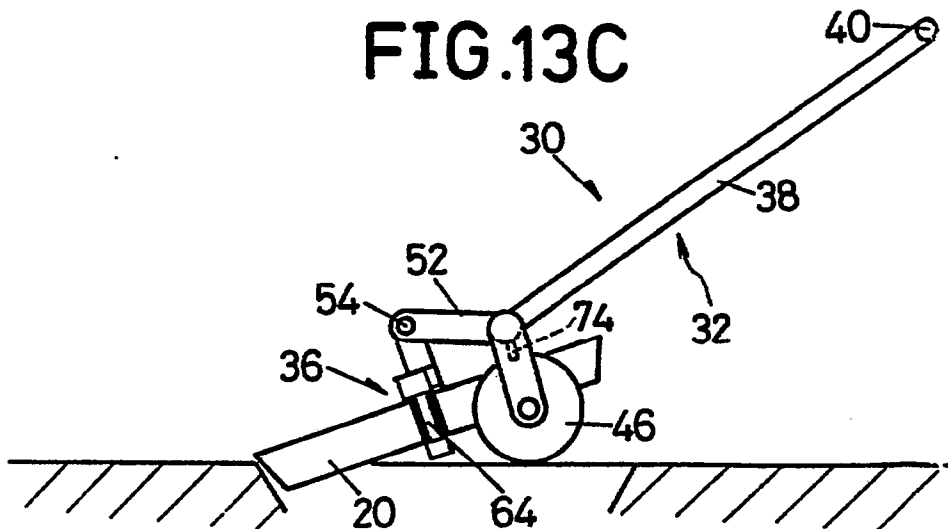


FIG.13D

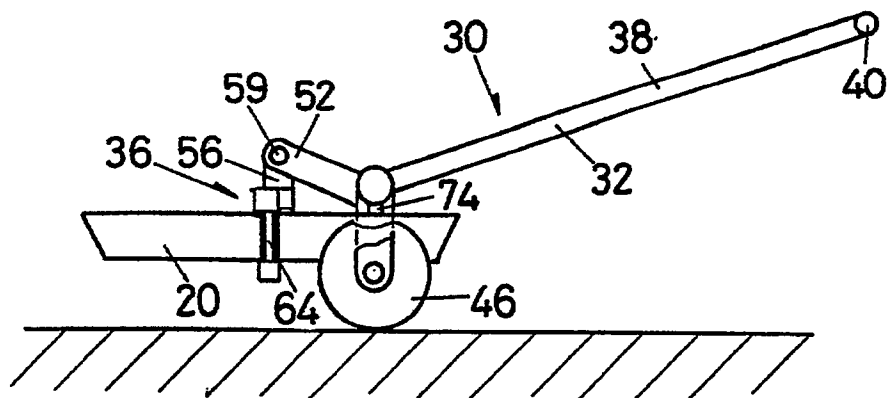


FIG.13E

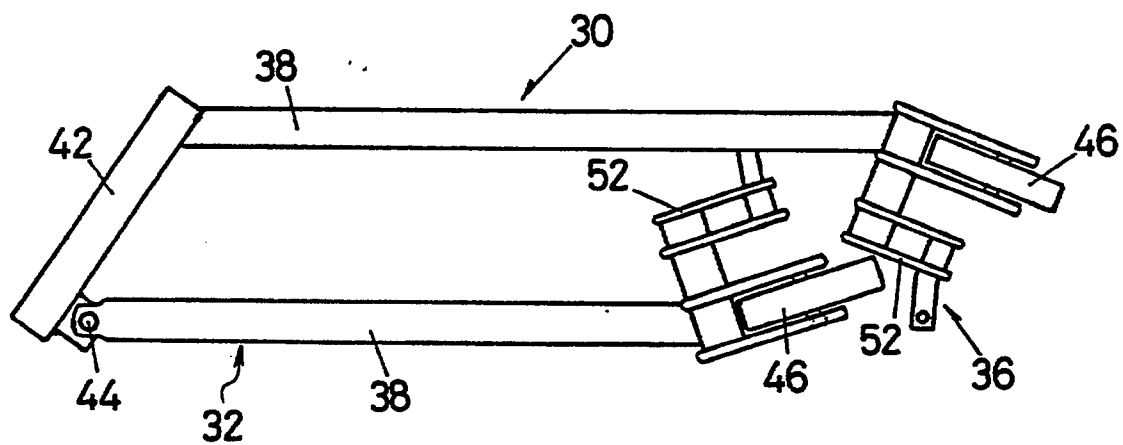


FIG.14 A

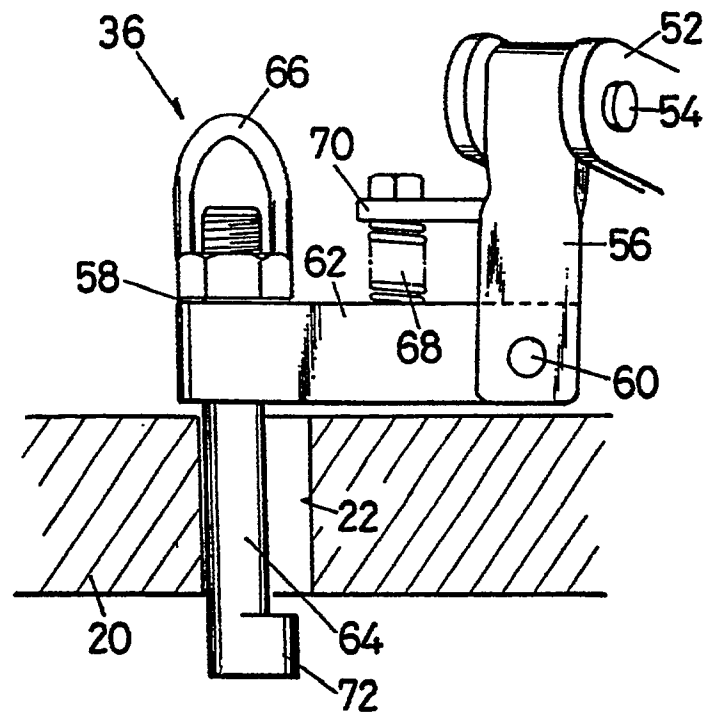


FIG.14 B

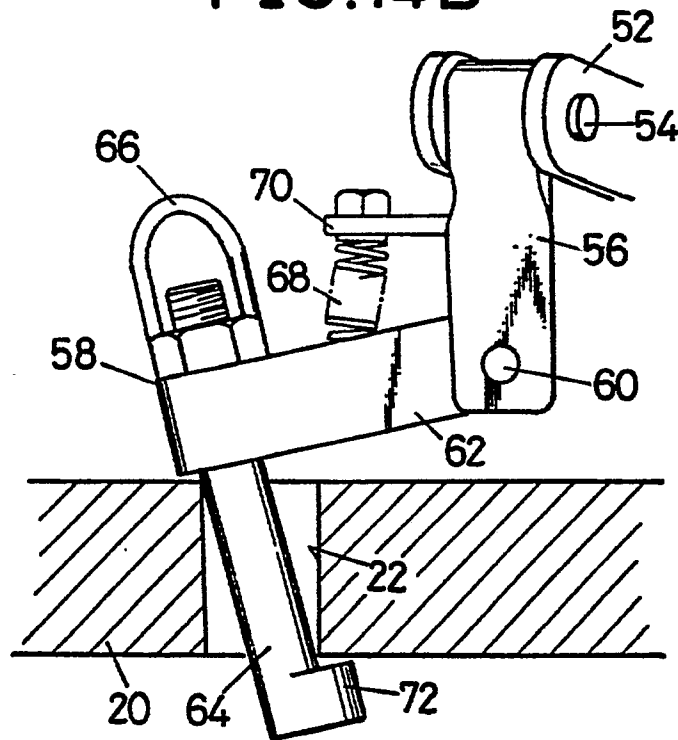


FIG.15

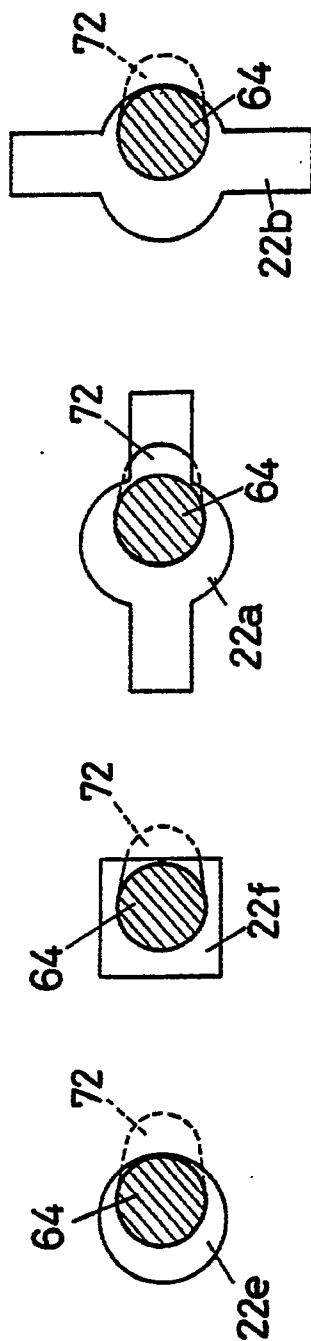


FIG.16

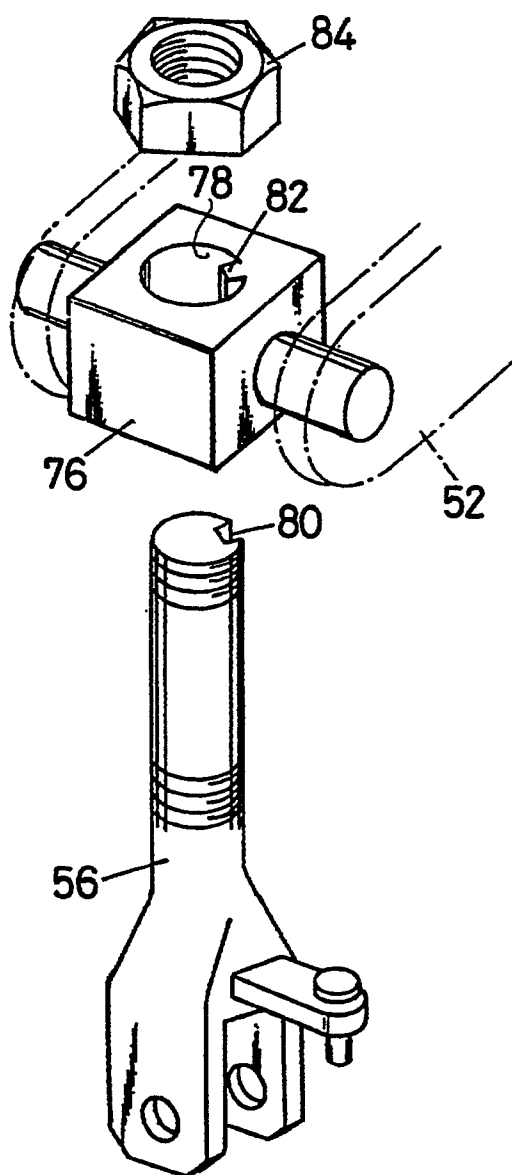


FIG.17

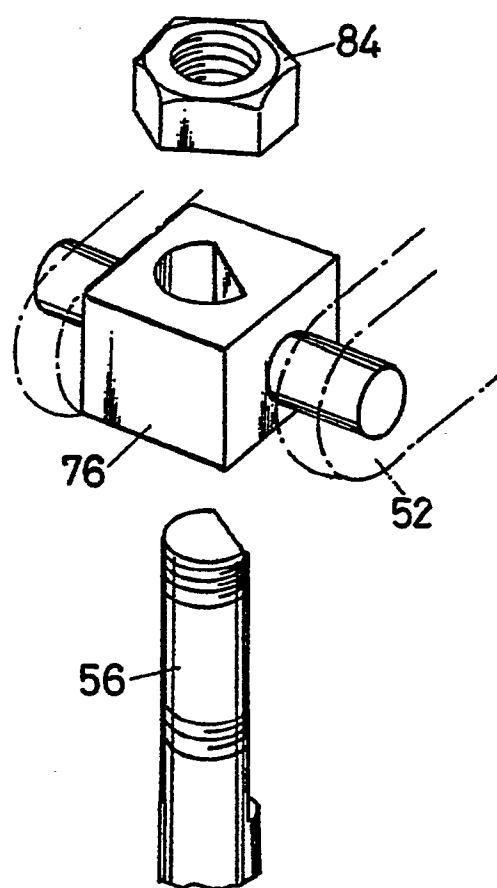


FIG.18A

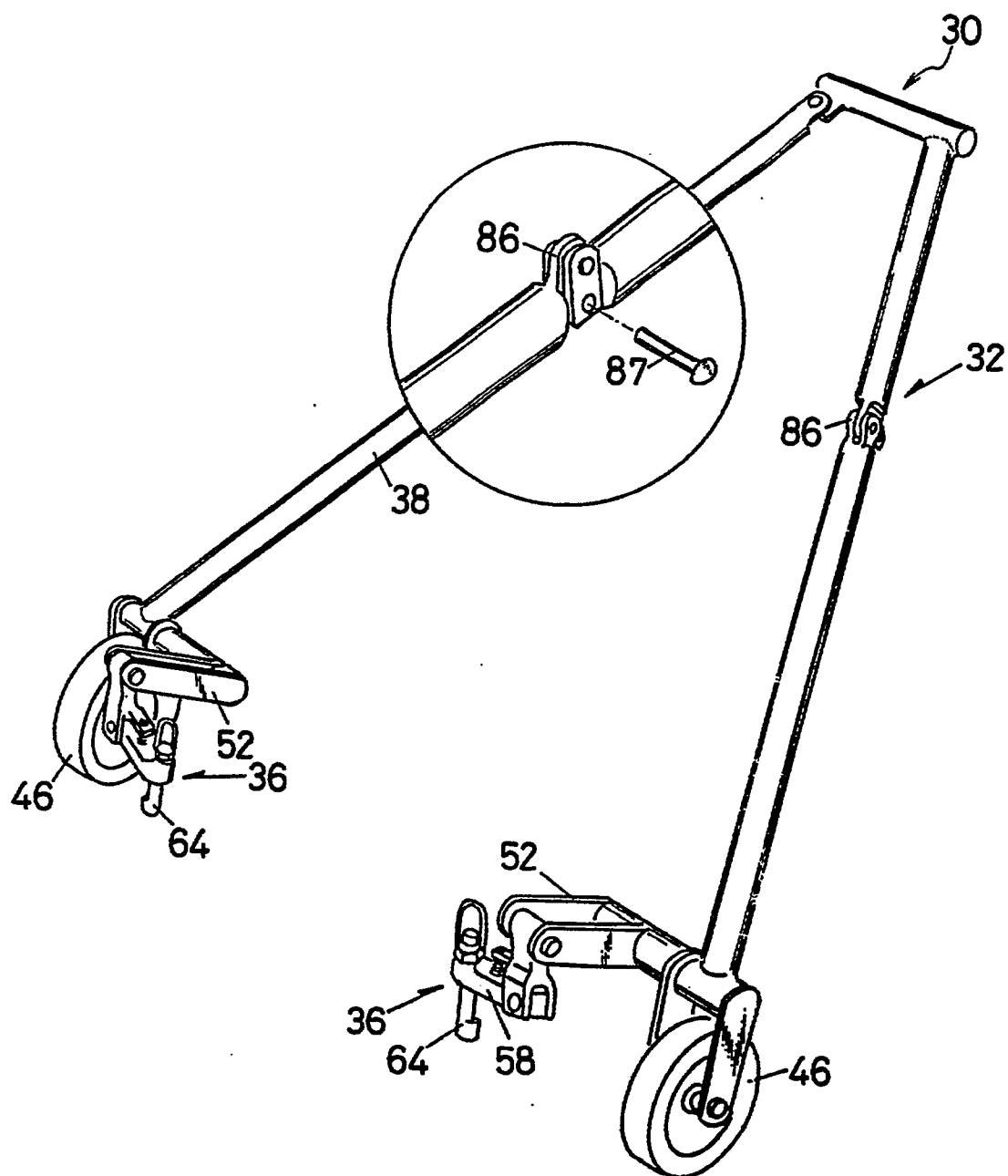


FIG.18B

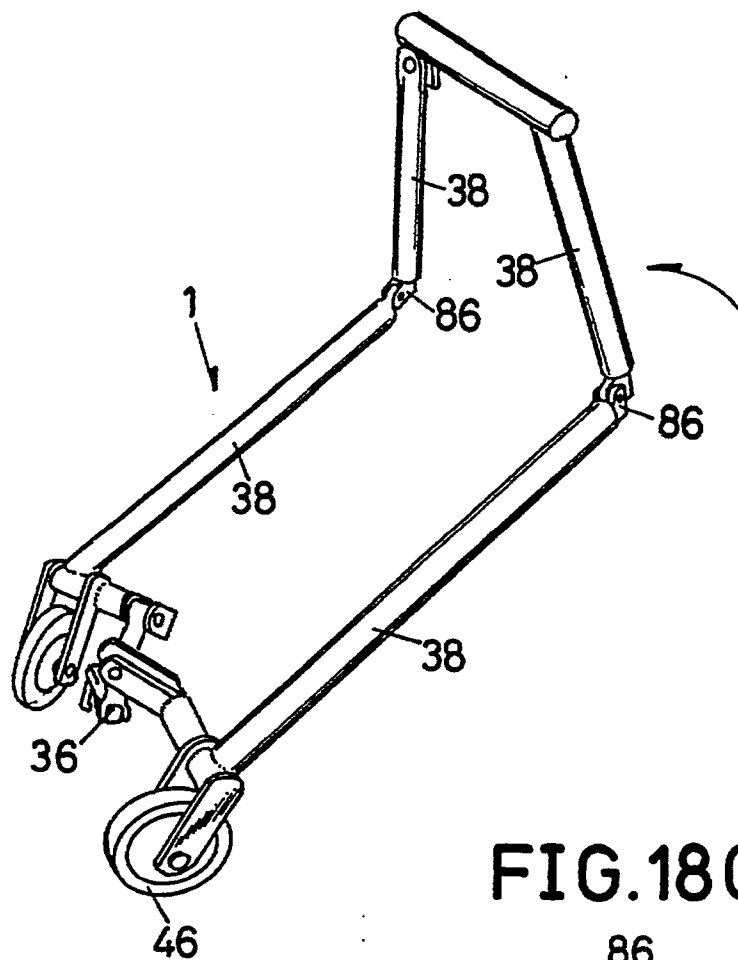


FIG.18C

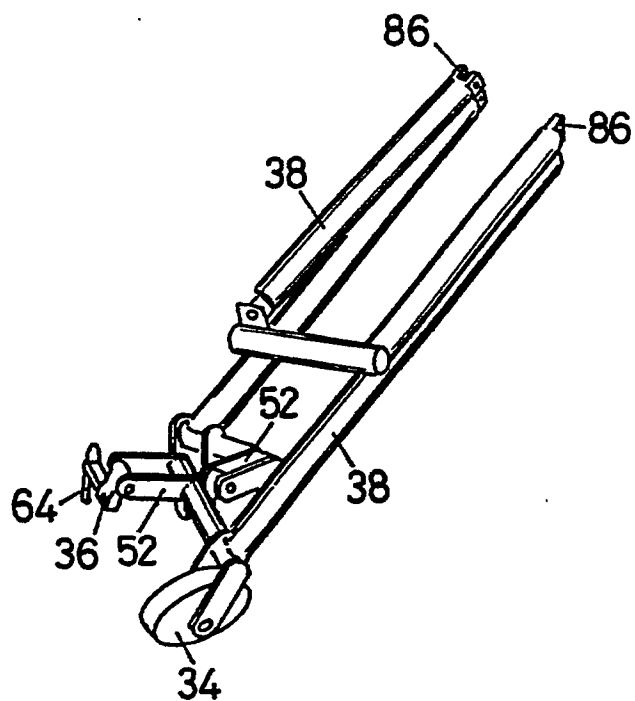


FIG.19A

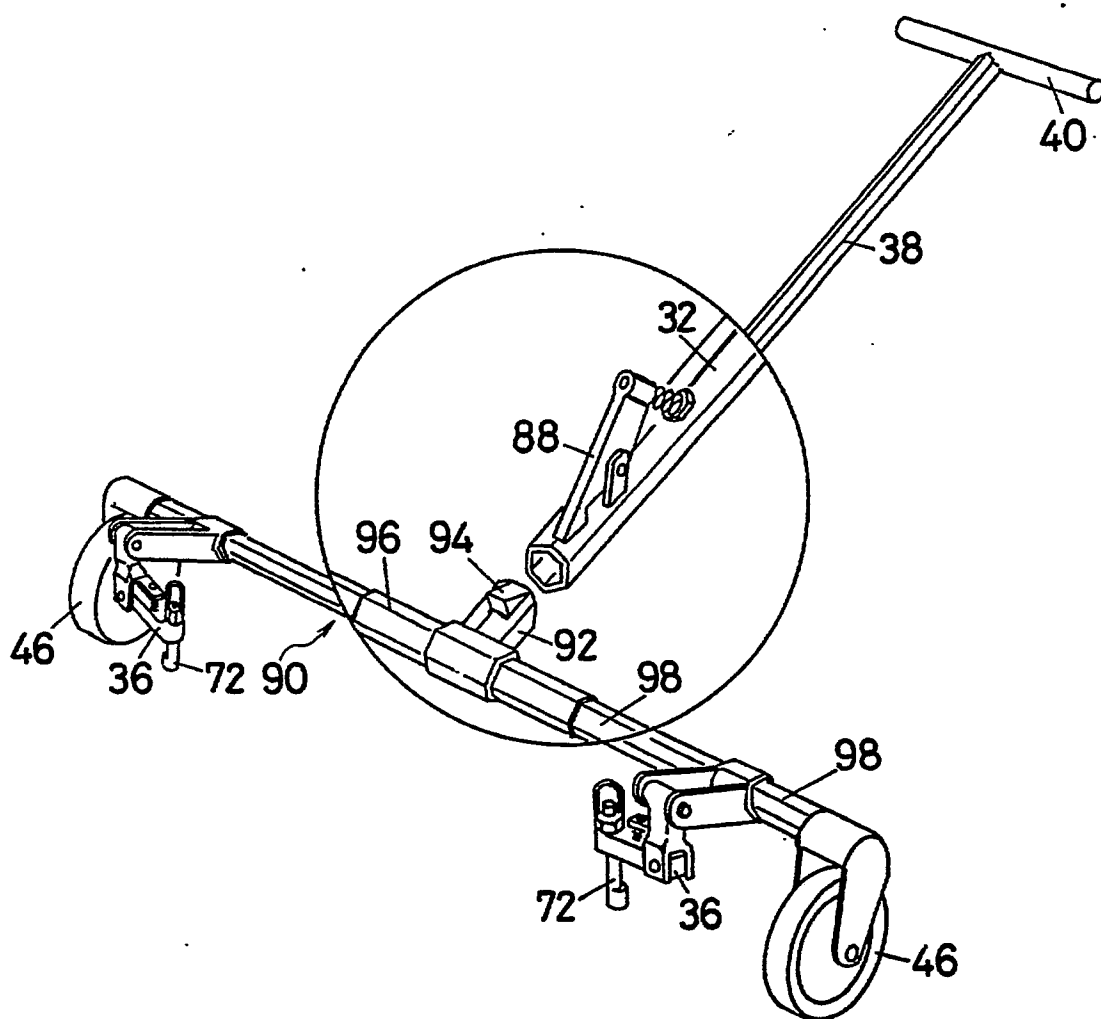


FIG.19B

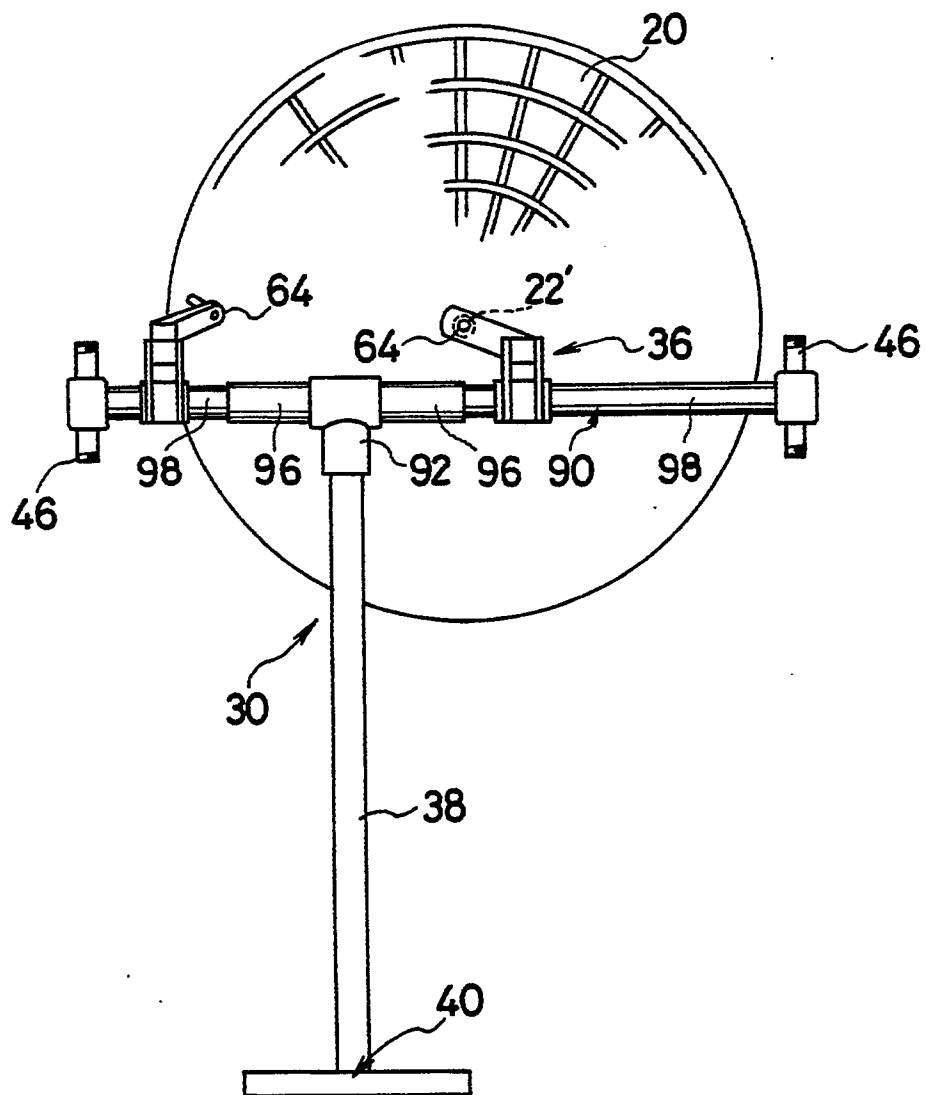


FIG.20

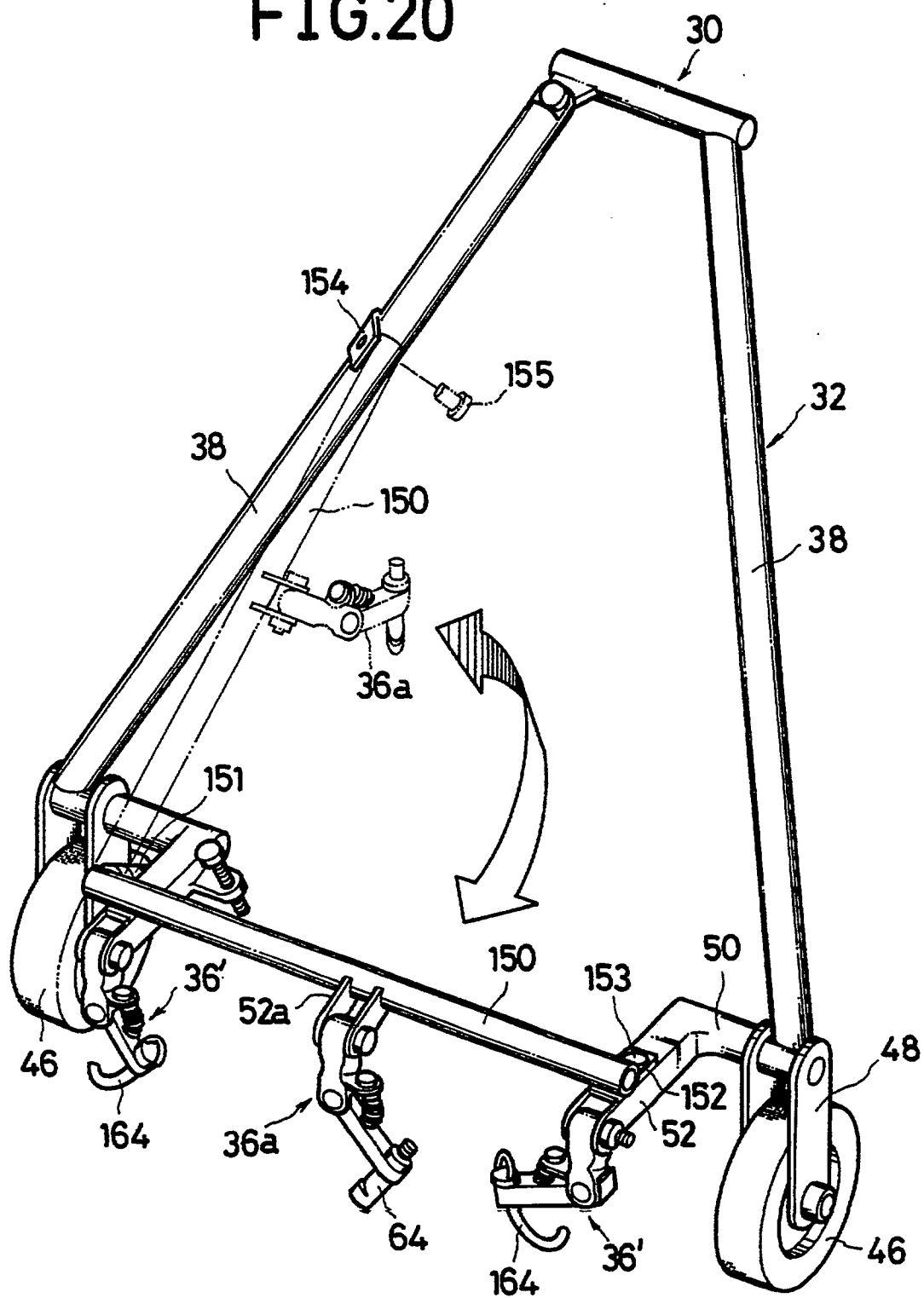


FIG.21

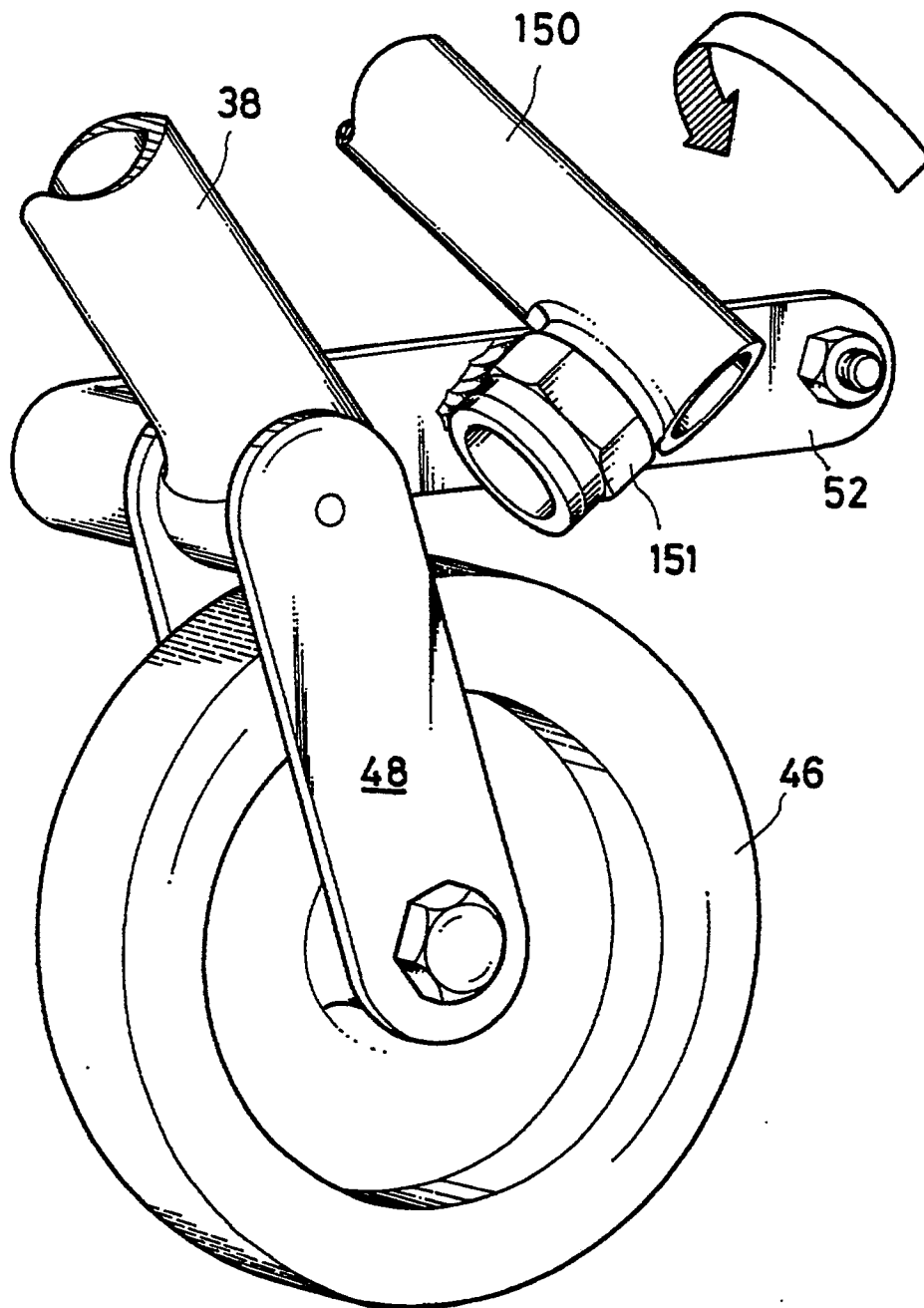


FIG.22

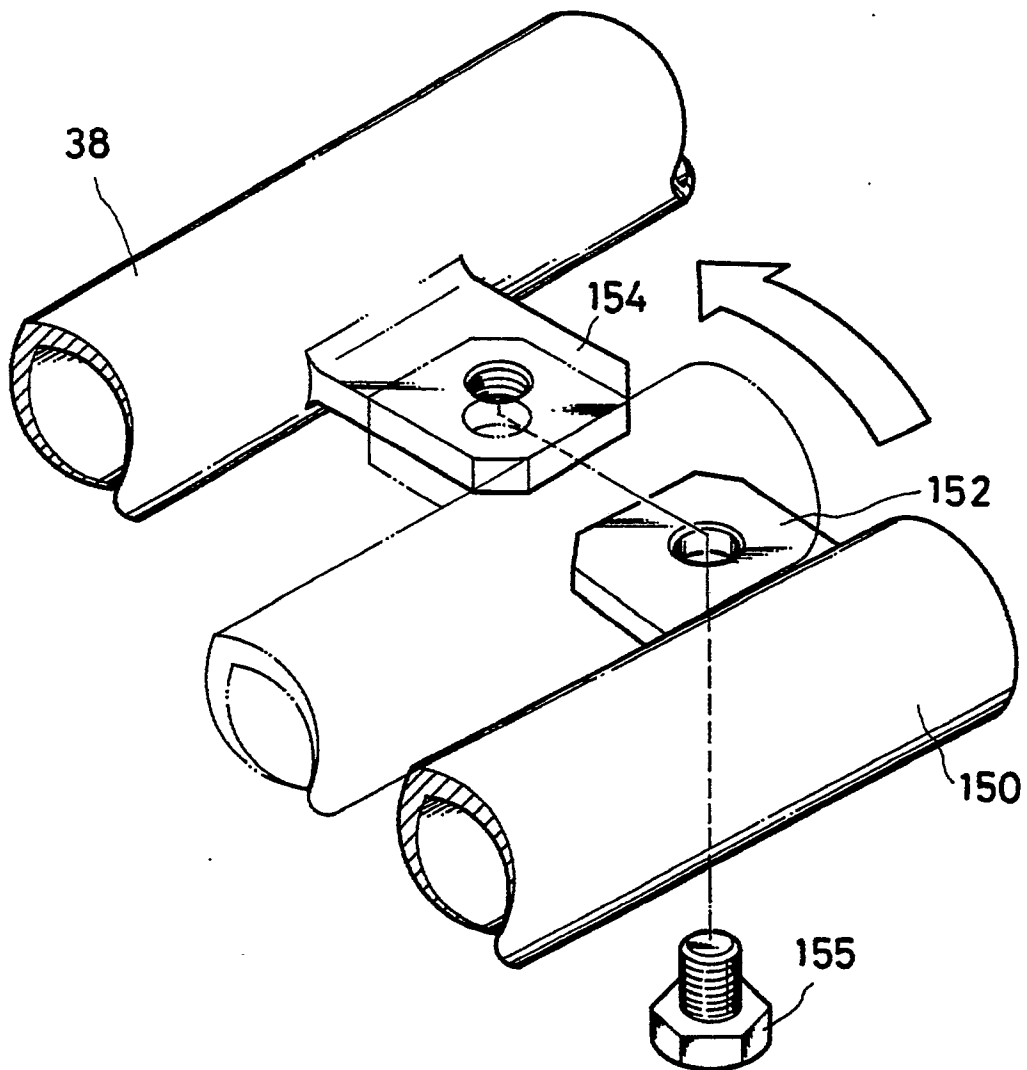


FIG.23

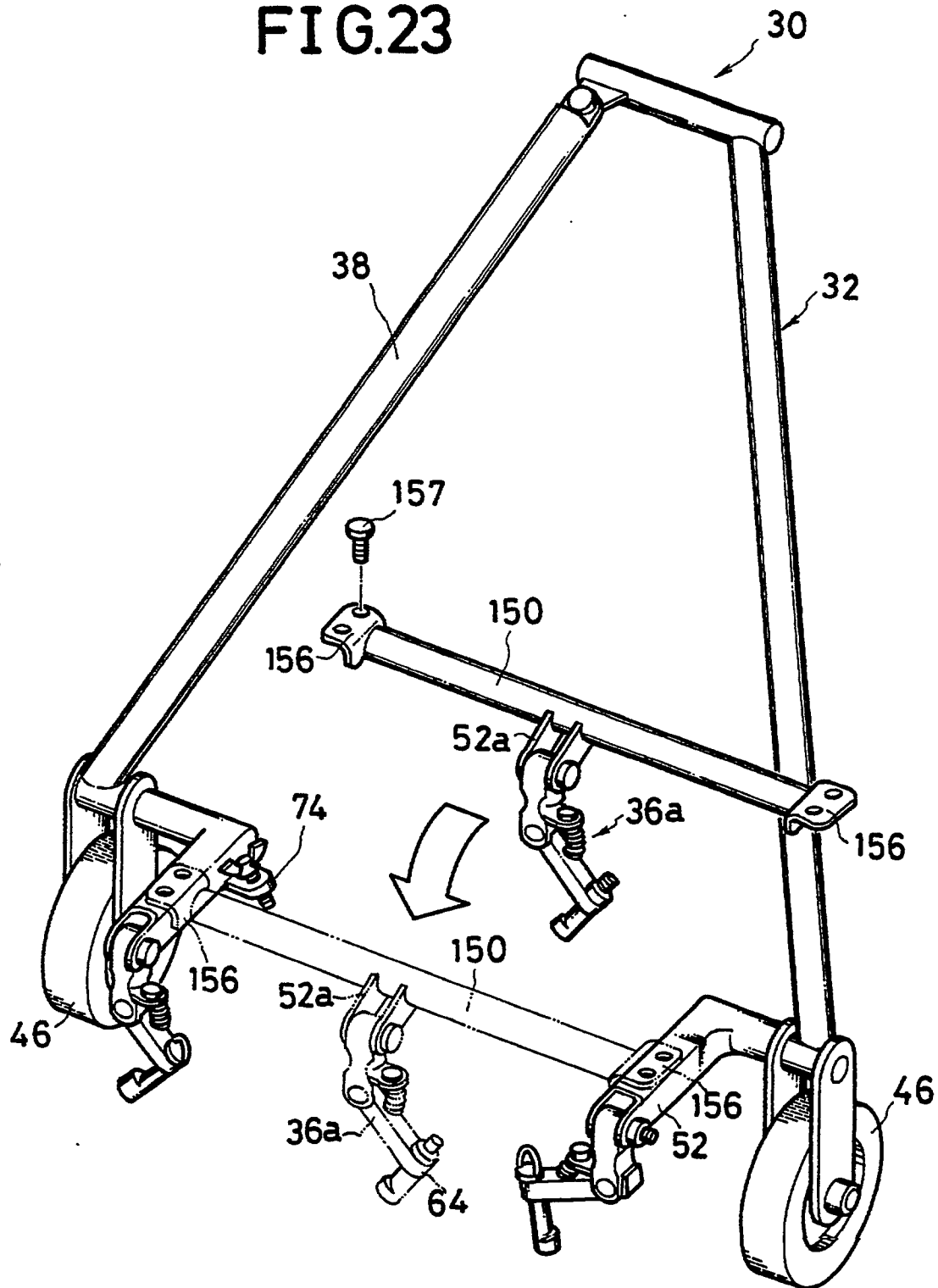


FIG.24

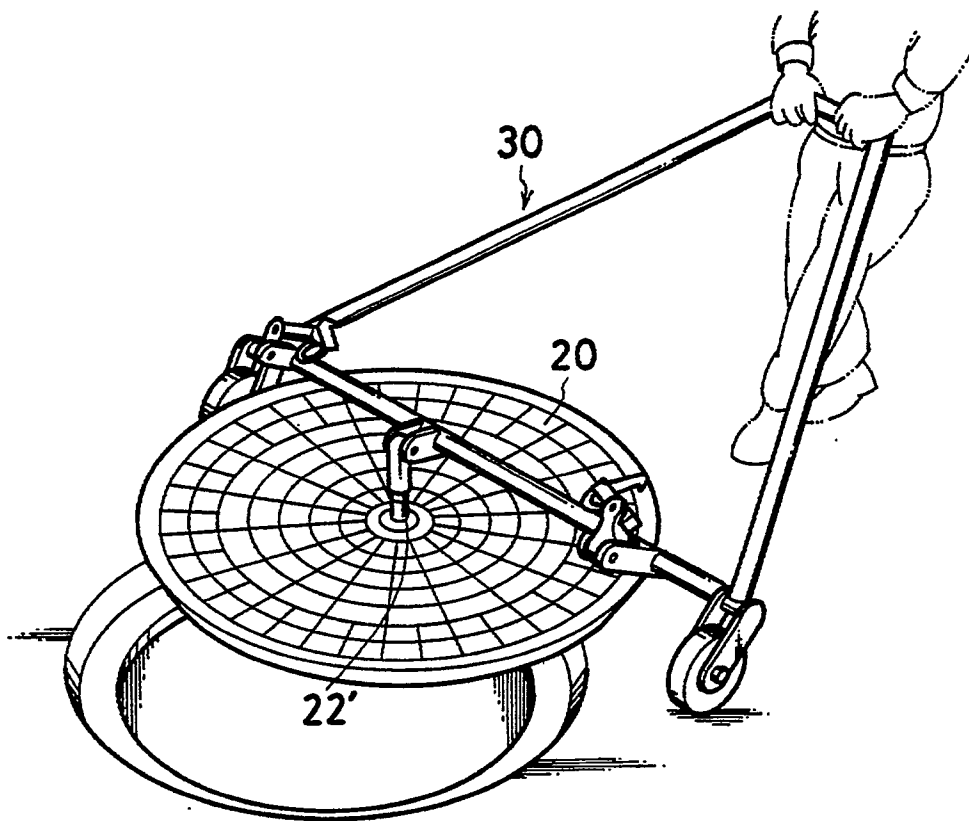


FIG.25

