

⑫

EUROPEAN PATENT SPECIFICATION

④⑤ Date of publication of patent specification: **09.10.85**

⑤① Int. Cl.⁴: **G 05 G 9/04**

②① Application number: **81850121.5**

②② Date of filing: **02.07.81**

⑤④ **Device in a multi-way lever.**

③① Priority: **04.07.80 SE 8004971**

④③ Date of publication of application:
13.01.82 Bulletin 82/02

④⑤ Publication of the grant of the patent:
09.10.85 Bulletin 85/41

⑧④ Designated Contracting States:
AT BE CH DE FR GB IT LI NL

⑤⑥ References cited:
EP-A-0 023 864
FR-A-2 400 250
US-A-3 095 754
US-A-3 550 466
US-A-3 827 313

⑦③ Proprietor: **HYDRINO AB**
Box 57
S-870 52 Nyland (SE)

⑦② Inventor: **Zettergren, Ted**
Kungsgarden 3402
S-870 52 Nyland (SE)

⑦④ Representative: **Örtenblad, Bertil Tore**
Noréns Patentbyrå AB Banérgatan 73
S-11526 Stockholm (SE)

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European patent convention).

Courier Press, Leamington Spa, England.

Description

This invention relates to a multi-way lever, a so-called "joy-stick" which, for example, is comprised in a manipulator.

Multi-way levers of this kind can in normal cases be moved from a central non-operative position in any directions. Multi-way levers of the kind here referred to often are used in machines and the like where several valves are desired to be controlled by one and the same operating lever.

Multi-way levers of this kind normally are supported at their lower end by two spring-loaded electric potentiometers, which are arranged perpendicularly to each other and capable each to emit an electric signal, so that the two signals together deliver information on the direction, in which the lever has been moved from the non-operative position, and on the distance of the lever movement from said position.

In a usual construction, the springs at the potentiometers together tend to maintain the lever in vertical non-operative position. The joint members, in which the lever is suspended, generally are yokes, on which the potentiometers and springs are mounted.

This construction, in which the springs are helical ones, does not permit the force, which is required for moving the lever from non-operative position, to be so varied as often is desired. Said force should be variable in such a manner, for example, that a much greater force is required when the lever has been moved through a certain distance from the non-operative position.

The US Patent No. 3550466 shows a lever which is supported at its lower end. In addition a sleeve is mounted concentrically about the lever and is intended, by action of the force exerted by a helical spring to abut the concave inner surface of a dome like top closure. However, the distance from the rotation centre of the lever to said inner surface of the closure is approximately the same all over the operation range of the lever. Therefore said force is about the same regardless of the position of the lever in relation to its non-operative position.

In known constructions, furthermore, the force required for initiating the lever movement out of non-operative position is very small. As a result thereof, the person operating the lever must strain the arm in order to prevent the lever from being moved through a too great distance out of non-operative position when the deflection desired is only a small one.

A further disadvantage of known multi-way levers is their structural height which, from the upper surface of an instrument inward to the panel, is great, due to the space required for said yokes and springs.

An essential desire, which cannot be satisfied by the present state of art, is a multi-way lever so designed that for moving the lever in some selected directions the force required is smaller than in the remaining directions.

The present invention eliminates entirely the

aforesaid disadvantages and permits a multi-way lever to be designed so as to satisfy the said desire.

The present invention, thus, relates to a device in a multi-way lever, so called "joy-stick", comprised for example in a manipulator, comprising a control lever hinged at one end thereof in a housing and projecting therefrom, a sleeve being mounted concentrically around said lever and biased by action of a spring force against a plate whereby said device is characterized in that the end of said sleeve, facing said plate, has a conic surface abutting a slide surface on said plate, in that said slide surface includes a central portion and a surrounding concave portion opposite to said sleeve and in that said central portion of said slide surface comprises also a conic surface designed to promote centering of said conic surface of said sleeve with respect to said slide surface.

The invention is described in greater detail in the following, with reference to the accompanying drawings, in which

Fig. 1 is a section through a multi-way lever, to which the invention is applied,

Fig. 2 is a downward directed view along the line A—A in Fig. 1,

Fig. 3 shows a modified embodiment of the invention, one detail shown in the same view as in Fig. 2,

Figs. 4, 5 show rolled-out circular sections of the detail in Fig. 3, and

Figs. 6, 7 show two modified embodiments.

In Fig. 1 a multi-way lever 1 is shown, to which the invention is applied.

The multi-way lever 1, for example, is comprised in a manipulator and comprises a housing 2 and projecting therefrom a control lever 3. At the upper end of the lever 3 a ball 4 or corresponding member is located, which is held gripped when the lever is operated. To the lower end of the lever 3 two potentiometers 5, 6 located perpendicularly to each other are attached. The fulcrum of the lever 3 is located at the lower end thereof on the same lever as the intersecting point between the two lines 7, 8. The lever 3 is attached to its fulcrum in a first joint member 9 so that the lever 3 can be moved in the plane of the drawing in Fig. 1. Said first joint member is hingedly attached to a second joint member 10, 11, so that the lever 3 can be moved in a direction perpendicular to the plane of the drawing in Fig. 1. Said two joint members 9, 10, 11, thus, together render it possible to move the lever 3 in any direction out of its non-operative position shown in Fig. 1.

The numeral 12 designates the upper surface of an instrument panel or corresponding means. The aforescribed attachment of the lever 3 to the joint members 9, 10, 11 and the location and design of the potentiometers 5, 6 are not per se part of the present invention, but can be formed in a way other than shown in Fig. 1.

According to the invention, a sleeve 13 is located concentrically about the lever 3. The sleeve 13 is provided at one end with a conic surface 14, and the entire sleeve 13 preferably is

axial-symmetric. At least, however, the conic surface 14 preferably is axial-symmetric.

A plate 15 further is provided, which has a slide surface 16, against which the sleeve is intended to slide. Said slide surface 16 of the plate 15 includes a portion 17 with a conic surface so formed, that the conic surface 14 of the sleeve 13 upon abutment to the conic surface of the slide surface 16 is centered with respect to the slide surface, as shown in Fig. 1.

The sleeve 13 is located about the lever 3 between the free end thereof and said plate 15. A compression spring 19 of helical type is located between the sleeve 13 and a seat 18 at the free end of the lever and, thus, presses the sleeve 13 down against the slide surface 16. When the conic surface 14 of the sleeve 13 abuts the conic portion 17 of the slide surface 16, the lever 3 is centered automatically by action of the spring force to the non-operative position shown in Fig. 1.

As appears from Fig. 1, the sleeve 13 is moved towards the free end of the lever 3 when the lever is moved in any direction from the non-operative position.

The slide surface 16 is inclined radially and has its lowermost point at the conic portion 17. As a result thereof, the lever automatically returns to non-operative position by action of the spring force of the spring 19, irrespective of in which direction and how far from the non-operative position the lever has been moved.

The portion of the device located above the instrument panel 12 preferably is protected by a rubber sleeve 20.

In Fig. 3 a modified embodiment of the invention is shown, at which the plate 15 has been given a modified design. Said plate 15 is designed in Fig. 3 by the numeral 21. Like the plate 15, the plate 21 has a conic portion 17.

According to this embodiment, the plate has different heights in different radial directions. In Fig. 4 the outer periphery 22 of the plate 21 is shown rolled-out, and in Fig. 5 a circular section at 23 is shown. Said circular section is an axial cross-section through the plate along the upper edge 32 of the conic portion 17. The conic portion 17 is axial-symmetric with the same form as shown in Fig. 1. The height of the plate 21 radially outside the conic portion varies so, that the plate is highest along four radii 24—27, which form 90° relative to each other, and that the plate 21 is lower along radii 28—31, which are offset 45° in relation to the radii 24—27.

The position of the radii is indicated by said numerals in Figs. 3 and 4. Between its higher and, respectively, lower portions, the plate 21 assumes sinus shape as shown in Fig. 4.

The amplitude of the sinus shape successively decreases for circular concentric sections through the plate 21 and is completely abolished at said inner periphery 23, see Fig. 5. According to this embodiment of the invention, the greatest diameter of the sleeve 13 is smaller than at the embodiment shown in Figs. 1 and 2, in order that the lower portion of the sleeve shall abut not only

the higher portions 24—27 of the plate 21.

Owing to this design of the plate 21, relatively little force is required for moving the lever 3 radially out from its non-operative position in four mutually perpendicular radial directions. After having been moved radially along such a direction, the lever 3 can be moved perpendicularly to the radial direction, i.e. so that the sleeve 13 passes over a higher portion of the plate 21. For this, however, a substantially greater force is required.

An operator, thus, easily will sense four mutually perpendicular directions, which is of great importance for manipulators at certain machines.

The plate 21, of course, can be designed according to the principle described with reference to Figs. 3 and 4, but instead in such a manner, for example, that the plate 21 is formed with radially directed lower portions in one, two or three directions instead of in four.

The amplitude of the sinus shape, furthermore, can be levelled from the periphery 22 of the plate to the conic portion 17 in a manner other than successively or linear.

Such modifications are regarded comprised in the invention.

In Figs. 6 and 7 additional embodiments of the plate 15 are shown, which in Fig. 6 is designated by 33 and in Fig. 7 by 34. The plates 33 and, respectively, 34 are shown in a section corresponding to the section B—B in Fig. 2. The plates 33, 34 in Figs. 6 and 7 are axial-symmetric.

In Fig. 6 the plate 33 is designed so that its height increases successively with the distance from its centre. The height increases substantially close to the periphery 35 of the plate 33, resulting in that the force required for moving the lever from its non-operative position increases with increasing deflection of the lever 3 and increases substantially when the sleeve 13 approaches the periphery 35 of the plate 33, i.e. at a great deflection of the lever 3.

In Fig. 7 a plate 34 is shown, which is designed so as to have a substantially plane portion 36, whereafter in radial direction the height of the plate increases substantially close to its periphery 37. Owing to this design, the force required for moving the lever 3 from its non-operative position increases substantially first when the sleeve 13 approaches the periphery 17 of the plate 34.

The features mentioned in the introductory portion as characteristic of the invention, thus, result in a simple and sturdy structural design, which besides renders it possible to form the characteristics of the force required for moving the lever in such a manner, that the characteristics is adapted to different purposes. A further advantage of the invention is, that the structural height from the instrument panel 12 and downward of a manipulator is reduced substantially compared with known manipulators, because the spring arrangement is located above the instrument panel.

Different modifications of the invention have

been mentioned above. The device according to the invention can be modified additionally without abandoning the invention idea.

The invention, thus, must not be regarded restricted to the embodiments referred to above, but can be varied within the scope of the attached claims.

Claims

1. A device in a multi-way lever, so called "joy-stick", comprised for example in a manipulator, comprising a control lever (3) hinged at one end thereof in a housing (2) and projecting therefrom, a sleeve (13) being mounted concentrically around said lever (3) and biased by action of a spring force against a plate (15), characterized in that the end of said sleeve (13) facing said plate (15), has a conic surface (14) abutting a slide surface (16) on said plate (15), in that said slide surface (16) includes a central portion (17) and a surrounding concave portion opposite to said sleeve and in that said central portion (17) of said slide surface (16) comprises also a conic surface designed to promote centering of said conic surface (14) of said sleeve (13) with respect to said slide surface (16).

2. A device as defined in claim 1, characterized in that the sleeve is located about the lever (3) between the free end of the lever and said plate (15), and that the slide surface (16) of the plate (15) is directed to the free end of the lever (3).

3. A device as defined in claim 1 or 2, characterized in that the height of the plate (15, 21) varies with the radial distance from the conic portion (17) and outward, at the same time as its height varies in circumferential direction, preferably according to a sinus shape, so that the variation in height in circumferential direction is greatest at the outer periphery (22) of the plate (21) and smallest or insignificant at the transition (32) of the conic portion (17) to the portion of the slide surface (16) which is located outside.

4. A device as defined in claim 3, characterized in that said variation in height is such, that the height of the plate (21) in radial direction is highest in four mutually perpendicular directions (24—27) and lowest in four perpendicular directions (28—31), which lastmentioned directions (28—31) are offset 45° in circumferential direction relative to said firstmentioned directions (24—27).

5. A device as defined in claim 1 or 2, characterized in that the plate (15) is axial-symmetric, and the height of the plate (15) varies with the radial distance from the conic portion (17) and outward, so that the height increases substantially in said direction close to the periphery of the plate (15, 33, 34).

Revendications

1. Dispositif pour levier à directions multiples, appelé "manche à balai", utilisé par exemple dans un manipulateur, comprenant un levier de commande (3) articulé par l'une de ses extrémités

dans un carter (2) et sortant de celui-ci, un manchon (13) étant monté concentriquement autour du levier (3) et poussé par l'action d'un ressort contre une plaque (15), dispositif caractérisé en ce que l'extrémité de ce manchon (13) faisant face à la plaque (15), comporte une surface conique (14) venant buter contre une surface de glissement (16) de la plaque (15), en ce que cette surface de glissement (16) comporte une partie centrale (17) et une partie d'enveloppe concave opposé au manchon, et en ce que cette partie centrale (17) de la surface de glissement (16) comporte également une surface conique destinée à assurer le centrage de cette surface conique (14) du manchon (13) par rapport à la surface de glissement (16).

2. Dispositif selon la revendication 1, caractérisé en ce que le manchon est placé autour du levier (3) entre l'extrémité libre du levier et la plaque (15), et en ce que la surface de glissement (16) de la plaque (15) est orientée vers l'extrémité libre du levier (3).

3. Dispositif selon l'une quelconque des revendications 1 et 2, caractérisé en ce que la hauteur de la plaque (15, 21) varie avec la distance radiale entre la partie conique (17) et l'extérieur, en même temps que sa hauteur varie dans la direction circulaire, de préférence sous forme sinusoidale, de façon que la variation de hauteur dans la direction circulaire soit maximum à la périphérie extérieure (22) de la plaque (21) et minimum ou négligeable à l'endroit de la transition (32) entre la partie conique (17) et la partie de la surface de glissement (16) située à l'extérieur.

4. Dispositif selon la revendication 3, caractérisé en ce que la variation de hauteur est telle que la hauteur de la plaque (21) dans la direction radiale soit maximum dans quatre directions mutuellement perpendiculaires (24 à 27), et minimum dans quatre directions perpendiculaires (28 à 31), ces dernières directions (28 à 31) étant décalées de 45° dans la direction circulaire, par rapport aux premières directions indiquées (24 à 27).

5. Dispositif selon l'une quelconque des revendications 1 et 2, caractérisé en ce que la plaque (15) est à symétrie axiale, et en ce que la hauteur de la plaque (15) varie avec la distance radiale entre la partie conique (17) et l'extérieur de façon que la hauteur augmente de manière importante dans la directions voisine du pourtour de la plaque (15, 33, 34).

Patentansprüche

1. Vorrichtung in einem Mehrweghebel, sog. "Steuernüppel", der z.B. in einem Manipulator enthalten ist und aus einem Schalthebel (3) besteht, der an einem Ende in einem Gehäuse (2) angelenkt ist und daraus herausragt, und einer Hülse (13), die konzentrisch um genannten Hebel (3) montiert und durch Wirkung einer Federkraft gegen eine Platte (15) vorgespannt ist, dadurch gekennzeichnet, daß das genannte Platte (15)

zugewandte Ende der genannten Hülse (13) eine Kegelfläche (14) aufweist, die gegen eine Gleitfläche (16) an genannter Platte (15) anliegt, daß genannte Gleitfläche (16) ein zentrales Teilstück (17) und ein umgebendes konkaves Teilstück gegenüber genannter Hülse aufweist, und daß genanntes zentrales Teilstück (17) der genannten Gleitfläche (16) auch eine Kegelfläche aufweist, die so geformt ist, daß sie die Zentrierung der Kegelfläche (14) der genannten Hülse (13) in Beziehung zu genannter Gleitfläche (16) fördert.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Hülse um den Hebel (3) zwischen dem freien Ende des Hebels und genannter Platte (15) liegt, und die Gleitfläche (16) der Platte (15) zum freien Ende des Hebels (3) gerichtet ist.

3. Vorrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Höhe der Platte (15, 21) mit dem radialen Abstand vom konischen Teilstück (17) nach außen sich verändert und gleichzeitig sich deren Höhe in Umkreisrichtung, vorzugsweise gemäß einer Sinusform, verändert, so

daß die Änderung in der Höhe in Umkreisrichtung am größten an der Außenperipherie (22) der Platte (21) und am kleinsten oder unbedeutend am Übergang (32) des konischen Teilstückes (17) zu dem außerhalb liegenden Teilstück der Gleitfläche (16) ist.

4. Vorrichtung nach Anspruch 3, dadurch gekennzeichnet, daß die genannte Änderung in der Höhe derart ist, daß die Höhe der Platte (21) in radialer Richtung am größten in vier Richtungen (24—27) quer zueinander und am kleinsten in vier Querrichtungen (28—31) ist, welche letztere Richtungen (28—31) 45° in Umkreisrichtung in Beziehung zu den erstgenannten Richtungen (24—27) versetzt sind.

5. Vorrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Platte (15) axialsymmetrisch ist, und die Höhe der Platte (15) sich mit dem radialen Abstand vom konischen Teilstück (17) auswärts ändert, so daß die Höhe in genannter Richtung nahe der Peripherie der Platte (15, 33, 34) wesentlich zunimmt.

25

30

35

40

45

50

55

60

65

5

Fig. 1



