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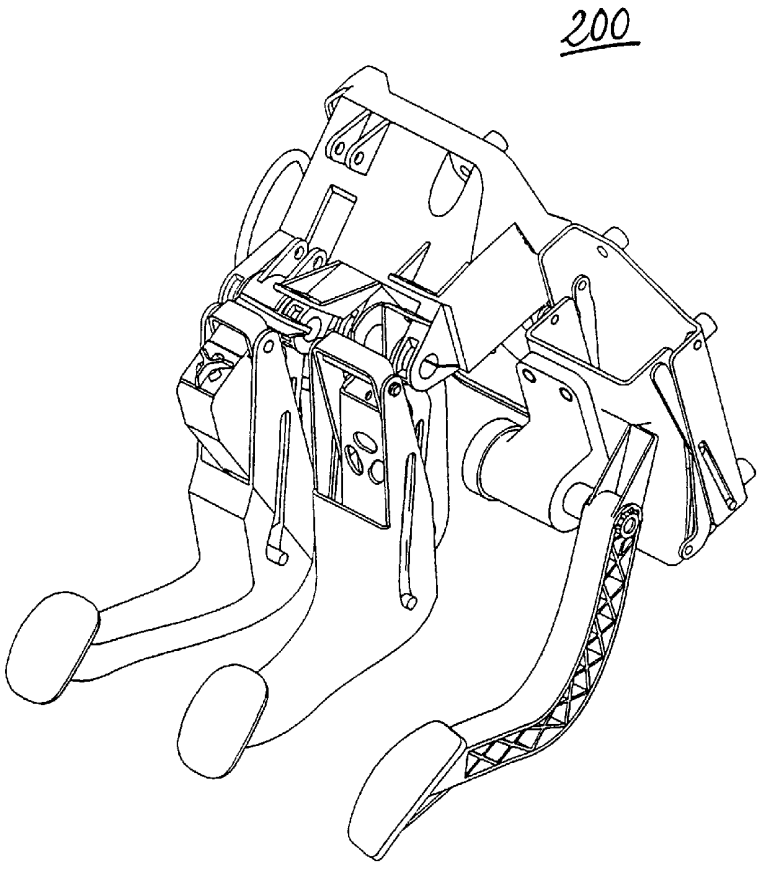

(57) Abstract: The present invention relates to an adjustable pedal (1), in particular for motor vehicles, by means of which the pedal foot (12), to be actuated, of the pedal (10) is set optimally to the driver's size. During the adjustment of the pedal (1), the pedal foot (12) is displaced parallel to the longitudinal axis of the vehicle. For this purpose, the adjustable pedal (1) has a pedal (10) and at least one subpedal (20a) and also a linkage (30, 31, 32) adjustable by means of an actuator (40), the actuator changing the angular relationship between adjacent components of the linkage (30, 31, 32).

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Adjustable pedal

1. Technical field

The present invention relates to an adjustable pedal, by means of which the distance between the pedal and the user can be set optimally, without the functioning of the pedal being impaired. In particular, the present invention relates to a brake pedal, clutch pedal and accelerator pedal in a motor vehicle.

2. Prior art

In many areas of mechanics, such as, for example, in general mechanical engineering or in motor vehicle construction, there is a problem of providing the possibility of setting a pedal in a controlled manner, in such a way that it can be actuated optimally by the user. Particularly in motor vehicles, drivers of different size have the problem of coordinating their leg length with the position of the pedal. This has hitherto been made possible essentially by the seat adjustment. It has recently also been possible to adjust the position of the pedal to the driver's size by means of various technical solutions.

Additional safety elements, such as, for example, the airbag in the steering wheel, allow increased protection for the motor vehicle occupants in the event of an accident, provided that the driver is at the correct distance from the steering wheel. If, then, the optimal distance between the driver and the pedals is regulated via the setting of the seat position, the functioning of the airbag may thereby be impaired or even cancelled completely, since the driver's position in relation to the steering wheel also changes. For this reason, it is necessary for adjustable pedals to be used especially in motor vehicles.

The prior art provides various technical solutions for adjustable pedals. The simplest technical solution is described in US-A-5,839,326. In this case, the pedal arm is designed in two parts, both parts of the pedal arm having long holes which overlap one another in their longitudinal direction. The length of the pedal arm can be adjusted to the driver's size, by means of the two long holes and a screw, by the continuous displacement of the two parts relative to one another. The technical solution presented here is very simple in design terms and can therefore be produced at a limited outlay. Its essential disadvantage, however, is that the pedal can be adjusted to the driver in each case only by the use of a tool. This fact is extremely inconvenient especially when there is a quick change of driver.

A further technical solution for adjustable pedals is offered by the publications WO 98/14857 and US 5,819,593. Here, the pedal to be actuated is fastened displaceably on a shaft which extends parallel to the longitudinal axis of the vehicle. The pedal is displaced towards the driver or away from the driver along this shaft and is thereby adapted to his or her seat position or leg length. The displacement of the pedal takes place via electrical actuators which are actuated without the use of additional tools. It is thus possible for the pedal position to be adapted to the seat position of the respective driver in a simple way. However, the adjustment shaft of the pedal projects into the driver's area. Especially in the event of a front collision of the vehicle, this gives rise to an increased risk of injury to the driver, because the adjustment shaft is pressed into the driver's area by the vehicle chassis which undergoes deformation.

A further technical design for adjustable pedals is provided by EP 0 918 273 A1. In this case, the adjustable pedal is articulated rotatably on a lever which is pivotable via a gear and a servomotor. The adjustment of the pedal takes place by rotation about an axis of rotation. The pedals are pivoted towards the driver or away from the latter about this axis of rotation. This is a disadvantage, however, since the distance between the pedal foot and the vehicle floor increases or decreases. This fact is extremely inconvenient especially for small drivers who usually also have small feet. To be precise, in order to actuate the pedal reliably, the foot has to be raised and cannot be supported on the floor

by the heel. The driver becomes fatigued and tense as a result. Furthermore, because it is composed of a motor, gear and complicated lever mechanism, this technical solution requires a considerable production outlay and subsequent maintenance which in each case incur unintended costs.

The adjustable pedal according to the publication US 5,823,064 makes use of a lever mechanism essentially consisting of a pedal, of a subpedal and of an eccentric. The subpedal serves for the always identical actuation of the connecting member to, for example, the clutch system or brake system. The eccentric is used as an actuator, in order to rotate the pedal about its bearing axis and thus bring it into the position suitable for the driver. The distance between the pedal and the driver's foot is set by means of this design. As before, however, because of the rotational adjustment of the pedal the pedal foot is raised when the pedal is moved in the direction of the driver. This is unfavourable, as already described above.

A further technical solution for adjustable pedals is provided by the publication US 5,855,143. In this case, the adjustable pedal is provided with the aid of a pedal and a subpedal which are connected adjustably to one another via a linking system. Two points of articulation of the linking system on the vehicle chassis are essential to the embodiment described. Using a suitable actuator in the linking system, the pedal rotates about one of the said points of articulation on the vehicle chassis and is adjusted in this way. This results, in a similar way to the embodiments described above, to an adjustment of the pedal which is parallel to the longitudinal axis of the vehicle and which is associated with an adjustment of the pedal height.

Further electrically adjustable pedal systems are discussed in US-A-5,927,154 and US-A-5,460,061.

The problem of the adjustable pedals provided by the prior art is that the distance between the pedal foot and the vehicle floor changes unfavourably during pedal adjust-

ment. More precisely, the adjustment of the pedal in the direction of the driver, carried out hitherto, is associated with a simultaneous undesirable raising of the pedal. By contrast, adjustment of the pedal away from the driver results in an undesirable lowering of the pedal.

The problem on which the invention is based is therefore to provide adjustable pedals which, when being set to the driver's size, allow displacement in the longitudinal axis of the vehicle, the distance from the vehicle floor remaining constant. Furthermore, the technical implementation of the adjustable pedal is to be carried out preferably by means of a simple construction which consists of inexpensive materials, is capable of being executed in a modular design and can be installed, irrespective of the type of vehicle.

3. Summary of the invention

The problem on which the invention is based is solved, according to the invention, by means of an adjustable pedal according to Patent Claim 1 and Patent Claim 10.

In particular, the problem on which the present invention is based is solved, according to Patent Claim 1, by means of an adjustable pedal, in particular for motor vehicles, which pedal has a pedal and at least one subpedal and also a linkage which is adjustable by means of an actuator and which connects the pedal and at least one subpedal directly to one another, the actuator changing the angular relationship between adjacent components of the linkage, and the pedal foot being at a predetermined distance from the vehicle floor during pedal adjustment.

The adjustable pedal according to Patent Claim 1 is distinguished by a simple mechanical construction which can be adjusted, for example, by means of an electrical actuator. This simple construction allows the pedal to be adjusted away from the driver or to-

wards the driver, essentially the distance between the pedal foot and vehicle floor remaining constant. The pedal foot is thereby adjusted, for example, at an average height relative to the vehicle floor and is adapted to large and small drivers. In the construction of the adjustable pedal, the height of the pedal foot is determined by means of the dimensioning of the linkage. The adjustable pedal according to the invention thus makes it possible for any driver to actuate it reliably and comfortably, whilst at the same time the safety requirements in the motor vehicle are taken into account.

Preferably, according to the invention, the linkage of the adjustable pedal consists, according to Patent Claims 3 and 4, of at least three components, the respective ends of the components being guided or rotatably fastened in a long hole, with the result that, during the movement of the actuator, the pedal executes a translational movement parallel to the longitudinal axis of the vehicle and a rotational movement about an axis of rotation.

The design according to the invention of the adjustable linkage, in particular the arrangement of the centres of rotation and the shape of the guiding long holes, make it possible to adjust the pedal in a controlled manner at the predetermined height relative to the vehicle floor. Especially by means of the shape of the long holes and suitable positioning of the centres of rotation, a distance varying with the adjustment position can also be provided in addition to a constant distance between the pedal foot and vehicle floor.

According to the preferred embodiments of the adjustable pedal which are described in Patent Claims 6 and 7, the first subpedal is designed to be U-shaped in its one end region, the two legs having opposite holes for receiving the pedal bearing shaft. Furthermore, the first subpedal, in addition to a connection means, has either at least two long holes for receiving the ends of the U-shaped component of the linkage or at least one fastening point, in order to fasten the lever-like component for connection to the second subpedal.

The first subpedal according to the invention serves for the always uniform transmission of the movement of the adjustable pedal according to the invention to the brake system or clutch system or the like. For this purpose, the said first subpedal is rotatably fastened with its end region to the pedal module. It is designed, furthermore, in such a way that it receives the respective ends of the adjustable linkage, so that the adjustable pedal can be suitably adjusted by means of the actuator.

According to a preferred embodiment of the adjustable pedal and according Patent Claim 8, the second subpedal consists of two L-shaped opposite components, the opposite ends of which are in each case connected by means of shafts, one shaft forming the axis of rotation of the second subpedal and the lever-like component for connection to the first subpedal being fastened to the other shaft.

A further embodiment of the adjustable pedal according to the invention comprises two subpedals which allow the suitable adjustment of the adjustable pedal. The use of two rotatably fastened subpedals may be preferred, depending on the configuration of the pedal module or of the vehicle chassis. In this case, the movement of the adjustable pedal is transmitted to the respective systems via the second subpedal and the first subpedal.

Preferably, according to the invention, in order to adjust the adjustable pedal an actuator is used which, according to Patent Claim 9, is fastened as a linear actuator to the first subpedal or as a rotating actuator to a lever-like component of the linkage.

The adjustable pedal according to the invention is preferably adjusted by means of electrical actuators. This allows a convenient and quick adjustment of the pedal position to the driver. Depending on the type of articulation of the actuator on the adjustable

pedal, various types of actuators based, for example, on a rotational movement or a translational movement are possible.

Furthermore, according to Patent Claim 10, the present invention provides an adjustable pedal, in particular for motor vehicles, which has a pedal fastened to a fastening means and a holding means and also a linkage which is adjustable by means of an actuator and which connects the fastening means and the holding means directly to one another, the actuator changing the angular relationship between adjacent components of the linkage. According to the invention, this adjustable pedal is suitable preferably for the actuation of the electrical actuating elements, such as, for example, the accelerator pedal in a motor vehicle.

The present invention provides a further embodiment of an adjustable pedal, in which, using an adjustable linkage, the pedal holding means and therefore the entire pedal are adjusted. This embodiment according to the invention is suitable particularly for pedals which have no mechanical coupling elements to other systems, such as, for example, the brake system.

According to Patent Claim 12, the embodiment of the adjustable pedal which is preferred according to the invention is characterized by a linkage comprising at least four lever-like components, of which two in each case are connected to one another in a scissor-like manner, in each case the first ends of the components being guided in a long hole and in each case the other ends being fastened rotatably, with the result that, during the movement of the actuator, the pedal executes a translational movement parallel to the longitudinal axis of the vehicle and a rotational movement about an axis of rotation.

The suitable articulation and dimensioning of the adjustable linkage according to the invention make it possible to adapt the pedal position to the driver. A predetermined adjustment travel of the adjustable pedal is fixed as a function of the positioning of the centres of rotation and of the shape of the long holes. In this case, according to Patent

Claim 11, the distance between the pedal foot and vehicle floor can remain constant or vary.

Furthermore, preferably, according to the invention, and according to Patent Claims 13 and 14, the adjustable pedal comprises a linear actuator which is fastened to the holding means, the actuator displacing a connecting element of the linkage, the said connecting element connecting two opposite ends of lever-like components.

4. Brief description of the drawings

Embodiments of the present invention which are preferred at the present time are explained in more detail with the aid of the drawing and the following detailed description. In the drawing:

Figure 1 shows a general illustration of a pedal module for motor vehicles, comprising an adjustable clutch pedal, an adjustable brake pedal and an adjustable accelerator pedal, in each case corresponding to the preferred embodiment of the present invention;

Figure 2 shows an illustration of an adjustable pedal according to a first preferred embodiment of the present invention;

Figure 3 shows an illustration of a first preferred embodiment of the present invention in a side view, two different adjustment positions of the adjustable pedal according to the invention being shown;

Figure 4 shows a second embodiment, preferred according to the invention, of an adjustable pedal according to the present invention;

Figure 5 shows a second embodiment, preferred according to the invention, of the adjustable pedal according to the present invention in a side view, two different adjustment positions of the adjustable pedal being shown;

Figure 6 shows a third embodiment, preferred according to the invention, of an adjustable pedal according to the present invention, consisting of a pedal, of a fastening means, of a holding means and of a linkage;

Figure 7 shows a third embodiment, preferred according to the invention, of an adjustable pedal according to the present invention, two different adjustment positions of the adjustable pedal being shown.

The preferred embodiments of the invention are explained in detail below with reference to the drawing.

5. Detailed description of the invention

Motor vehicles are nowadays being produced to an increased extent in a modular design. This means that specific modules, such as, for example, the pedal module, are manufactured, irrespective of the type of vehicle, and are subsequently installed in the respective motor vehicle. Such a pedal module 200 mentioned above is shown in Figure 1.

Preferably, according to the invention, this pedal module is composed of three adjustable pedals which form the brake pedal, clutch pedal and accelerator pedal of a motor vehicle. Furthermore, however, it is also possible for adjustable pedals to be installed individually rather than in a modular design, in motor vehicles, machines or the like.

Preferably, according to the invention, the adjustable pedals are manufactured from plastics, such as, for example, polyamide, which, if necessary, are supplemented by additional reinforcing elements. It is also possible, however, to manufacture the adjustable pedals from any other desired materials, as long as they satisfy the technical application requirements.

Various embodiments, preferred according to the invention, of adjustable pedals are explained below with reference to the drawing. Figure 2 shows a first preferred embodiment of an adjustable pedal according to the present invention, which is composed of a pedal 10, of a subpedal 20a, of an adjustable linkage 30, 31, 32 and of an actuator 40. The pedal 10 and the subpedal 20a are connected directly to one another by the adjustable linkage 30, 31, 32. The linear actuator 40 is fastened to the subpedal 20a and engages on the adjustable linkage 30, 31, 32 in such a way that the distance between the pedal 10 and subpedal 20a is varied by means of the change in length of the actuator 40.

The adjustable linkage 30, 31, 32 preferred according to the invention is composed of a U-shaped lever 30 and of two levers 31, 32 fastened rotatably to the legs of the U-shaped lever 30 in a scissor-like manner. The levers 31, 32 preferred according to the invention have, in their longitudinal direction, a long hole, in which one end of the actuator is guided. Furthermore, preferably, according to the invention, the first ends 31a, 32a of the levers 31, 32 have projections, by means of which they are guided in the long holes 11 of the pedal 10. Suitable orifices are formed at the second ends 31b, 32b of the levers 31, 32, in order to fasten the levers 31, 32 to the pedal bearing shaft 60. The U-shaped lever 30 of the adjustable linkage 30, 31, 32 has, at its ends 30a, projections which point into the inner region of the U-shaped lever 30 and are guided in the long holes 21 of the subpedal 20a. Furthermore, the U-shaped lever 30 has, near the connection of the two legs, two opposite centres of rotation 30b, at which the pedal 10 is fastened rotatably.

Preferably, according to the invention, the first embodiment of the adjustable pedal 1 has a subpedal 20a which is fastened to the pedal module 80 rotatably via the pedal bearing shaft 60. It is also possible, however, for the subpedal 20a to be directly fastened rotatably to the vehicle chassis. The upper end region of the subpedal 20a is of U-shaped design, the opposite legs 21, 22 having likewise opposite holes for receiving the pedal bearing shaft 60. Furthermore, preferably, according to the invention, the subpedal 20a has connection means 25, via which it can be connected, for example, to the clutch system or to the brake system of a motor vehicle. Moreover, symmetrically arranged long holes 21, already mentioned above, extend on both sides in the second end region 20a, run approximately in the longitudinal direction of the subpedal 20a and receive the projections of the ends 30a of the U-shaped lever 30.

Moreover, the linear actuator 40 is fastened to the subpedal 20a, so that the said actuator can engage into one of the long holes of the levers 31, 32 of the adjustable linkage 30, 31, 32, in order thereby, as a result of the variation in its length, to place the subpedal 20a and the pedal 10 at a distance from one another. It is also possible, of course, to fasten the actuator 40 at any other desired point on the subpedal 20a or within the adjustable linkage 30, 31, 32 and also to design the said actuator as a non-linear actuator, in order to perform the function of the adjustable pedal.

The pedal 10 has an end region which terminates in a U-shaped manner and the opposite legs 13 of which are fastened rotatably to the U-shaped lever 30 at the centres of rotation 30b. Furthermore, preferably, according to the invention, long holes 11 run in the middle region of the pedal 10 and receive and guide the projections 31a and 32a of the levers 31 and 32 of the adjustable linkage 30, 31, 32. That end region of the pedal 10 which is located opposite the U-shaped end region is bent in an L-shaped manner and has a pedal foot 12 for the actuation of the adjustable pedal 1.

The illustration in Figure 3 shows diagrammatically the adjustment of the adjustable pedal. In a first adjustment position of the adjustable pedal 1, identified by I and unbro-

ken lines, the scissor-like regions of the adjustable linkage 30, 31, 32 are open to the greatest possible extent. Furthermore, the ends 30a of the U-shaped lever 30 are located at the lower end of the long holes 21 of the subpedal 20a and the ends 31a and 32a of the levers 31 and 32 are located at that end of the long holes 11 of the pedal 10 which faces the pedal foot 12. As a result of the deflection of the actuator 40, the scissor-like regions of the adjustable linkage 30, 31, 32 are increasingly closed and the pedal 10 is thereby placed at a distance from the subpedal 20a. By virtue of this movement of the actuator 40, the ends of the adjustable linkage 30, 31, 32 which are guided in the long holes 21 and 11 move into the upper region of the subpedal 20 and of the pedal 10. Due to the deflection of the actuator 40, the pedal 10 is displaced along the broken line 90. This movement, executed essentially as a translational movement, displaces the pedal 10, and the pressure region 12 important for actuating the pedal, parallel to the longitudinal axis of the vehicle and simultaneously executes a variation in height relative to the motor vehicle floor 95. At the same time, during the movement of the pedal 10 towards the driver, the pressure region 12 is lowered. During the movement of the pedal 10 away from the driver, the pressure region 12 is correspondingly raised. The pedal position is thereby adjusted optimally to the driver in terms of height and distance.

A second preferred embodiment of the adjustable pedal 1 of the present invention is shown in Figure 4. Preferably, according to the invention, the adjustable pedal 1 consists of a pedal 10, of two subpedals 20a and 20b, of a linkage 33, 34, 35, 36, 37 and of an actuator 40. The first subpedal 20a has, in a similar way to the first preferred embodiment of the present invention, a U-shaped end region with legs 21 and 22, in which opposite holes for receiving the pedal bearing shaft 60 are located. Furthermore, preferably, according to the invention, the subpedal 20a has a connection means 25 which serves for connection to further systems to be actuated. Possible examples of such systems are the brake system or clutch system. By means of a lug 23 fastened to the subpedal 20a or as a result of a suitable fastening facility taking a different form, the first subpedal 20a is connected to the second subpedal 20b via the lever-like component 37 of the adjustable linkage 33, 34, 35, 36, 37. The connection via the lever-like component 37 allows the transmission of force between the first subpedal 20a and the second subpedal 20b.

The second subpedal 20b is fastened (see Figure 5) rotatably either to the pedal module 80 or to the motor vehicle chassis 97. Furthermore, preferably, according to the invention, the second subpedal 20 consists of two opposite L-shaped components 26, 27, the ends of which are connected by means of shafts 28, 29. The upper shaft 29 of the second subpedal 20b, the said shaft also serving for the rotatable fastening of the second subpedal 20b to the pedal module 80 or to the motor vehicle chassis 97, defines a subpedal axis of rotation 50b. The second subpedal 20b is connected directly to the pedal 10 via an adjustable linkage 33, 34, 35, 36. The adjustable linkage 33, 34, 35, 36 is composed of lever-like components 33, 34, 35, 36, the first end of which is fastened rotatably to the pedal 10 and the second end of which is fastened rotatably to the subpedal 20b. Via a rotating actuator 40, which is fastened to the lever-like component 34 preferably according to the invention, the linkage 33, 34, 35, 36 can be adjusted in such a way that the pedal 10 is placed at a distance from the first subpedal 20a and is adapted optimally to the driver's foot position.

Figure 5 describes, by means of a diagrammatic illustration, how the adjustable pedal 1 according to a second preferred embodiment of the present invention is adjusted from a first adjustment position, identified by unbroken lines, into a second adjustment position, identified by broken lines. As a result of the actuation of the actuator 40 (not shown here), the pedal 10 is placed at a distance from the first subpedal 20a as a result of a translational movement parallel to the longitudinal axis of the vehicle and as the result of a rotational movement about the pedal axis of rotation 50b of the second subpedal 20b. If, in this case, the adjustable pedal 1 is adapted to the foot position of a driver of small body size, which here corresponds to the broken-line illustration, both the pedal 10 is displaced in the direction of the driver and its height relative to the motor vehicle floor 95 is reduced. The pedal position is thereby adjusted optimally to the driver's respective foot position with the aid of the adjustable pedal 1 according to the invention.

Figure 6 gives an illustration of a third preferred embodiment of an adjustable pedal 100 of the present invention. This adjustable pedal 100 serves, for example, for the actuation of electrical systems. This applies, for example, to accelerator pedals in motor vehicles which are actuated via a potentiometer.

The adjustable pedal 100 of the present invention is composed of a pedal 110, of a fastening means 120, of a holding means 130 and of an adjustable linkage 140, 141, 142, 143. The pedal 110 is fastened rotatably to the fastening means 120. The fastening means 120 is formed, in this case, by a sheet-like U-shaped profile. At the upper end of the fastening means 120, an axis of rotation 160 is defined by opposite centres of rotation of the adjustable linkage 140, 141, 142, 143 which are positioned on the legs of the U-shaped profile. In the lower half of the fastening means 120, long holes 122 are introduced in the leg regions of the U-shaped profile and run approximately in the longitudinal direction of the fastening means 120. They serve for receiving and guiding the ends of the lever-like components 141 of the adjustable linkage 140, 141, 142, 143.

Preferably, according to the invention, the holding means 130 is likewise formed by a sheet-like U-shaped profile, the legs of the U-profile pointing in the direction of the fastening means 120. The holding means 130 serves for fastening the adjustable pedal 100 to the pedal module or to the vehicle chassis (not shown). Furthermore, the holding means 130, in its upper region, provides on the legs the centres of rotation 131, in each case opposite one another, for the lever-like components 141 and 142 of the adjustable linkage 140, 141, 142, 143. Long holes 133 are made opposite one another on the legs in the lower region of the holding means 130, the said long holes running essentially in the direction of the longitudinal axis of the holding means 130 and serving for receiving the ends of the lever-like components 140 and 143 of the adjustable linkage 140, 141, 142, 143. Furthermore, preferably, according to the invention, the holding means 130 has fastened to it an actuator 150, by means of the change in length of which the adjustable linkage 140, 141, 142, 143 is adjusted. The actuator 150 is coupled to a connecting component 170 which connects the two ends of the lever-like components 140 and 143

of the adjustable linkage 140, 141, 142, 143, the said ends being guided in the long holes 133 of the holding means 130.

The scissor-like adjustable linkage 140, 141, 142, 143 consists of four lever-like components 140, 141, 142, 143, the lever-like components 140, 141 and 142, 143 being connected to one another in a scissor-like manner via a centre of rotation. Furthermore, preferably, according to the invention, the lever-like components 141 and 142 are of L-shaped design, one end being connected rotatably to the legs of the U-shaped holding means 130 and the other end being guided in the long hole 122 of the fastening means 120. One end of the lever-like components 140 and 143 is guided in long holes 133 of the U-shaped holding means 130, whilst the other end is fastened rotatably to the legs of the U-shaped fastening means 120.

As a result of the displacement of the connecting component 170 via the actuator 150, the scissor-like adjustable linkage 140, 141, 142, 143 is opened or closed, and the distance between the fastening means 120 and holding means 130 is varied in this way. By virtue of the shape of the long holes 133 in the holding means 130 and of the long holes 122 in the fastening means 120, the distance between the holding means 130 and the fastening means 120 is varied due to the movement of the actuator 150, and the pedal position is thereby set optimally. In this case, the movement of the fastening means 120 may be composed of a translational movement and of a rotational movement.

Figure 7 gives a diagrammatical illustration of the third preferred embodiment of the adjustable pedal 100 according to the present invention in a first adjustment position, illustrated by unbroken lines, and in a second adjustment position, illustrated by broken lines. In a similar way to the first and second embodiments of the present invention which have already been explained in detail, when the adjustment position of the adjustable pedal 100 is varied both the distance between the pedal 110 and the driver and the height of the pedal foot 112 are set optimally.

With the aid of the preferred embodiment, described in detail, of the present invention, it is possible, for example, to build up a pedal module for motor vehicles which consists of an adjustable clutch pedal, of an adjustable brake pedal and of an adjustable accelerator pedal. In this way, the pedal position can be adjusted to the foot position of any driver, with the result that, on the one hand, comfort is increased and, on the other hand, the motor vehicle satisfies more stringent safety requirements. It is also possible, however, to use the adjustable pedal 1, 100 according to the invention in other areas in which an adjustable pedal assembly is necessary for the actuation of various systems.

List of reference symbols

1, 100	Adjustable pedal
10, 110	Pedal
11	Long holes in the pedal 10
12, 112	Pedal foot
20a, 20b	Subpedal
21	Long holes in the subpedal 20a
23	Lug
25	Connection means
26, 27	L-shaped components
28, 29	Shafts
30, 31, 32	Adjustable linkage
33, 34, 35, 36, 37	Adjustable linkage
30	U-shaped lever
30a	Ends of the U-shaped lever
30b	Centres of rotation of the pedal 10 on the U-shaped lever 30
31, 32	Levers
31a, 32a	First end of the levers 31, 32
31b, 32b	Second end of the levers 31, 32
33, 34, 35, 36, 37	Lever-like components
40	Actuator
50a, 50b	Subpedal axis of rotation
60	Pedal bearing shaft

80	Pedal module
90	Adjustment line of the pedal 10
95	Motor vehicle floor
97	Motor vehicle chassis
120	Fastening means
130	Holding means
140, 141, 142, 143	Adjustable linkage
140, 141, 142, 143	Lever-like components
150	Actuator
170	Connecting component
200	Pedal module
I	First adjustment position
II	Second adjustment position

Claims

1. Adjustable pedal (1), in particular for motor vehicles, with:

   a. a pedal (10) with a pedal foot (12) and with at least one subpedal (20a, 20b);

   b. a linkage (30, 31, 32; 33, 34, 35, 36, 37) which is adjustable by means of an actuator (40) and which connects the pedal (10) and the at least one subpedal (20a, 20b) directly to one another,

   c. the actuator changing the angular relationship between adjacent components of the linkage (30, 31, 32; 33, 34, 35, 36, 37), and, during pedal adjustment, the pedal foot (12) being at a predetermined distance from the vehicle floor (95).

2. Adjustable pedal (1) according to Claim 1, characterized in that, during pedal adjustment, the distance between the pedal foot (12) and vehicle floor (95) remains constant or is changed.

3. Adjustable pedal (1) according to one of the preceding claims, characterized in that the linkage (30, 31, 32; 33, 34, 35, 36, 37) comprises at least three components, the respective ends of the components being guided or rotatably fastened in a long hole, with the result that, during the movement of the actuator (40), the pedal (10) executes a translational movement parallel to the longitudinal axis of the vehicle and a rotational movement about an axis of rotation (50a, 50b).

4. Adjustable pedal (1) according to Claim 3, characterized in that the linkage (30, 31, 32; 33, 34, 35, 36, 37) has:

a. a U-shaped lever (30), the ends (30a) of which are guided in long holes (21) of the subpedal (20), and two levers (31, 32) fastened rotatably in a scissor-like manner to the legs of the U-shaped lever (30), the levers (31, 32) each having a long hole for receiving one end of the actuator (40), their first end (31a, 32a) being guided in a long hole (11) of the pedal (10) and their second end (31b, 32b) being articulated on the pedal bearing shaft (60); or

b. four lever-like components (33, 34, 35, 36), the first end of which is fastened rotatably to the pedal (10) and the second end of which is fastened rotatably to the second subpedal (20b), a lever-like component (37) making a connection between the first subpedal (20a) and the second subpedal (20b).

5. Adjustable pedal (1) according to one of Claims 3 or 4, characterized in that those ends of the components of the linkage (30, 31, 32; 33, 34, 35, 36, 37) which are guided in long holes have projections which engage into the respective long holes.

6. Adjustable pedal (1) according to Claim 1, characterized in that the first subpedal (20a) has a U-shaped design in its one end region, the two legs (21, 22) having opposite holes for receiving the pedal bearing shaft (60).

7. Adjustable pedal (1) according to Claim 6, characterized in that the first subpedal (20a), in addition to a connection means (25), has:

a. at least two long holes (21) for receiving the ends (30a) of the U-shaped component (30) of the linkage (30, 31, 32); or

b. at least one fastening point (23), in order to fasten the lever-like component (37) for connection to the second subpedal (20b).

8. Adjustable pedal (1) according to Claim 1, characterized in that the second subpedal (20b) consists of two L-shaped opposite components (26, 27), the opposite ends of which are in each case connected by means of shafts (28, 29), one shaft (29) forming the axis of rotation (50b) of the second subpedal (20b) and the lever-like component (37) for connection to the first subpedal (20b) being fastened to the other shaft (28).

9. Adjustable pedal (1) according to Claim 1, characterized in that the actuator (40) is fastened as a linear actuator to the first subpedal (20a) or as a rotating actuator to a lever-like component (34) of the linkage (33, 34, 35, 36, 37).

10. Adjustable pedal (100), in particular for motor vehicles, with:

a. a pedal (110) fastened to a fastening means (120) and a holding means (130);

b. a linkage (140, 141, 142, 143) which is adjustable by means of an actuator (150) and which connects the fastening means (120) and the holding means (130) directly to one another,

c. the actuator (150) changing the angular relationship between adjacent components of the linkage (30, 31, 32; 33, 34, 35, 36, 37), and, during pedal adjustment, the pedal foot (112) being at a predetermined distance from the vehicle floor (95).

11. Adjustable pedal (100) according to Claim 10, characterized in that, during pedal adjustment, the distance between the pedal foot (112) and vehicle floor (95) remains constant or is changed.

12. Adjustable pedal (100) according to Claim 10 or 11, characterized in that the linkage (140, 141, 142, 143) comprises at least four lever-like components (140, 141, 142, 143), of which two (140, 141; 142, 143) in each case are connected to one another in a scissor-like manner, in each case the first ends of the components being guided in a long hole and in each case the other ends being fastened rotatably, with the result that, during the movement of the actuator (150), the pedal (110) executes a translational movement parallel to the longitudinal axis of the vehicle and a rotational movement about an axis of rotation (160).

13. Adjustable pedal (100) according to Claim 10, characterized in that the actuator (150) is a linear actuator and is fastened to the holding means (130).

14. Adjustable pedal (100) according to Claim 13, characterized in that the actuator (150) displaces a connecting element (170) of the linkage (140, 141, 142, 143), the said connecting element connecting two opposite ends of lever-like components (140, 143).

Fig. 1

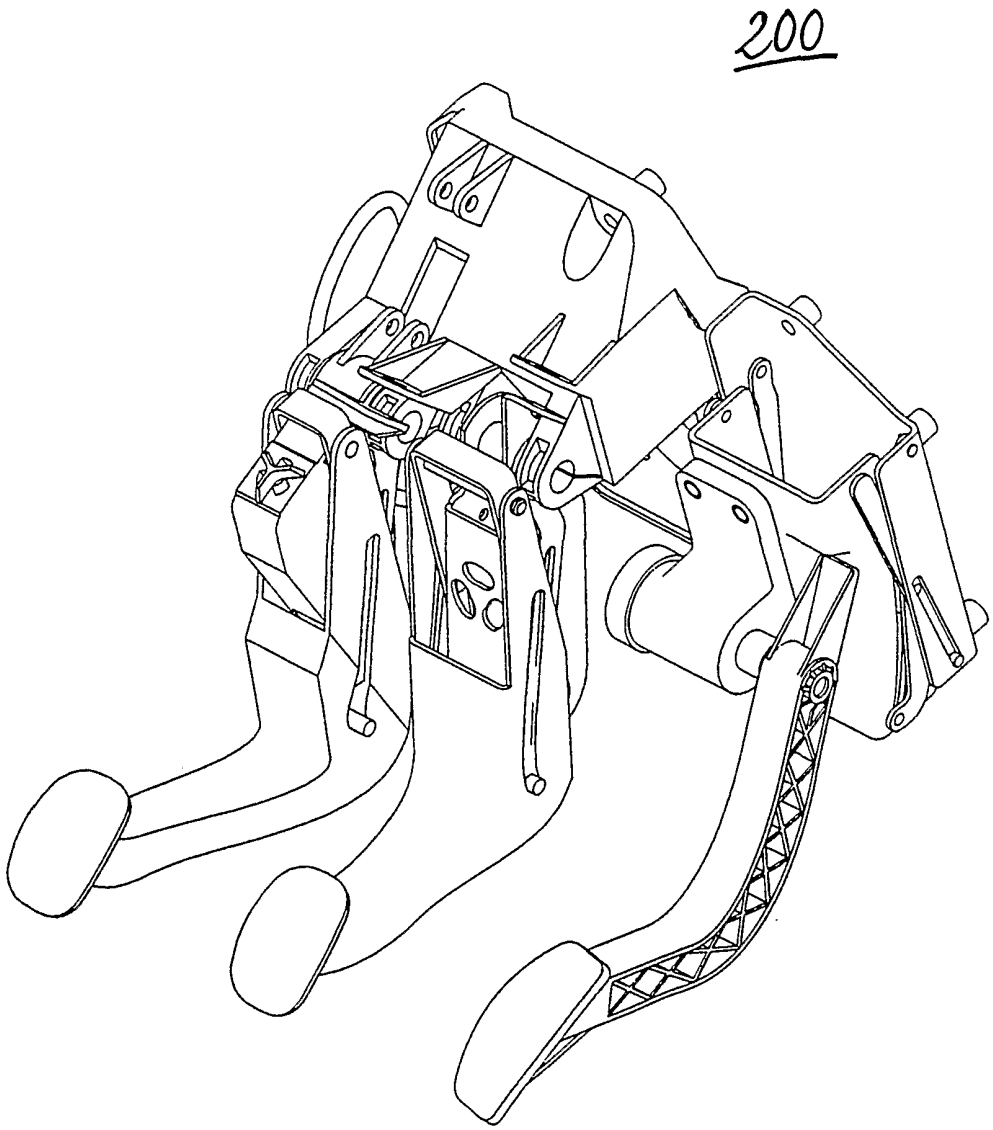


Fig. 2

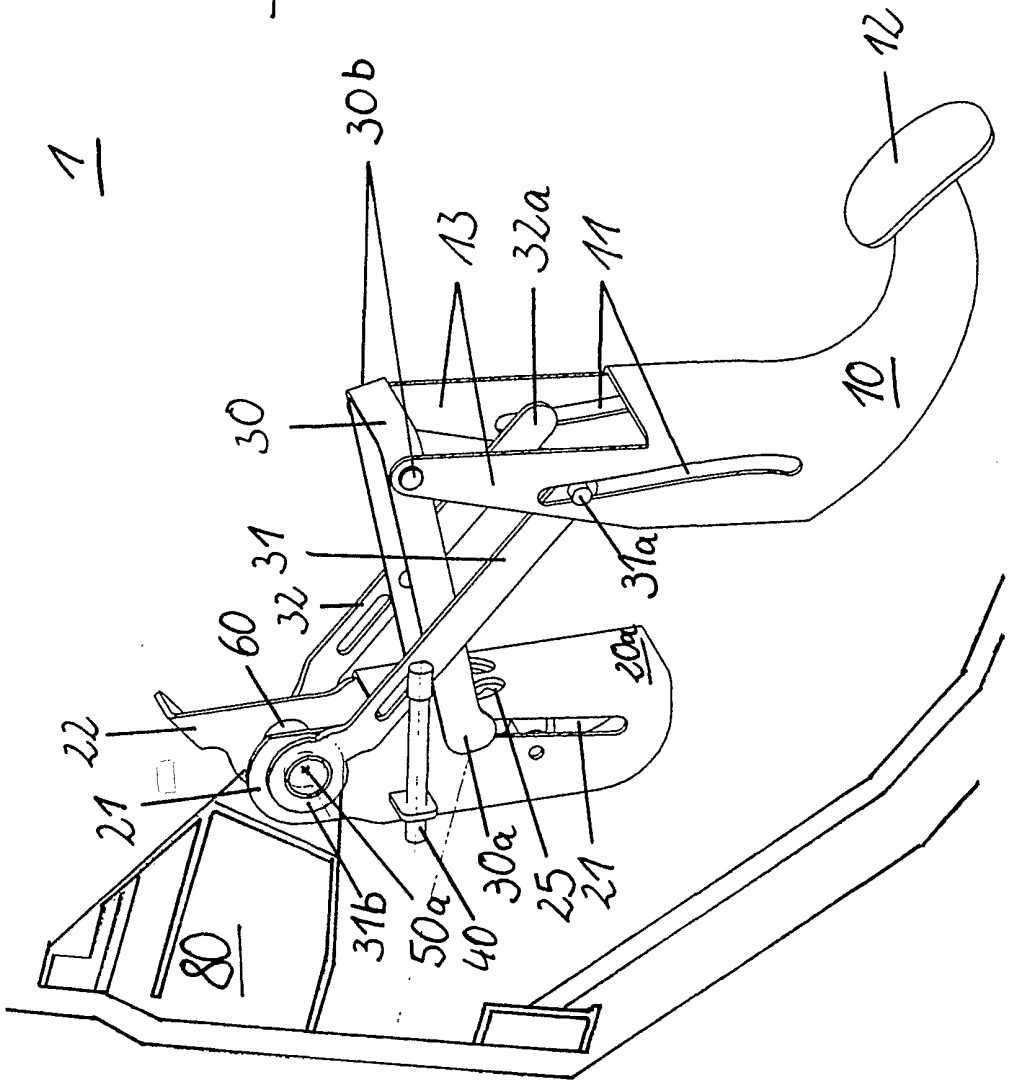

1
30b
12
13
32a
11
30
10
31
31a
60
32
10a
22
21
80
31b
50a
40
30a
25
21

Fig. 3

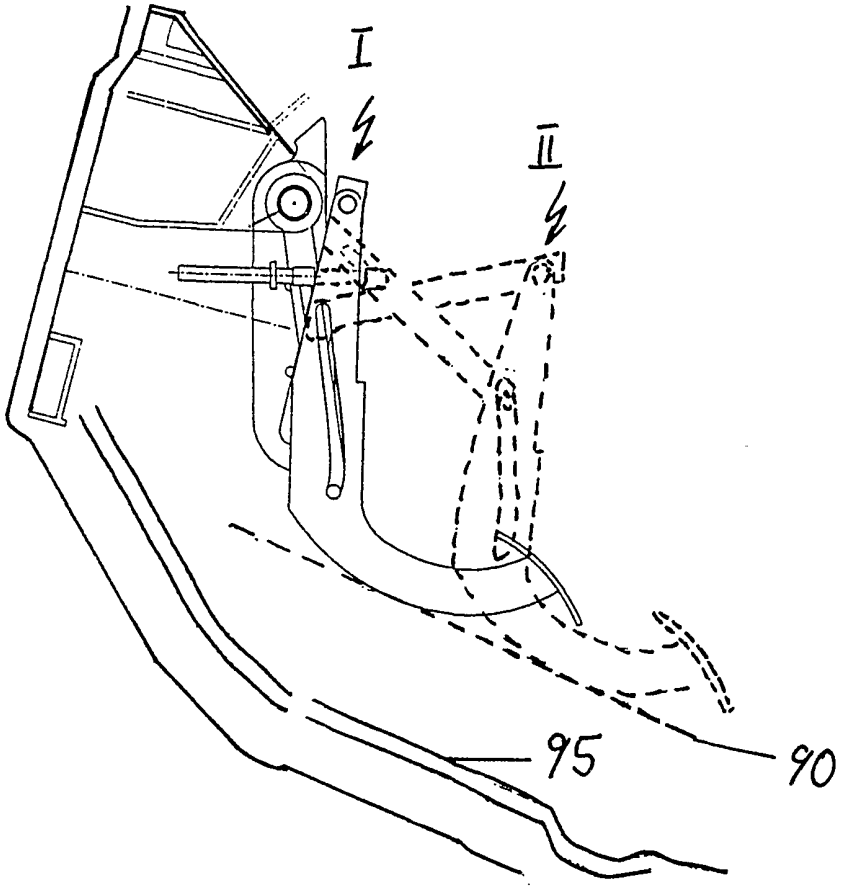
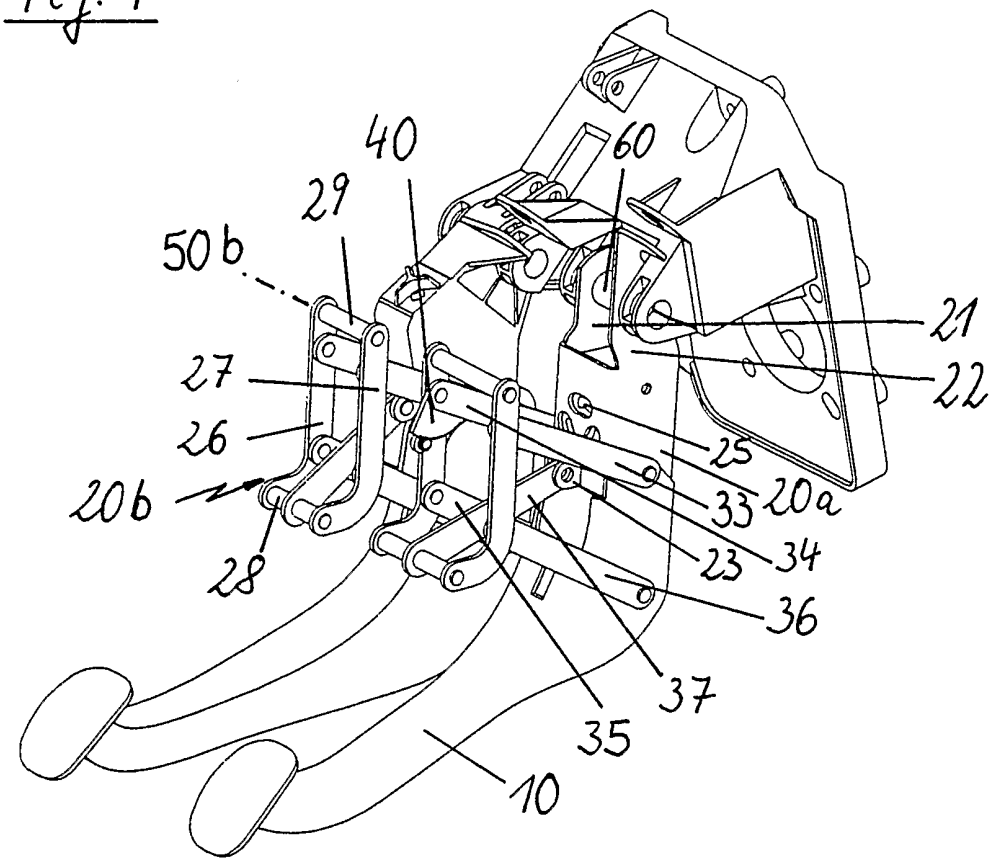


Fig. 4



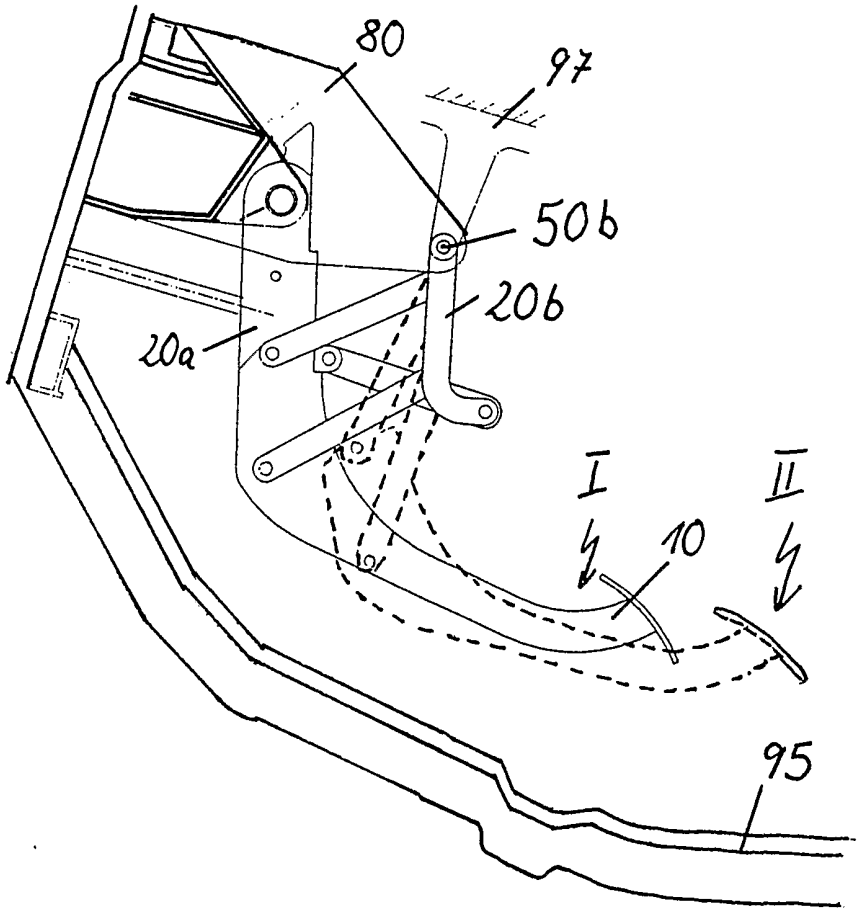


Fig. 5

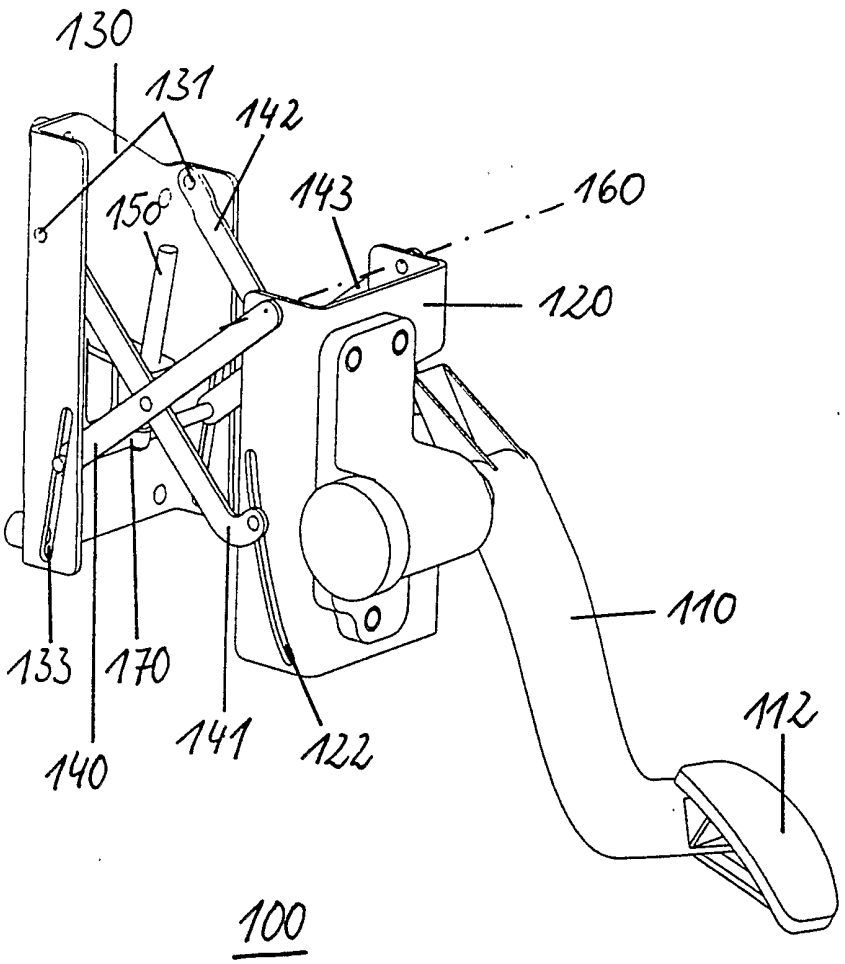


Fig. 6

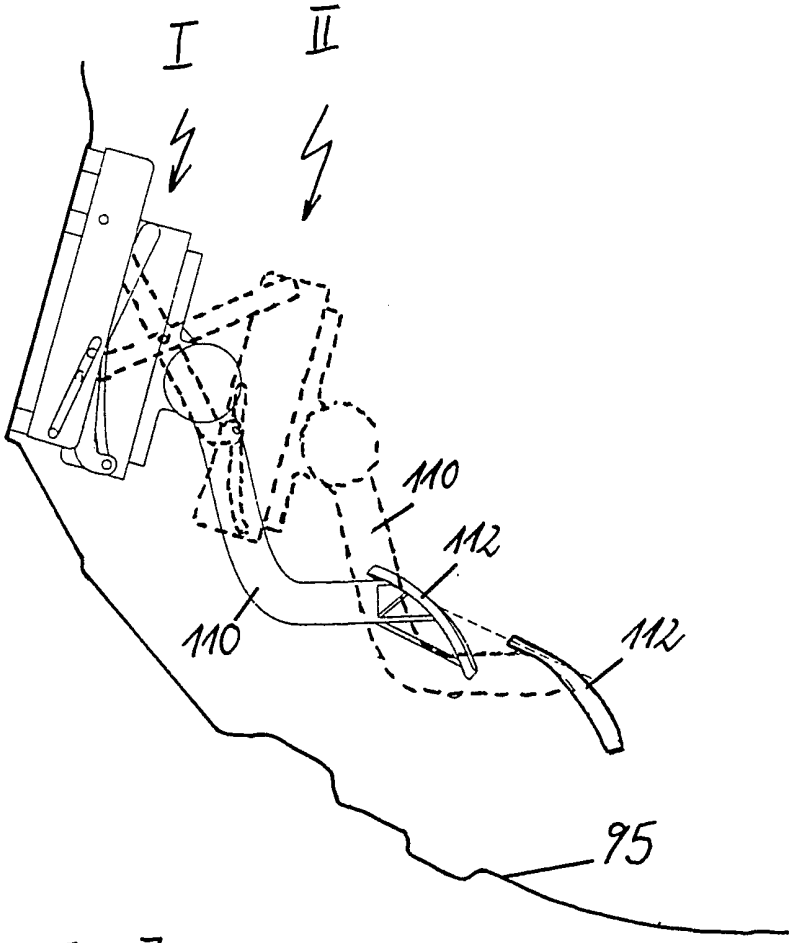


Fig. 7

INTERNATIONAL SEARCH REPORT

In ›nal Application No
PCT/EP 01/08064

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G05G1/14

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G05G B60T B60K

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 151 499 A (ROE RONALD W) 6 October 1964 (1964-10-06) column 2, line 3 -column 3, line 75 figures 1-5	1,10
A	US 5 172 606 A (DZIOBA DONALD L ET AL) 22 December 1992 (1992-12-22) column 1, line 56 -column 3, line 46 figures 1-4	1,10
A	GB 813 923 A (STANDARD PRESSED STEEL CO) 27 May 1959 (1959-05-27) page 1, column 55 -page 2, column 2 figures 1,2	2,11

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

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
8 November 2001	16/11/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Vermander, W

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int ial Application No
PCT/EP 01/08064

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3151499 A	06-10-1964	GB 973638 A	28-10-1964
US 5172606 A	22-12-1992	NONE	
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