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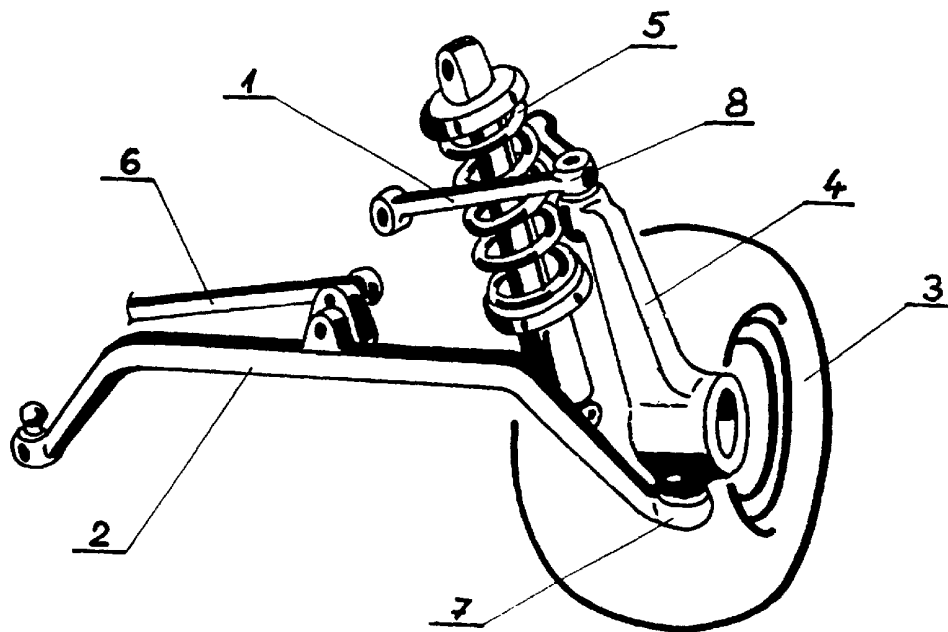
(71) Applicant and

(72) Inventor: **Kovář, Josef**[CZ/CZ]; Karlova 4, 110 00 Praha 1 (CZ).

(74) Agent: **NOVOTN , Karel**; Terronská 21, 163 00 Praha 6 (CZ).

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(54) Title: WHEEL AXLE ASSEMBLY



(57) **Abstract:** A wheel axle assembly specifically for road vehicles comprising an axle body which is connected at its both ends to axle wheels and is spring mounted on the vehicle frame wherein the wheels (3) of the wheel axle are mutually connected by means of at least one axle body (2) over a bottom mounting (7) and further connected to a vehicle frame over an upper mounting (8) and over at least one upper connecting arm (1) or an upper mounting (8) as a part of a spring unit (5).



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## Wheel axle assembly

### Field of the invention

The invention relates to a wheel axle assembly specifically for road vehicles comprising an axle body, which is connected at its both ends to axle wheels, and is spring mounted on the vehicle frame

### Description of prior art

The road vehicles with a rigid wheel axle have the wheels carried by an axle body disposed transversally with respect to the vehicle longitudinal axis. The axle body is sprung mounted on the vehicle frame by means of springs and, as the case may be, transversally stabilized by means of additional struts. A vehicle axle drive box with laterally extending propeller shafts connected to the vehicle wheels is located on the vehicle frame above the axle body. Such type of assembly has certain disadvantage of a low ground clearance defined by the distance between the horizontally disposed axle body and the road surface. In the effort to enhance the ground clearance the gear speed reducers are incorporated into the wheels what of course brings about increased production costs of the whole axle.

The arrangement with the axle drive box incorporated in the axle body brings about further reduction of the ground clearance and moreover additional unsprung weight.

Where the axles are provided with independently suspended wheels, which designs are used specifically for the road vehicles to improve the vehicle driving properties, the wheels are suspended by means of upper and lower wishbones and by connecting the wheel to a spring unit. Such wheel suspension is often replaced by so called "McPherson" type axle, where the wheel is mounted for rotatable motion with respect to the lower wishbone and to a combined spring and shock absorbing unit that is by its upper portion pivotally coupled with the vehicle frame to substitute the original function of a wishbone. In an off road operation of the vehicle with independently suspended wheels the ground clearance is considerably restricted due to a relatively small wheel swinging amplitude due to a limited span of the wishbones. In the situation where both axle wheels move upwardly the ground clearance of the vehicle becomes substantially reduced and the capability of the vehicle to operate off road is thus limited. The independent suspension is also used with the off road trucks assigned for alternative operation on regular roads, nevertheless the problem accompanied by said restricted off road operability caused by the limited length of the wishbones survives.

It is the object of the invention to provide a wheel axle assembly by which the ground clearance of the vehicle required for off road operations is similar to that achieved with the vehicles provided with rigid wheel axles whereby the desired driving properties characterizing the vehicles with independently suspended wheels and low portion of unsprung weight are preserved.

### Summary of the invention

In accordance with the first aspect of the invention wheels of the wheel axle are mutually connected by means of at least one axle body over a bottom mounting and further connected to a vehicle frame over an upper mounting and over at least one upper connecting arm or an upper mounting as a part of a spring unit.

The main advantages of said wheel axle assembly is that the vehicle ground clearance may be increased to the same extend as is usual with a rigid - portal wheel axle whereby the unsprung weight is substantially reduced and the production costs are kept low.

In accordance with other aspects of the invention the wheels of the wheel axle are connected to the axle body over longitudinal arms.

The bottom mounting between the wheels and the axle body may be in the form of a ball joint or a pivotally coupling and the upper mounting may be as well in the form of a ball joint or a pivotally coupling.

The wheels of the wheel axle may be connected to a spring unit consisting of a helical spring and a shock absorber or of a leaf spring the ends of which are in the form of connecting arms.

In still another embodiment of the invention the wheel axle assembly may comprise two axle bodies one situated in front of the spring unit the second behind the spring unit.

### Brief description of the drawings

The wheel axle assembly according to the invention will now be described in more details with reference to the accompanying drawings where:

Fig. 1 shows a perspective view of a portion of a wheel axle;

Fig. 2 and 3 show schematic views of another embodiment of a wheel axle taken in the direction of the vehicle longitudinal axis where in Fig. 2 the wheels of the wheel axle are

positioned in one plane while in Fig. 3 the same wheels are positioned in different parallel planes;

Fig. 4 shows a schematic view of another embodiment of the invention;

Fig 5 to 7 shows schematic side views of other different embodiments of a portion of the wheel axle;

Fig. 8 to 15 show a wheel axle according to the invention provided with a "McPerson" spring unit where,

Fig 8 shows a perspective view of a portion of a wheel axle provided with a spring unit;

Fig. 9 and 10 show schematic views of another embodiment of a wheel axle taken in the direction of the vehicle longitudinal axis where in Fig. 9 the wheels of the wheel axle are positioned in one plane while in Fig. 10 the same wheels are positioned in different parallel planes;

Fig. 11 shows a schematic view of another embodiment of the invention;

Fig 12 to 14 shows schematic side views of other embodiments of a portion of the wheel axle.

### Examples

Referring now to Fig 1 a wheel 3 is carried in a hub of a bracket 4. The bracket 4 is coupled by means of a bottom mounting 7 to an axle body 2 and by means of an upper mounting 8 to a vehicle frame, which may constitute an integral part of the vehicle body. In this embodiment the mountings 7, 8 are performed as ball joints enabling the steering of the wheels of the axle.

The upper mounting 8 is coupled with at least one connecting arm 1 pivotally mounted on the vehicle frame while the bottom mounting 7 is coupled with the axle body 2. The axle body 2 is disposed transverse relative to the longitudinal vehicle axis and its opposite end is coupled with the bottom mounting of the opposite wheel 3 of the wheel axle. The transversal guiding of the axle body 2 is secured by a transverse guide 6 or so called "Panhard" type rod. The wheels 3 are sprung by a spring unit 5 that may be executed as a helical spring, leaf spring, torsion rod, pneumatic spring unit, liquid spring unit, each independently or in combination with another one and/or in combination with a shock absorber. The transversal guiding of the axle body 2 may be also secured by two transversal guides supported by a balance beam ( Fig. 4, 11 ) mounted on the axle body 2 or an engine.

An alternative embodiment of the wheel axle with non-steered wheels is shown in Fig. 2. The upper connecting arm is pivotally coupled with the vehicle frame and the bracket 4 and

the axle body 2 is also pivotally coupled with the wheels. The axle body 2 may support the engine 9. In Fig. 3 the same wheel axle as illustrated in Fig. 2 is shown but with one vehicle side wheel 3 resting on a level surface that is in different horizontal plane with respect to that of the wheel 3 of the opposite end of the wheel axle.

Likely a wheel axle in Fig 4 is substantially the same as that shown in Fig. 2 provided that the upper connecting arm 1 is in the form of a transversal leaf spring fixed to the vehicle frame by two resilient blocks 10 disposed symmetrically to the vehicle longitudinal axis.

The longitudinal guiding of the axle body 2 that is secured by longitudinal arms 11 is apparent from Fig. 5. One end of the longitudinal arm 11 is mounted on the vehicle frame while the other end on the axle body 2. Alternatively, as shown in Fig. 6, one end of the longitudinal arm 11 may be mounted on the vehicle frame and its other end coupled with the bottom mounting 7 of the bracket 4. In this embodiment, the body axle is not directly connected to the bottom mounting 7 of the bracket 4 but is pivotally coupled with the longitudinal arm 11.

In another embodiment of the invention the wheel axle assembly may comprise two axle bodies 2 as show in Fig. 7 one of which is situated in front of a spring unit 5 and the second one behind the spring unit 5 relative to the longitudinal vehicle axis.

In similar embodiment with two axle bodies each axle body 2 may be independently spring mounted ( not shown in the drawings ) without the necessity to install the central spring unit 5 according to Fig. 7.

With reference to the embodiment in Fig. 8 the wheel 3 is mounted in a hub of the bracket 4. The bracket 4 is coupled with the axle body 2 by means of a bottom mounting 7 and is constitutes also a part of the spring and/or shock absorbing unit 5, hereinafter designated as the spring unit 5 that may be executed as a McPherson type unit, or as the case may be, as a shock absorber where the spring is located outside the shock absorber, etc.. The spring unit 5 is mounted on the vehicle body or a frame as a portion thereof by means of the upper mounting 8. The spring unit 5 may be combined with another resilient element such as torsion rod, pneumatic spring, liquid spring or as a combination of a number of spring elements. In the exemplary embodiment the mountings 7, 8 are in the form of ball joints enabling the steering of the axle wheels. The bottom mounting 7 is connected to the axle

body 2. The axle body 2 is disposed transversal relative to the vehicle longitudinal axis and its opposite end is connected to the bottom mounting of the opposite wheel of the wheel axle. The transversal guiding of the axle body is secured by a transversal guide 6, for example in the form of a "Panhard" rod".

Fig. 9 shows an alternative wheel axle assembly with non-steered wheels where the axle body is pivotally coupled with the wheels. The axle body 2 may support an engine 9. The same axle body is shown in Fig. 10 in the situation, where one vehicle side rests by its wheel 3 on a ground level which is in other horizontal plane than that of the transversally opposite wheel 3 of the axle body 2.

Another wheel axle assembly is shown in Fig. 11 the only difference from that in Fig. 9 being in that the axle body 2 is connected to two transversal guides 6 the ends of which are mounted on the vehicle frame over a balance beam 12 fixed on the axle body 2. The balance beam may be alternatively secured to an engine 9 (as shown in Fig. 10) with the outer ends of the transversal guides coupled with the axle body 2.

Fig. 12 shows the longitudinal guiding of the axle body 2 executed by means of the longitudinal arms 11. One end of each longitudinal arm 11 is coupled to the vehicle frame and the other end to the axle body 2. Similar arrangement as in Fig. 12 is shown in Fig. 13 where the axle body 2 is connected to two longitudinal arms 11.

According to another embodiments of the invention illustrated in Fig. 14 one end of the longitudinal arm 11 is coupled with the vehicle frame and the other end with the bottom mounting of the bracket 4 wherein the axle body 2 is connected to the bottom mounting 7 of the bracket 4 indirectly, in that it is mounted on the longitudinal arm 11.

In the embodiment with two axle bodies as shown in Fig. 15 one axle body is situated in front of the spring unit 5 and the second behind the spring unit 5 with respect to the longitudinal vehicle axis.

Alternatively, each axle body 2 may be independently spring mounted by means of a resilient element (not shown).

## CLAIMS

1. A wheel axle assembly specifically for road vehicles comprising an axle body which is connected at its both ends to axle wheels and is spring mounted on the vehicle frame characterized in that the wheels (3) of the wheel axle are mutually connected by means of at least one axle body (2) over a bottom mounting (7) and further connected to a vehicle frame over an upper mounting (8) and over at least one upper connecting arm (1) or an upper mounting (8) as a part of a spring unit (5).
2. A wheel axle assembly as claimed in claim 1 characterized in that the wheels (3) of the wheel axle are connected to the axle body (2) over longitudinal arms (11).
3. A wheel axle assembly as claimed in any of claims 1 and 2 characterized in that the bottom mounting (7) between the wheels (3) and the axle body (2) is in the form of a ball joint.
4. A wheel axle assembly as claimed in any of claims 1 and 2 characterized in that the bottom mounting (7) between the wheels (3) and the axle body (2) is in the form of a pivotally coupling.
5. A wheel axle assembly as claimed in any of claims 1 and 2 characterized in that the upper mounting (8) is in the form of a ball joint.
6. A wheel axle assembly as claimed in any of claims 1 and 2 characterized in that the upper mounting (8) is in the form of in the form of a pivotally coupling.
7. A wheel axle assembly as claimed in any of claims 1 to 6 characterized in that the wheels (3) of the wheel axle are connected to a spring unit (5) consisting of a helical spring and a shock absorber.
8. A wheel axle assembly as claimed in claim 7 characterized in that the spring unit (5) is a leaf spring the ends of which are in the form of connecting arms (1).
9. A wheel axle assembly as claimed in any of claims 1 to 8 characterized in that the first axle body (2) is disposed in front of the spring unit (5) and the other axle body (2) is disposed behind the spring unit (5) of the wheels (3).

FIG.1

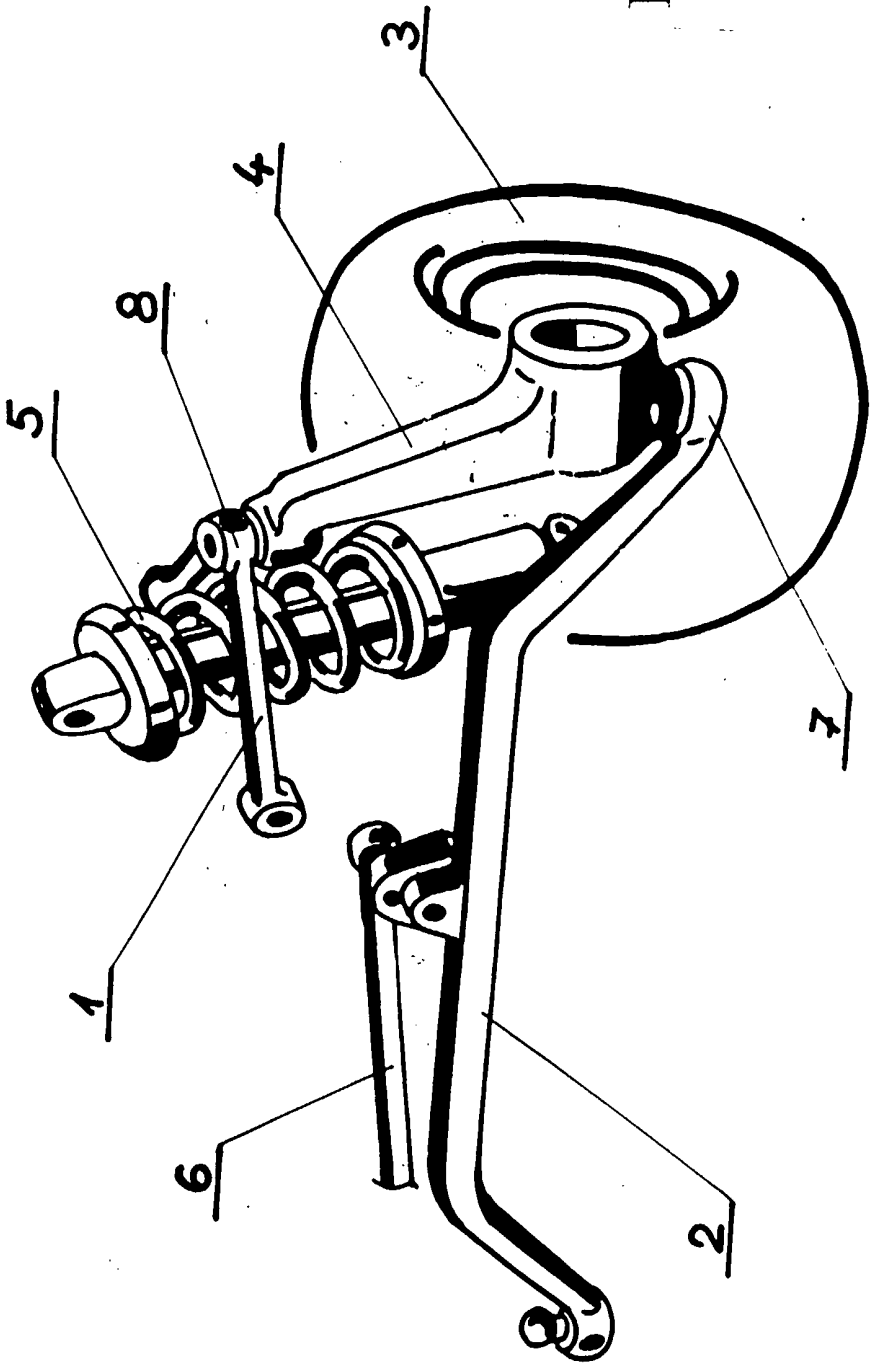
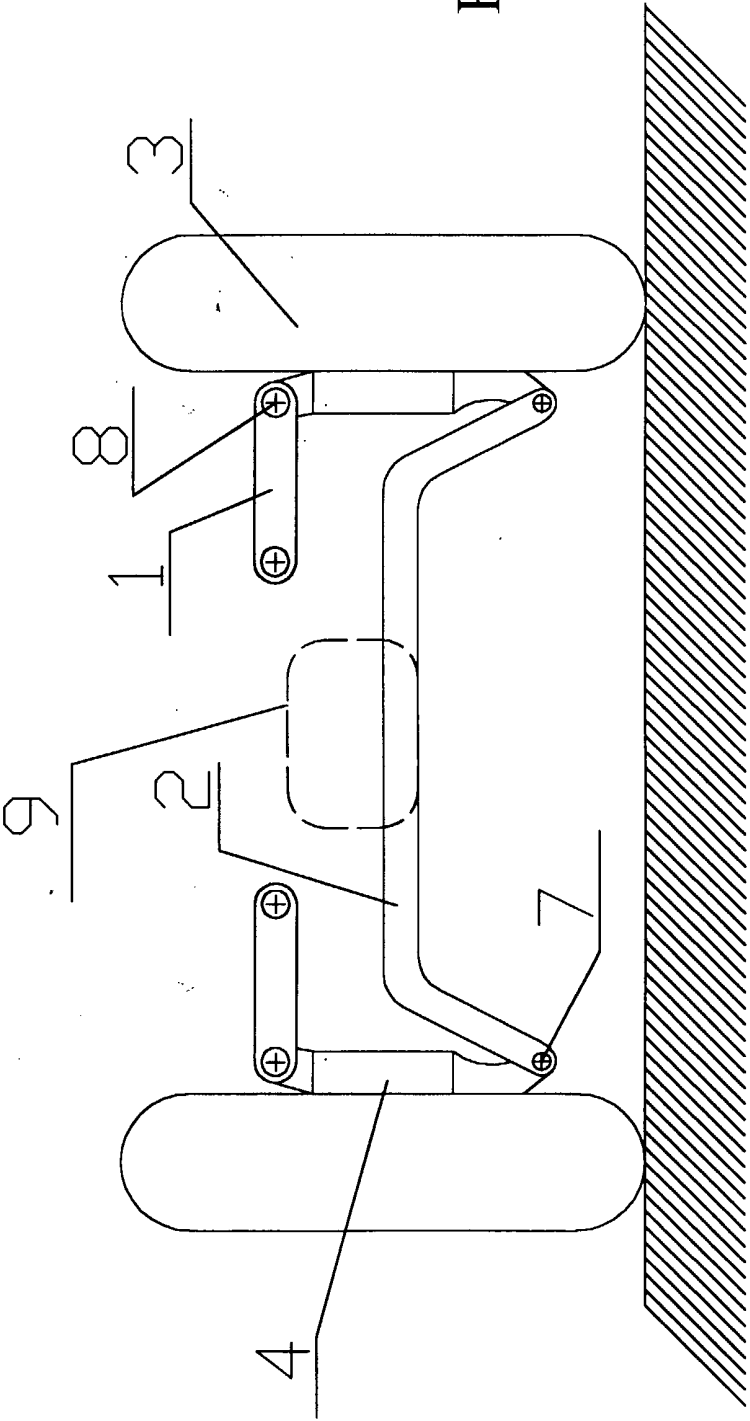


FIG. 2



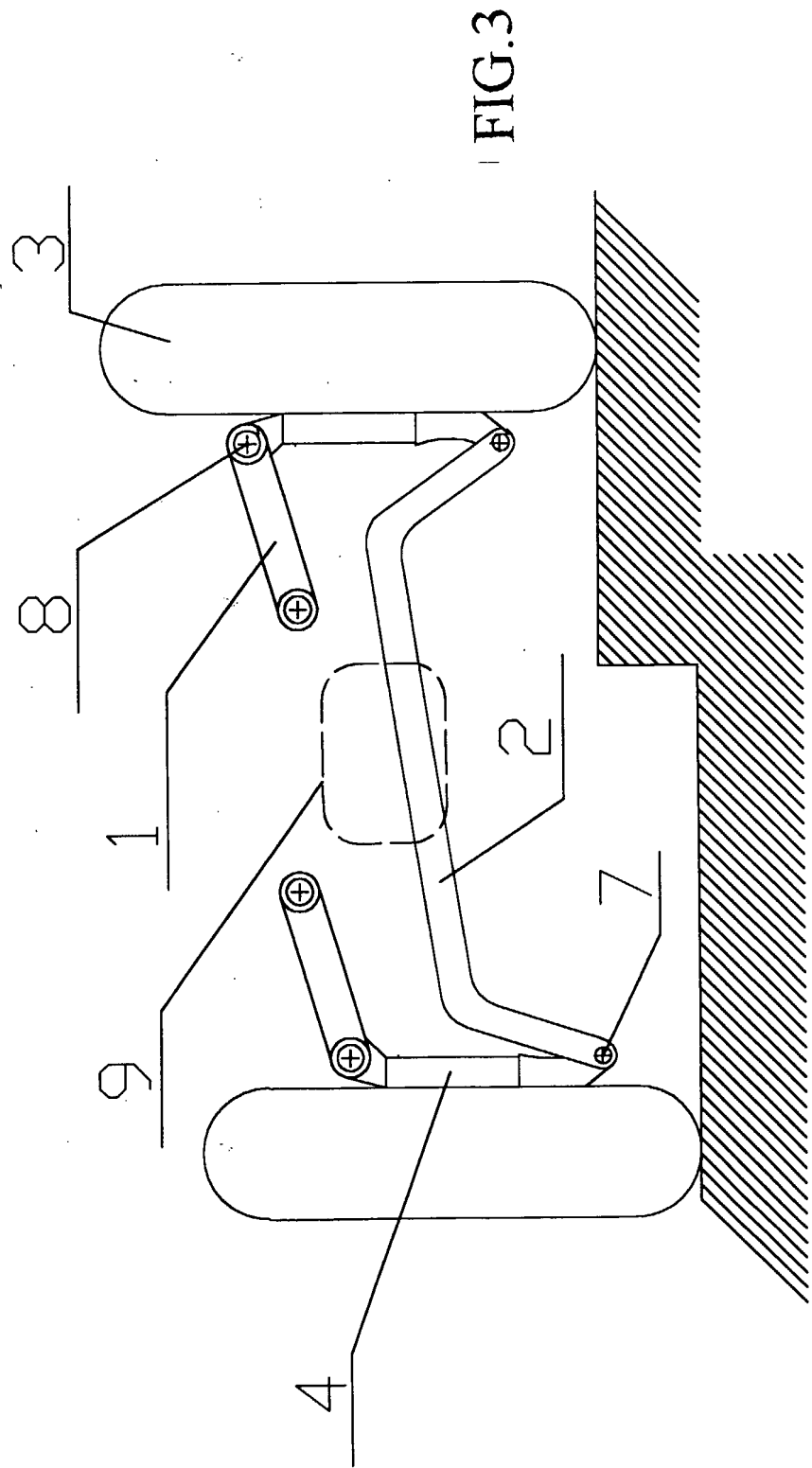


FIG.4

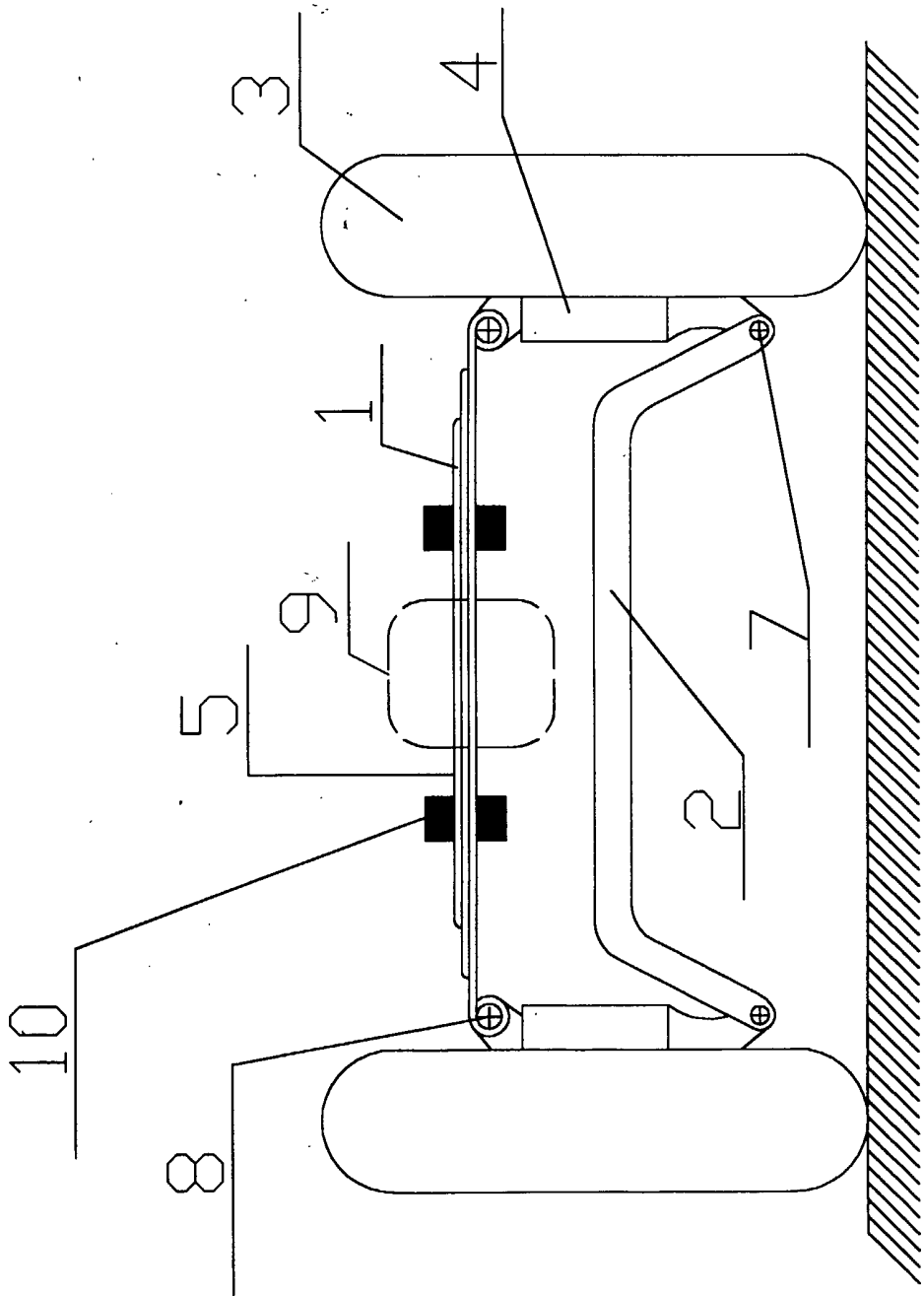
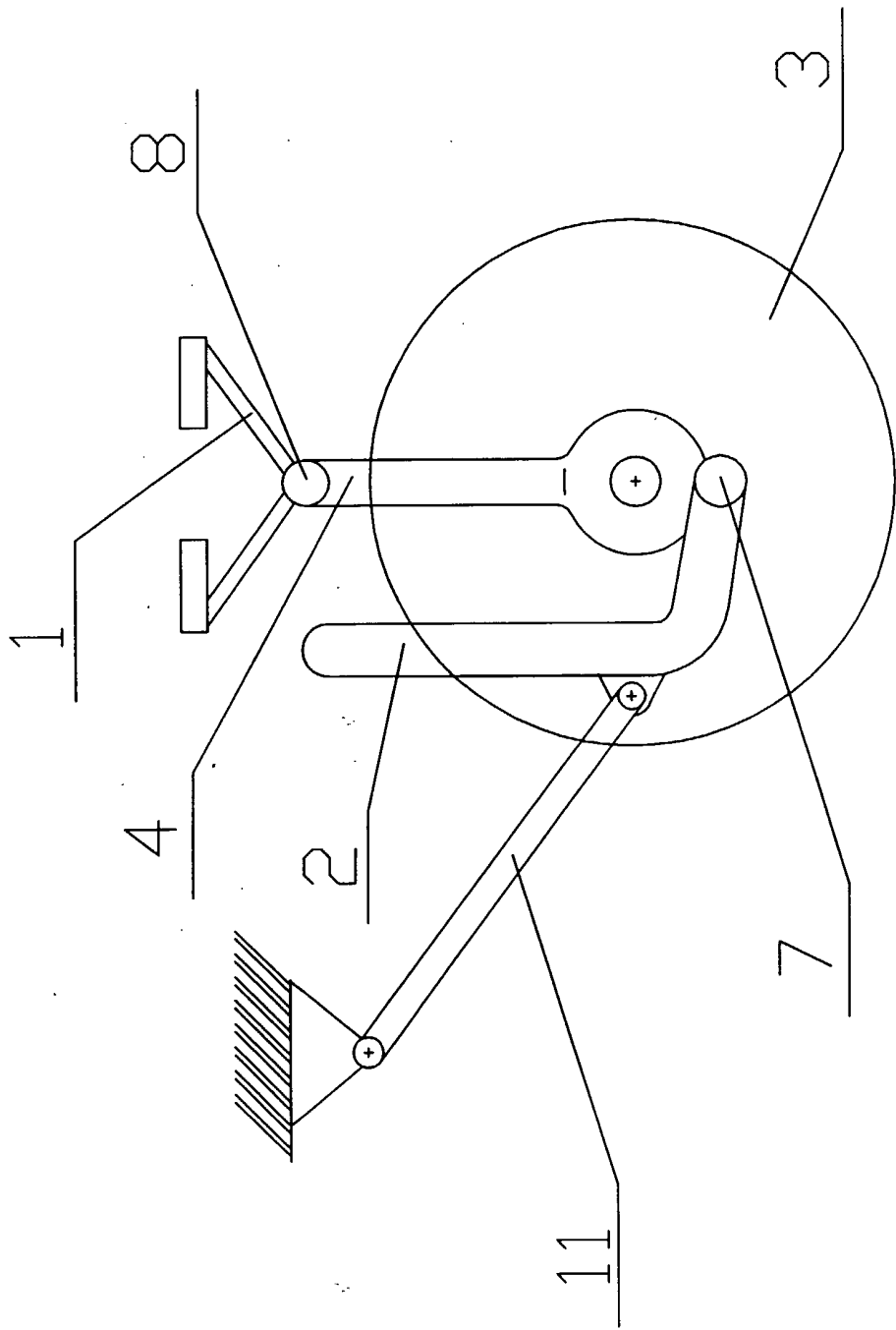


FIG. 5



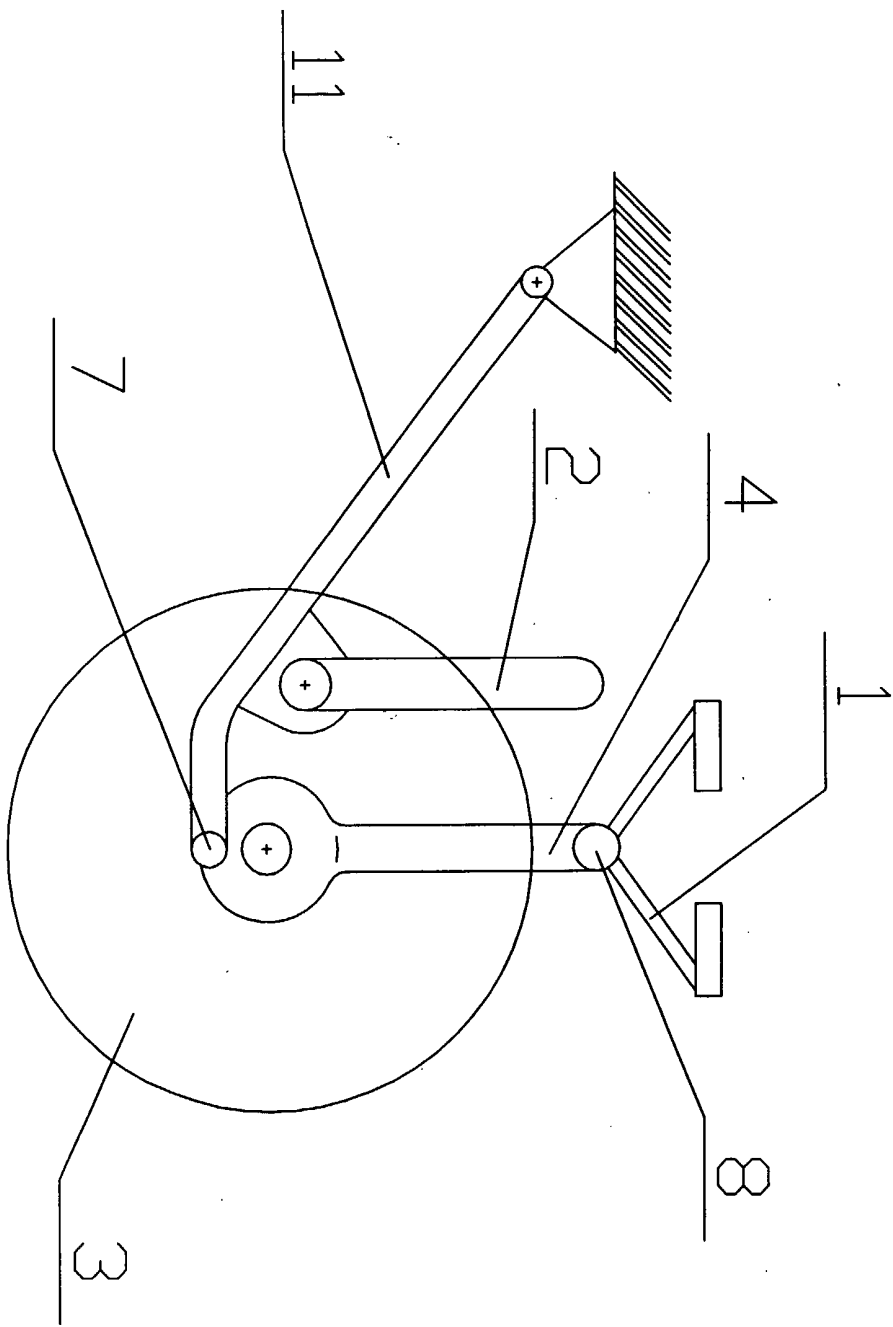


FIG.6

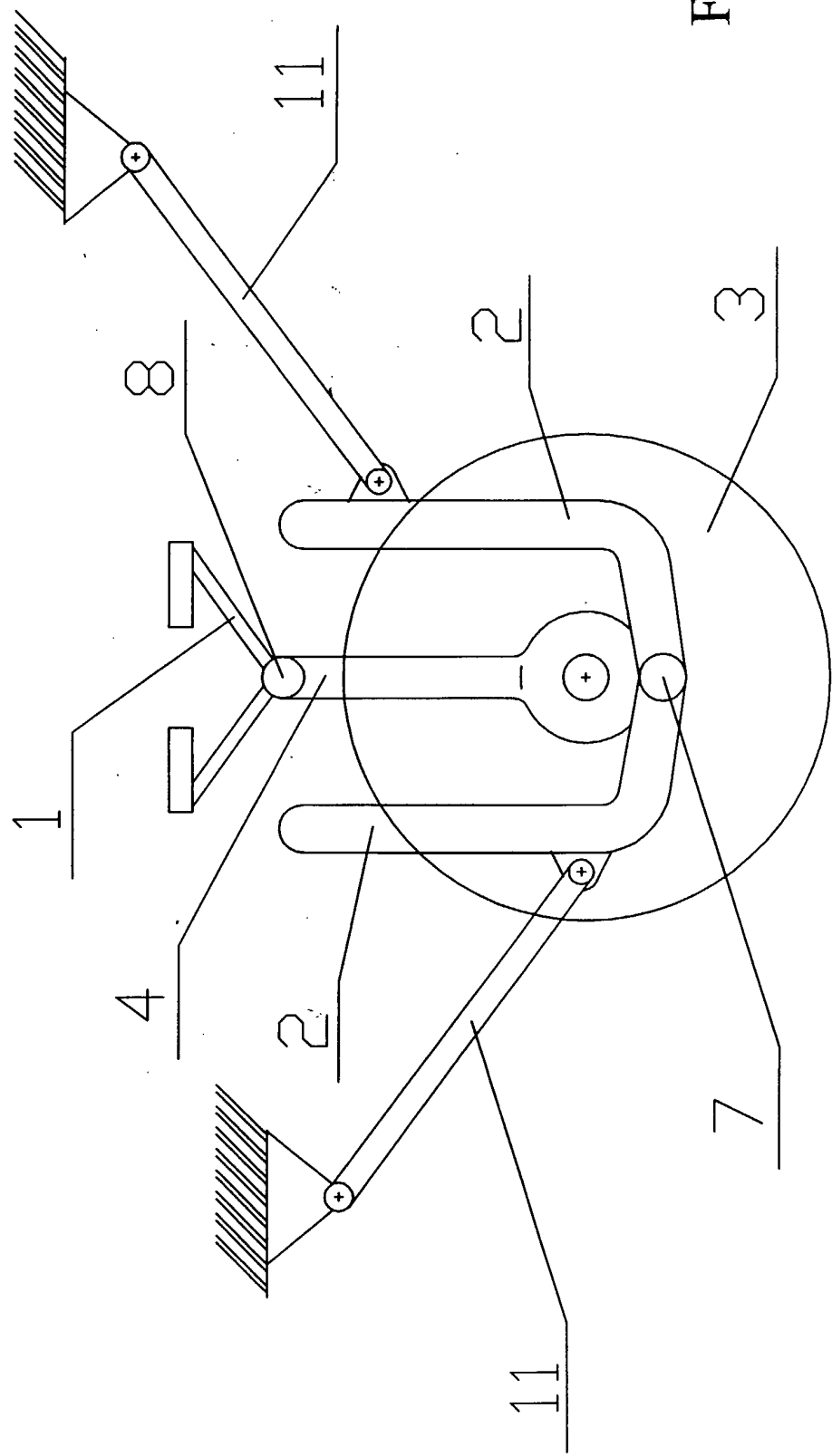
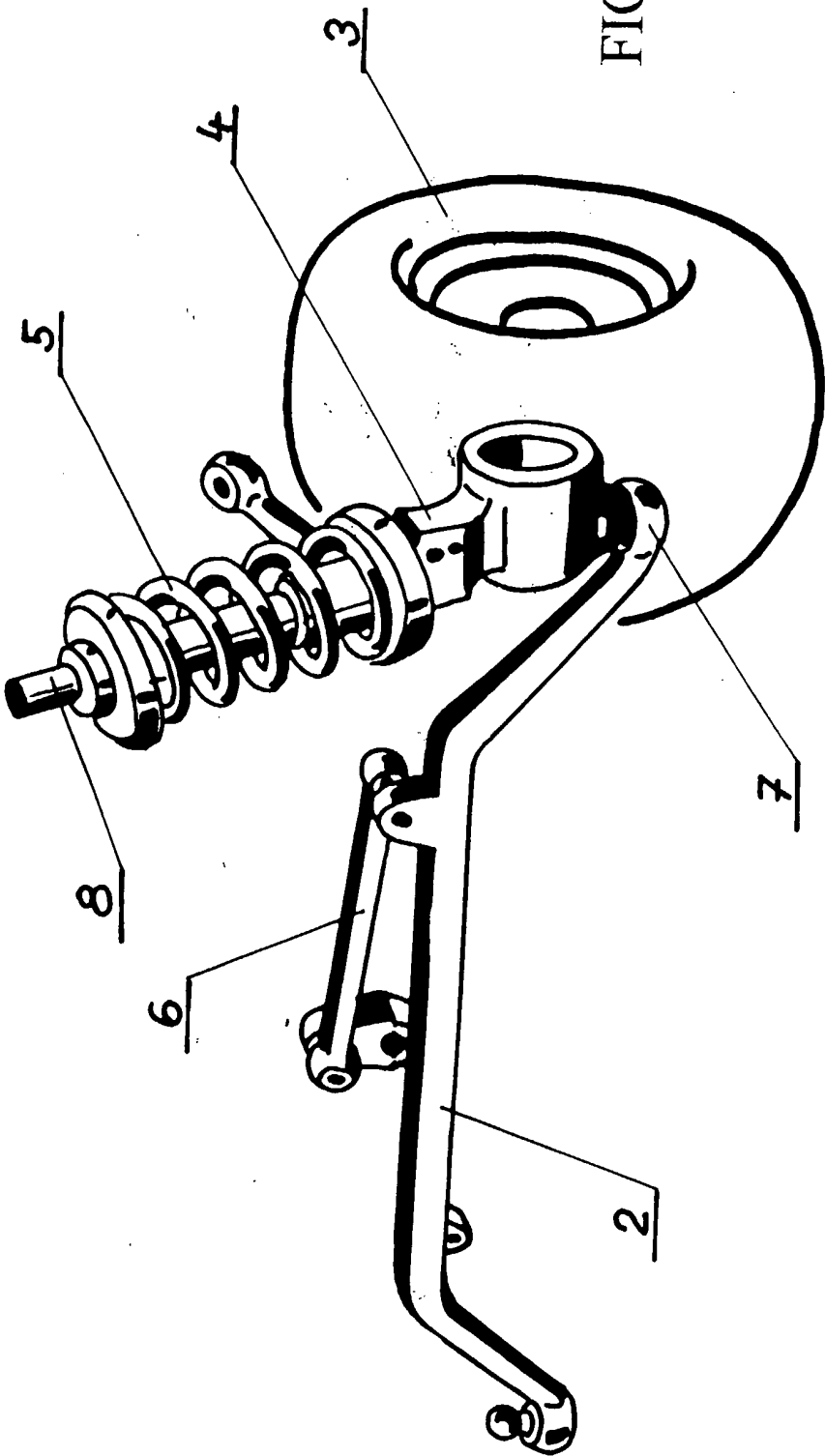
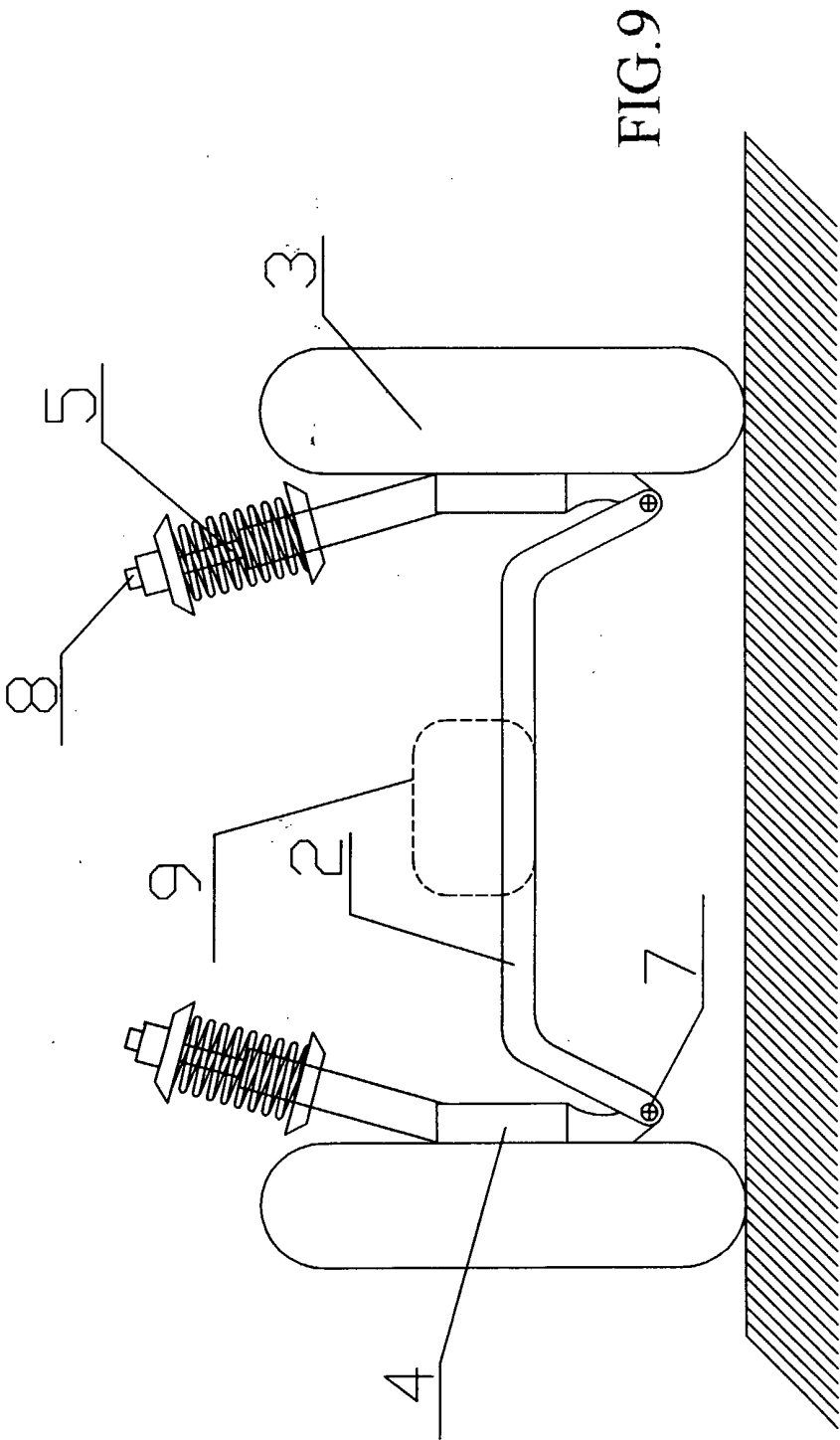


FIG.7

FIG. 8





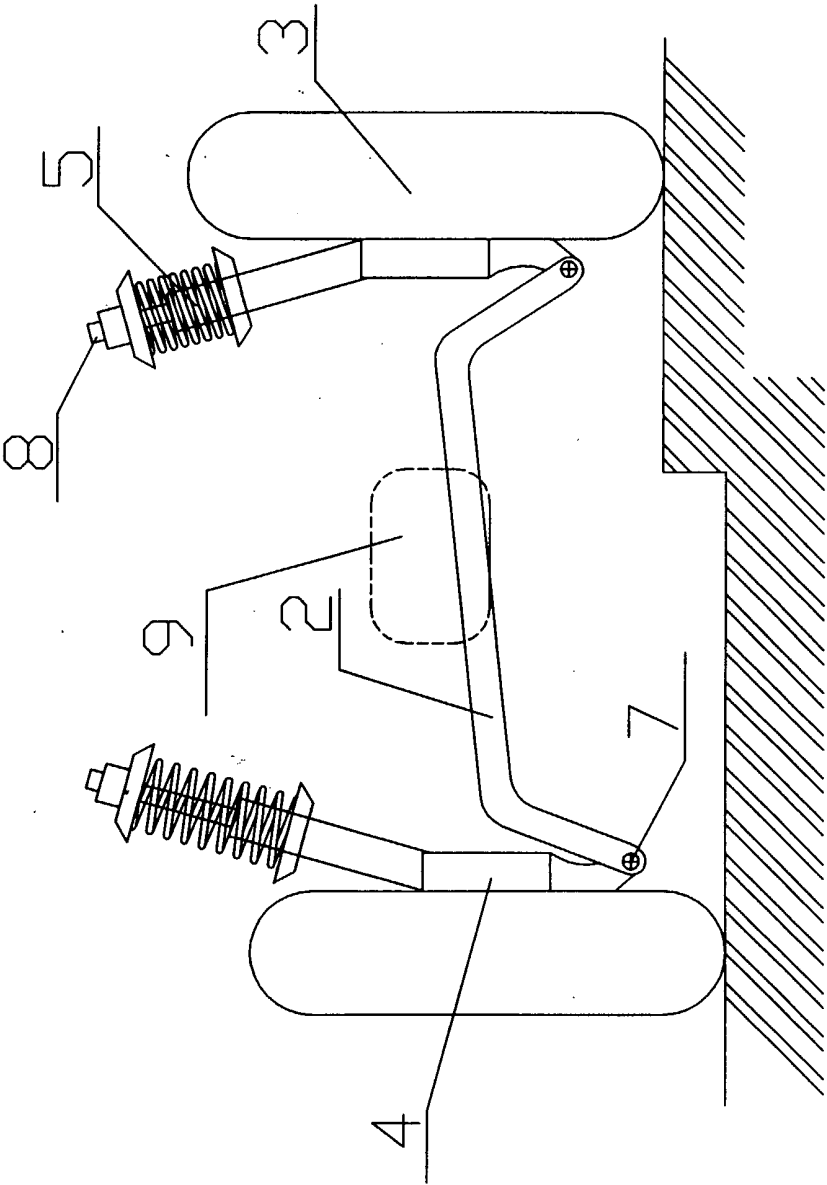


FIG. 10

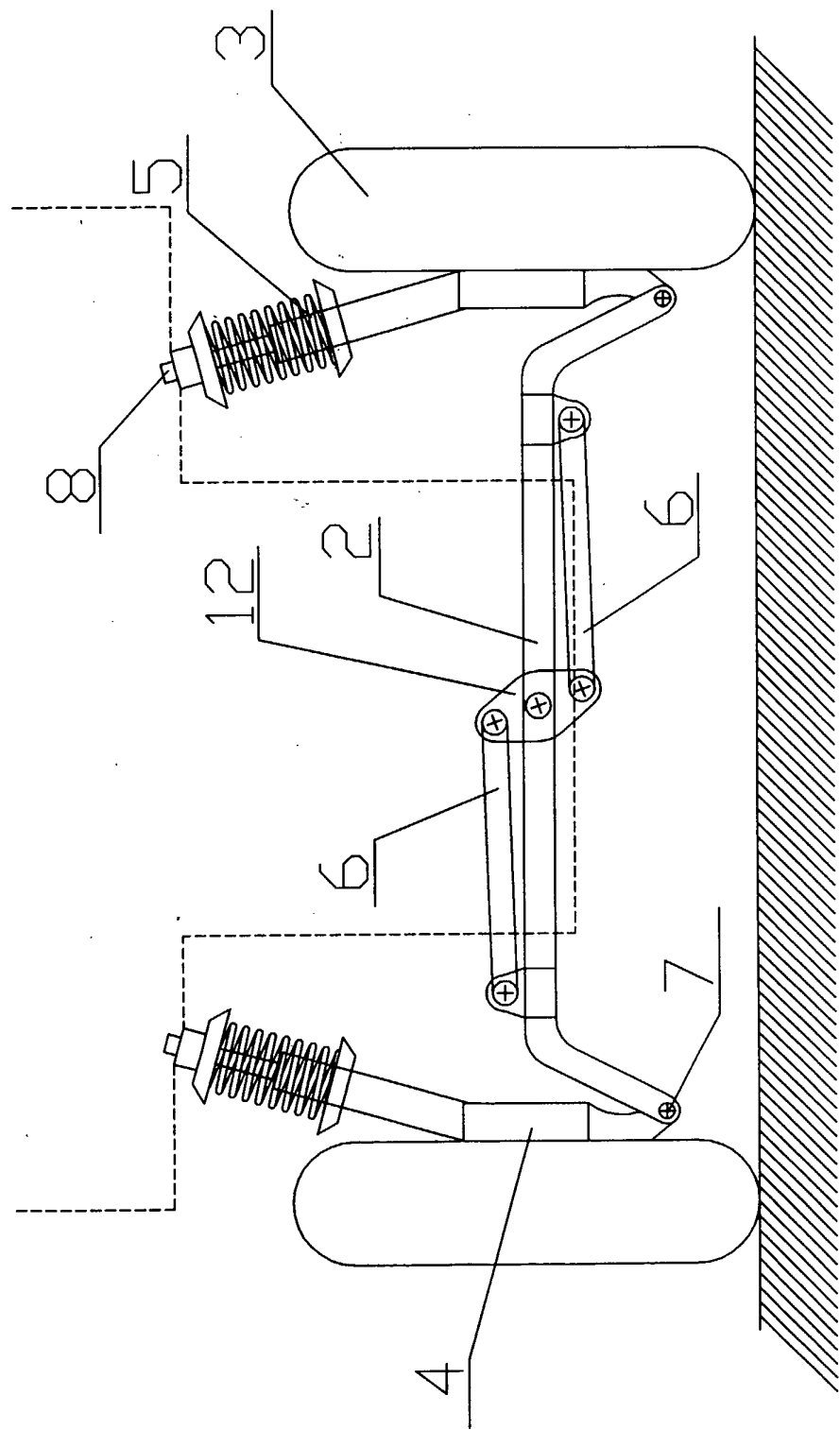


FIG.11

FIG.12

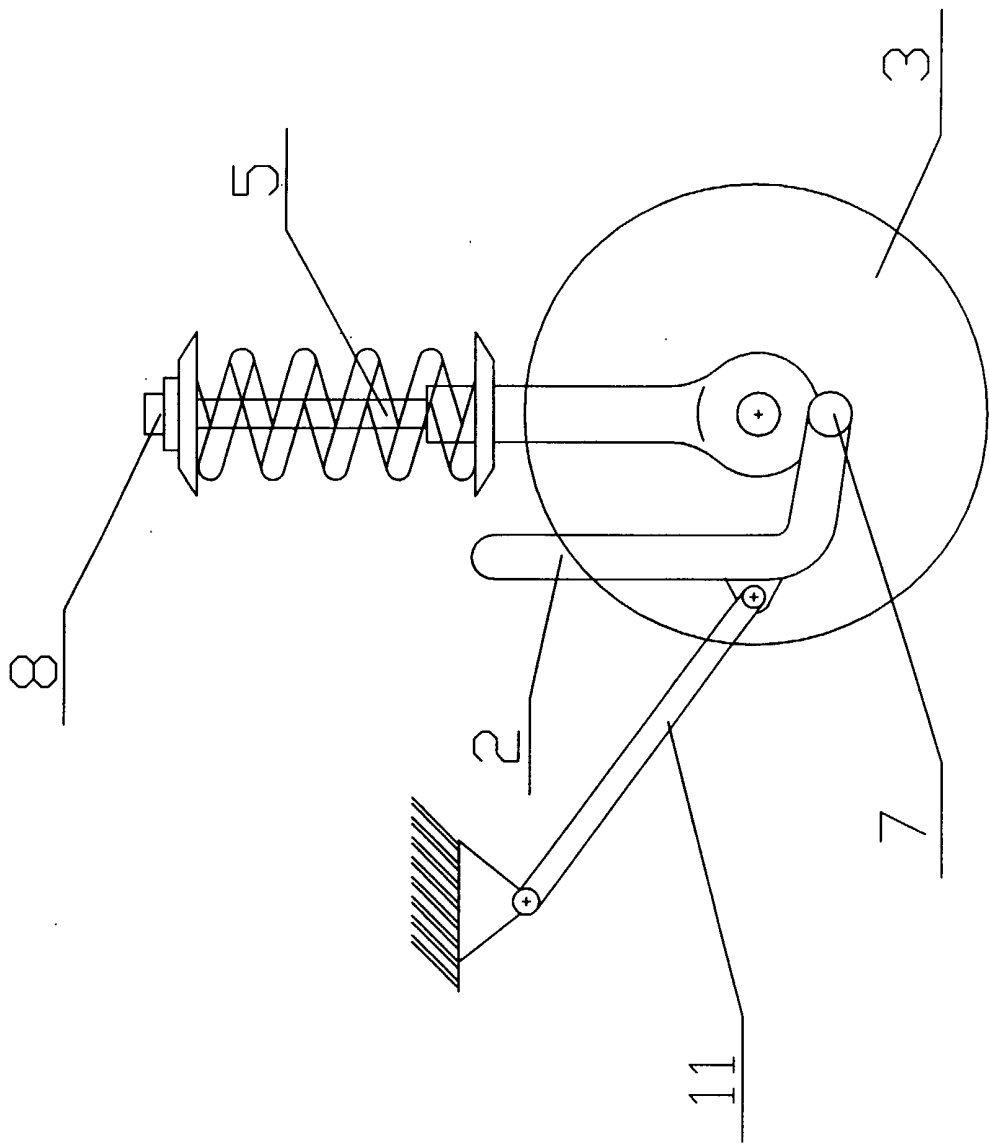




FIG.14

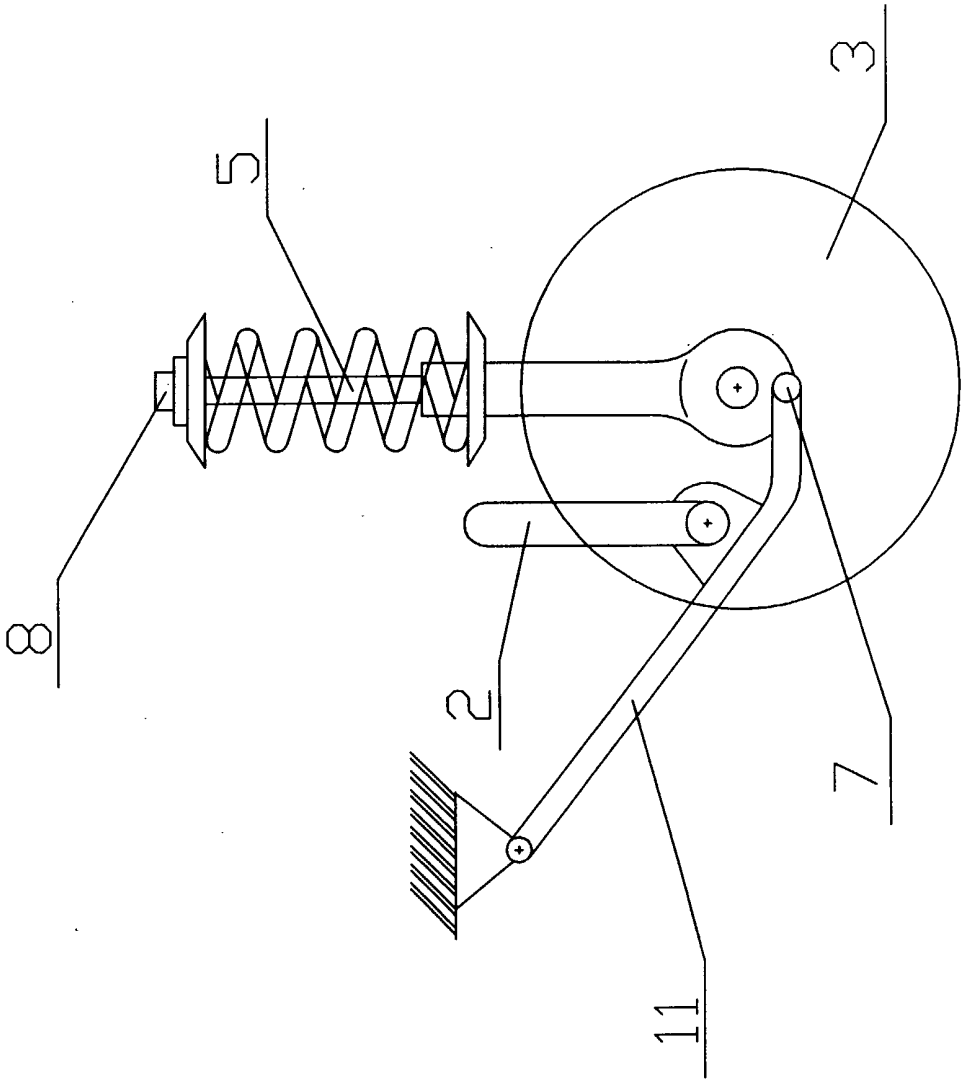
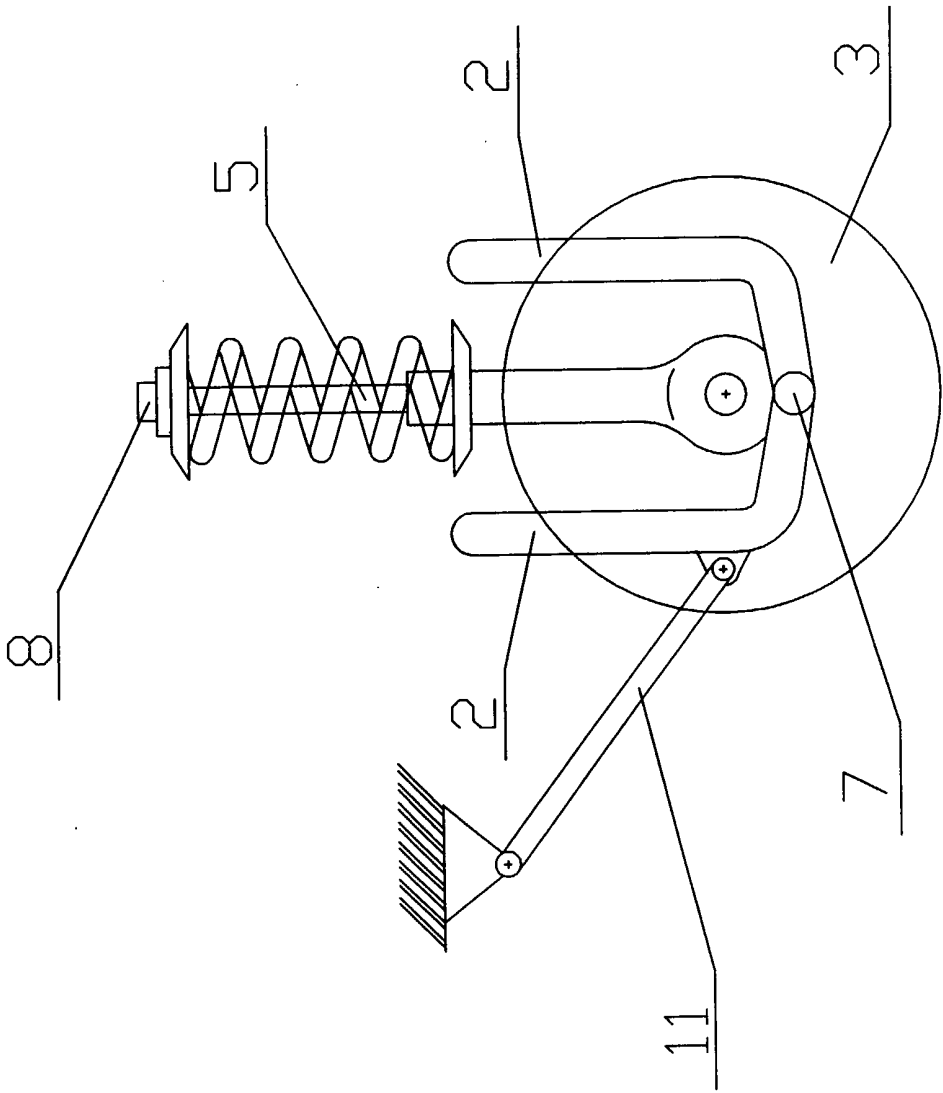


FIG.15



## INTERNATIONAL SEARCH REPORT

International Application No

PCT/CZ 01/00022

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B60G9/00 B60G9/02

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 B60G

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, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages                                                           | Relevant to claim No. |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| X          | FR 1 191 743 A (DAIMLER BENZ)<br>21 October 1959 (1959-10-21)                                                                                | 1                     |
| Y          |                                                                                                                                              | 2-8                   |
| A          | the whole document<br>figures 1-3                                                                                                            | 9                     |
| Y          | GB 2 296 223 A (SECR DEFENCE)<br>26 June 1996 (1996-06-26)<br>page 3, paragraph 2 -page 4, paragraph 1<br>page 6, paragraph 4<br>figures 1,3 | 2,7                   |
| Y          | FR 666 209 A (SOMBRUN M.)<br>7 October 1929 (1929-10-07)<br>figures 1,2                                                                      | 3,4,8                 |
|            | ---<br>-/--                                                                                                                                  |                       |



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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Date of the actual completion of the international search

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Name and mailing address of the ISA

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

Authorized officer

Savelon, O

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|------------------------------------------------------------------------------------|-----------------------|
| Y          | FR 658 925 A (SOMBRUN M.)<br>20 June 1929 (1929-06-20)<br>figures 5,7<br>-----     | 5,6                   |

**INTERNATIONAL SEARCH REPORT**  
 information on patent family members

International Application No  
 PCT/CZ 01/00022

| Patent document<br>cited in search report |   | Publication<br>date | Patent family<br>member(s)                  | Publication<br>date          |
|-------------------------------------------|---|---------------------|---------------------------------------------|------------------------------|
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| GB 2296223                                | A | 26-06-1996          | NONE                                        |                              |
| FR 666209                                 | A | 07-10-1929          | GB 339625 A<br>FR 658925 A                  | 08-12-1930<br>20-06-1929     |
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