Aug. 9, 1938. F. W. MURRAY 2,126,653

DIFFERENTIAL CONTROL DEVICE

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Fig. 1.

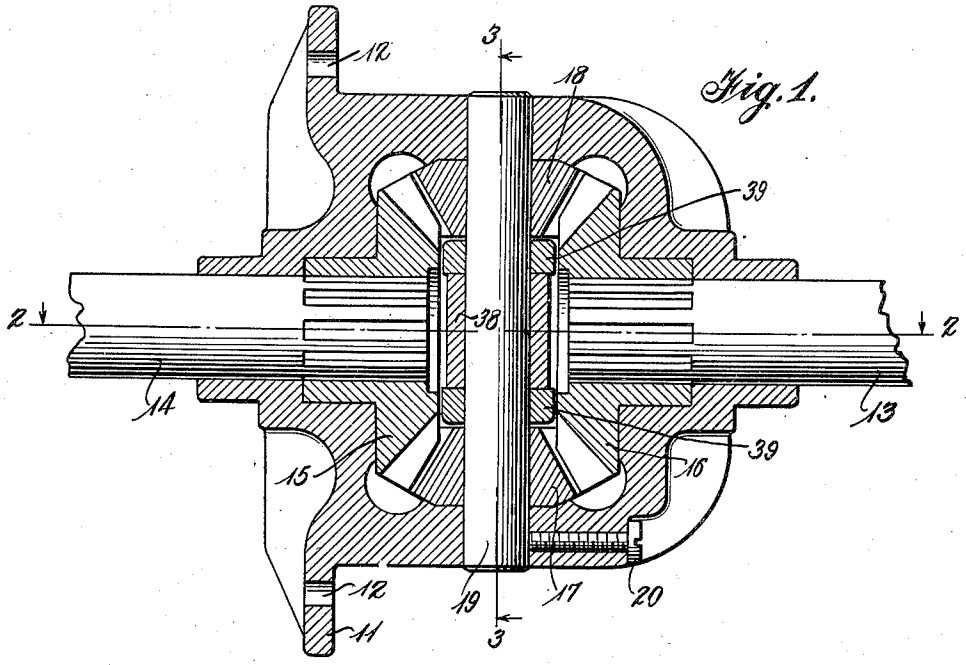
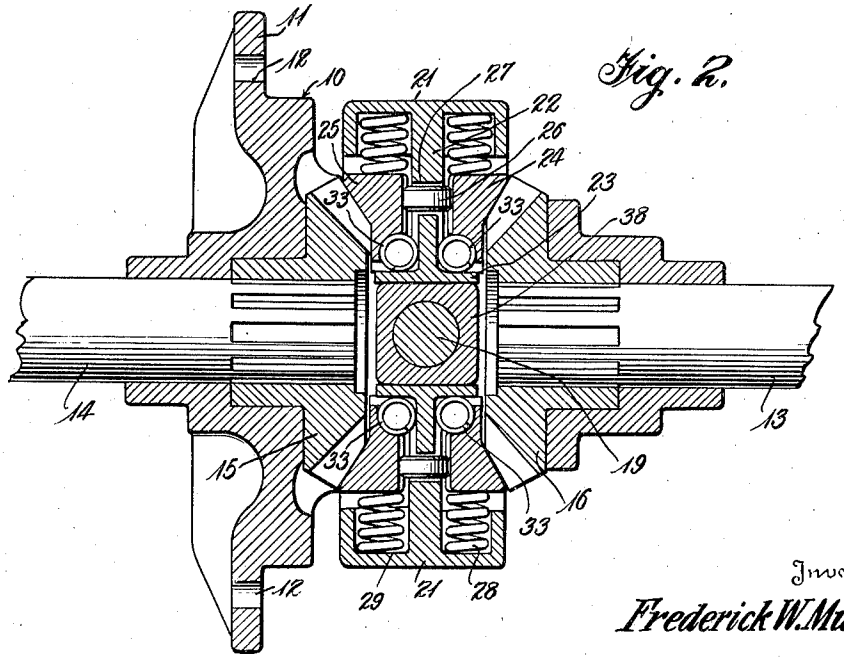


Fig. 2.



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Fig. 3.

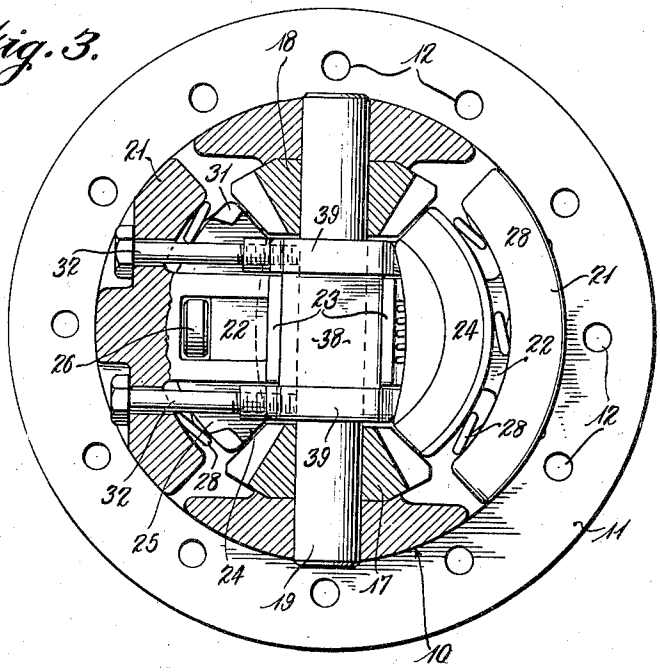


Fig. 4.

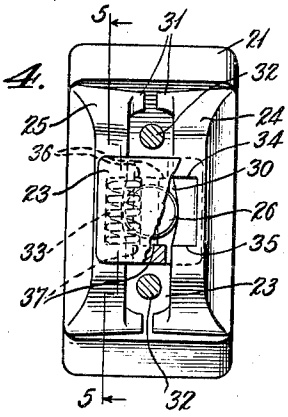


Fig. 5.

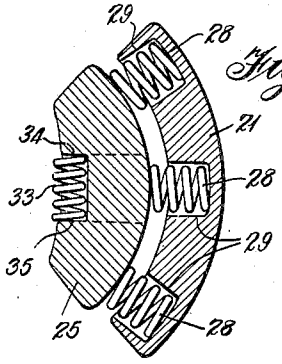
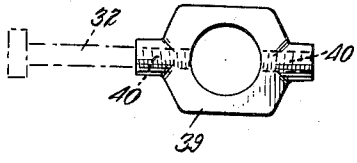


Fig. 6.



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UNITED STATES PATENT OFFICE

2,126,653

DIFFERENTIAL CONTROL DEVICE

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Application February 5, 1937, Serial No. 124,295

10 Claims. (Cl. 74—315)

The invention relates to control of differentials and has as an object the provisions of mechanism to be applied to known forms of differentials to control the action thereof.

It is an object of the invention to provide a mechanism that will allow a differential to act to permit one rear wheel to move relative to the other with slow motion on turns or curves but will prevent rapid relative motion between the wheels at any time.

It is a further object of the invention to provide mechanism to so control the action of a differential that a vehicle may be driven by the rear wheel having traction when traction is not had by the remaining rear wheel.

It is a further object of the invention to provide a mechanism that will prevent initiation of skids caused by spinning of a wheel temporarily, and then recovering traction while the vehicle is traveling at speed.

Further objects of the invention will appear from the following description when read in connection with the accompanying drawings showing an illustrative embodiment of the invention and in which:

Fig. 1 is a central vertical section in the plane of the axles, showing the mechanism in place;

Fig. 2 is a section on line 2—2 of Fig. 1;

Fig. 3 is a transverse section on line 3—3 of Fig. 1;

Fig. 4 is a detail side elevation of one block assembly utilized in the mechanism;

Fig. 5 is a detail section on line 5—5 of Fig. 4; and

Fig. 6 is a detail side elevation of a securing bolt and ring.

It is well known, in fact within the experience of every motorist, that when one rear wheel loses traction, whether on a slippery pavement or jacked up, it will spin if the clutch is let in. This is a major difficulty in driving on ice or snow without chains. It is also well known that when a car is driving at speed, a rear wheel will come down spinning after it bounces clear of the pavement as the result of striking a projection, thus causing much wear upon tires.

It is not so well known that when a rear wheel of a car traveling at speed, strikes a slippery spot, as oil, the delivery of the full driving power of the motor to the wheel which has thus lost traction will cause a great increase of speed, or spin, of that wheel, which when the car by its momentum has passed the slippery spot, will violently throw the front wheels laterally by the unbalanced drive forces, causing what is known as a straight away or power skid. By the present invention the differential is controlled to remove these defects in the operation of an automobile. The mechanism acts as a solid rear axle vehicle normally but permits the necessary slow differential movement on turns or curves.

In the drawings a form of differential that is in most common use is shown, comprising the differential frame 10, to the flange 11 to which the ring gear (not shown) is bolted by bolts passing through openings 12. The rear axles are shown at 13, 14 splined in bevel gears 15, 16 respectively each in mesh with planetary gears 17, 18 revoluble on pin 19 fixed in frame 10 as by set screw 20 (Fig. 1).

To control or check revolution of one axle relative to the other two instrumentalities are provided one of which may act without the other upon slow relative movement and both of which may act cooperatively when a quick start of relative movement exists.

To this end two assemblies as shown in Figs. 4 and 5 are placed in the spaces bounded by gears 15, 16, 17 and 18. As shown in Figs. 2, 4 and 5 each assembly comprises an outwardly arcuate supporting block 21, formed with a web 22, and an inner T flange 23. The assembly further comprises two wedge shape brake blocks 24, 25 each having a wedge surface as shown complemental to and pressed against the edges of the gears 15, 16 respectively. Instead of reacting against web 22, as they may operatively be caused to do if only the wedge action is to be relied upon, the wedges are shown as reacting against each other through the medium of roller 26 housed in an opening 27 in web 22. By virtue of the central line contact of blocks 24, 25 with the roller 26 the blocks may adjust themselves to the surfaces of the gears. Because the rollers are relatively thin, the brake blocks may also tilt slightly relative to the axis of the roller.

To press the wedge blocks against the gears 15, 16 springs 28 are shown seating in recesses 29 in the members 21. Three such springs as preferred, are shown for each wedge block and the springs are so disposed as to press radially of the longitudinal arcs of the blocks. By the radial action any tendency of the blocks to be displaced longitudinally is resisted but as will be shown below, not positively prevented. Experiment has shown that a pressure of 150 to 160 pounds per spring when three springs are provided for each block will be satisfactory.

To provide a supplemental control to prevent sudden spin of one axle relative to the other

under extreme conditions, the rollers **26** are shown as seating in a concavity **30** in each block **24**, **25**; best shown in Fig. 4. This concavity may be shallow V shaped but is preferably curved as shown. As a result of this structure any sudden attempt of one wheel to spin will cause one of the blocks **24**, **25** to move lengthwise relative to the other—dragged by the spinning gear **15** or **16** by reason of the friction induced by the springs **28**. The rollers **26** of both assemblies will then ride up in the concave seats **30** thus positively separating the blocks **24**, **25** to provide a very great additional friction upon gears **15**, **16**.

The blocks **24**, **25** may however, secure relief from this pressure, to prevent damage to the gears or the differential frame, as the blocks may be forced upwardly toward their bases with added compression of springs **28**. The combined action of the wedges and the rollers **26** is sufficient to at all times prevent any perceptible spin of a wheel.

To prevent excessive endwise movement of the blocks **24**, **25** they are formed at their ends with projections **31** over hanging and spaced from bolts **32**, to be described.

To restore the blocks **24**, **25** to a central position after displacement springs **33** are shown comprised and seated between abutments **34**, **35** forming a spring recess in each block, and between registering abutments **36**, **37** formed on web **22**.

To hold the assemblies of arcuate members **21**, wedge blocks springs and rollers in place and to compress the springs **28**, the usual spacer for the gears **17**, **18** upon the pin **19** is replaced by a shortened spacer **38**, and collars **39** are slipped into the spaces thus provided, after which the pin **19** is returned to position and secured, the bolts **32** are then passed through openings provided in the arcuate members **21** to engage threaded openings **40** in collars **39** which bolts when screwed home will press the assemblies to operative positions with compression of springs **28**.

In many cars now in use the device may be installed by merely removing the cover plate from the differential housing, loosening set screw **20**, slipping pin **19** axially to release the spacer which is removed and the collars **39** and the shortened spacer **38** may be inserted and the pin restored to position. The released gear **17** cannot fall out. One assembly can then be inserted and two bolts **32** placed. One wheel is then turned to revolve the differential frame **10** to a position for insertion of the other assembly. No change is made in the existing differential structure.

An important feature of the invention is the relation of the strength and action of the springs **33** in coaction with the rollers **26**. The relative rotation between the gears **15** and **16** is always slow. In making sharp turns a car is forced to move relatively slowly to avoid over-turning and on curves of long radius there is only a fraction of a full relative rotation of these gears. When all elements are taken into account it will be found that this relative rotation will rarely exceed one full turn per second.

The strength of springs **33** should be such that during the necessary relative rotation for rounding curves the said springs will not be compressed sufficiently to cause the locking action of the rollers to take effect, and yet initiation of a spin of one wheel will overcome the springs **33** and bring the rollers into action.

Minor changes may be made in the physical embodiment of the invention within the scope of the appended claims without departing from the spirit of the invention.

I claim:

1. A differential control device comprising, in combination: a support member; means to secure said member to a differential structure over a space bounded by the axle gears and planetary gears thereof; a pair of oppositely facing wedge blocks to contact the teeth respectively of two similar surfaces of said gears; and spring means reacting between said member and said blocks edgewise of the latter to produce friction upon said gears.

2. A differential control device comprising, in combination: a pair of oppositely facing wedge blocks; individual spring means reacting upon the respective blocks, edgewise thereof to press the same into the angle between pairs of like gears of a differential and against the teeth of said gears; each of said blocks reacting directly against the abutting pressure of the other thereof.

3. A differential control device comprising, in combination: a pair of oppositely facing wedge blocks; spring means reacting upon said blocks, edgewise thereof, to press the same into the angle between pairs of like gears of a differential and against the teeth of said gears; means reacting between the central portions of said blocks to serve as an abutment for each against the other and whereby said blocks may each adjust themselves to the surfaces of said gears by pivotal movement about said abutment.

4. A differential control device comprising, in combination: a pair of oppositely facing wedge blocks; spring means reacting upon said blocks, edgewise thereof, to press the same into the angle between pairs of like gears of a differential and against the teeth of said gears; abutment and spreader means reacting between said wedge blocks to mutually transmit pressure from each to the other, and increase said pressure upon longitudinal movement of either.

5. A differential control device comprising, in combination: a pair of brake blocks; means to support said blocks in a space between a like pair of the gears of a differential; means to preserve contact of said blocks with the teeth of the respective gears; and means acting automatically upon movement of rotation of said gears about their axes to exert spreading stress between said blocks to press them more firmly against the teeth of said respective gears.

6. A differential control device comprising, in combination: a pair of oppositely facing wedge blocks; spring means to press said blocks respectively against the points of the teeth of a like pair of the gears of a differential; and means reacting between said blocks to apply spreading pressure thereto upon longitudinal movement of either under influence of revolution of said gears on their axes.

7. A differential control device comprising, in combination: a pair of oppositely facing wedge blocks formed with registering depressions at mutually opposed faces and opening therebetween; rolling abutment means seated in said depressions; spring means acting edgewise upon said blocks to force them into the angular space between a pair of like gears of a differential and into forcible contact with the teeth of said gears with compressive stress upon said abutment means; whereby said blocks may adjust themselves to the surface including the edges of said teeth.

8. A differential control device comprising, in combination: a pair of oppositely facing wedge blocks formed with approximately V-shaped,

registering depressions opening therebetween with widely flaring walls; rolling abutment means seated in said depressions; spring means acting edgewise upon said blocks to force them into the angular space between a pair of like gears of a differential and into forcible contact with the teeth of said gears, with compressive stress on said abutment means; whereby longitudinal movement of said blocks under influence of rotation of said gears shall cause spreading stress upon said blocks.

9. A differential control device comprising, in combination: a pair of oppositely facing wedge blocks formed with approximately V-shaped, registering depressions opening therebetween with widely flaring walls; rolling abutment means seated in said depressions; spring means acting edgewise upon said blocks to force them into the angular space between a pair of like gears of a differential and into forcible contact with the teeth of said gears, with compressive stress on said abutment means; whereby longitudinal movement of said blocks under influence of rotation of said gears shall cause spreading stress upon said blocks.

10. A differential control device comprising, in combination: a carrier block T-shaped in cross section having an arcuate head, a central flange and bolt openings through said head; a pair of longitudinally arcuate wedge blocks respectively seating under said head and at the respective sides of said flange; compression springs reacting between said head and the thick edges of the respective wedge blocks; and bolts passing through the bolt openings of two of said carrier blocks when placed in opposite spaces between pairs of like gears of a differential to force both carrier blocks and their assembly of wedge blocks and springs into said spaces with said wedge blocks bearing against the teeth of the respective like gears with compression of said springs.

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