Oct. 13, 1936. E. CAPO 2,057,415

WHEEL FOR ROAD AND RAIL TRANSPORTS

Filed Aug. 28, 1933 3 Sheets-Sheet 1

Fig. 1.

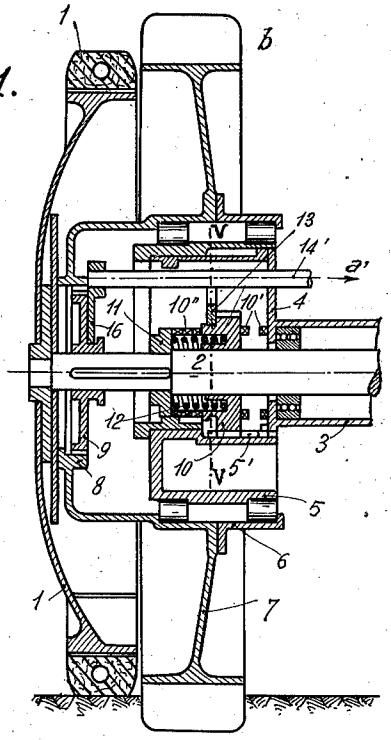



Fig. 1a.

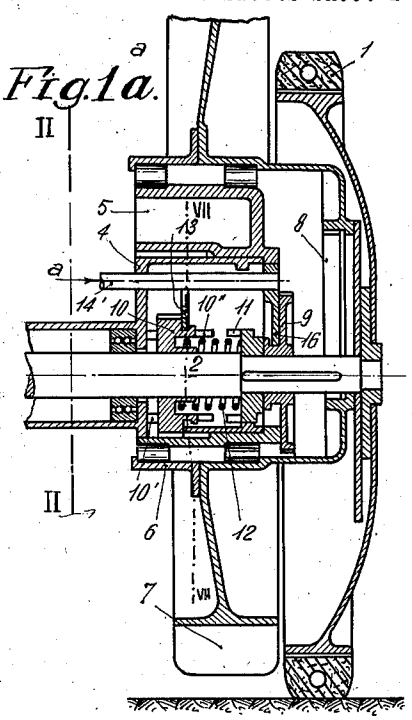
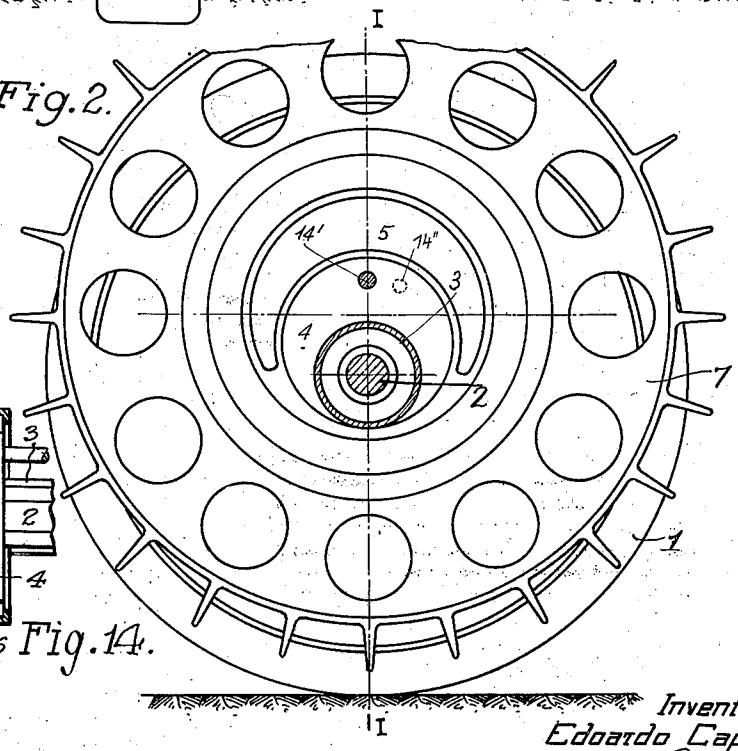



Fig. 2.



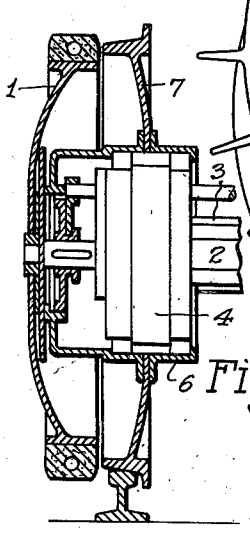




Fig. 1a.

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Oct. 13, 1936. E. CAPO 2,057,415

WHEEL FOR ROAD AND RAIL TRANSPORTS

Filed Aug. 28, 1933 3 Sheets-Sheet 2

Fig. 3.

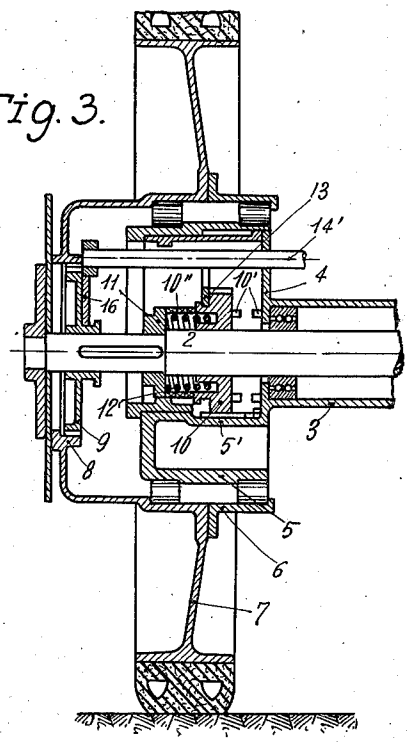



Fig 3a

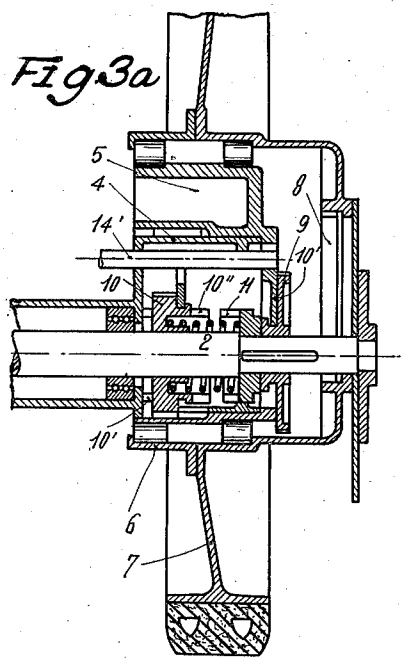



Fig. 4.

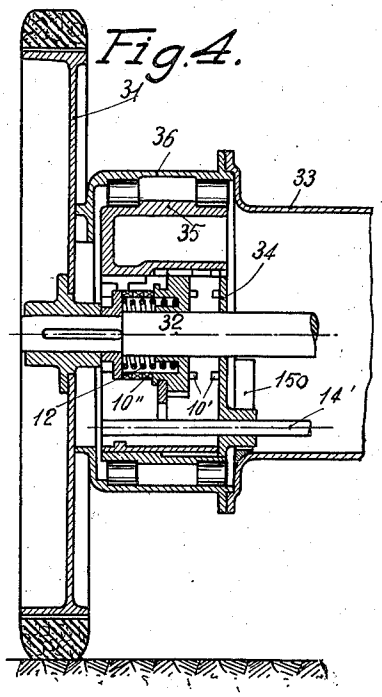
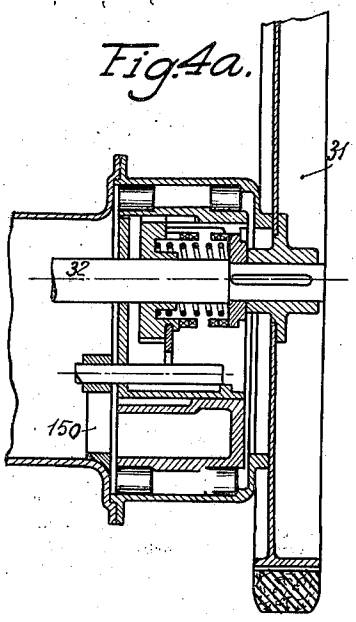



Fig. 4a.



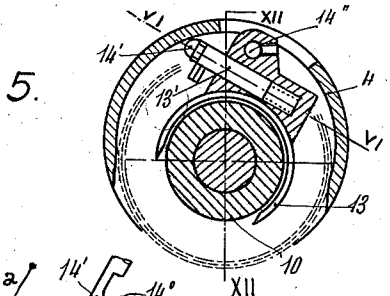

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Oct. 13, 1936. E. CAPO 2,057,415

WHEEL FOR ROAD AND RAIL TRANSPORTS

Filed Aug. 28, 1933 3 Sheets-Sheet 3

Fig. 5.



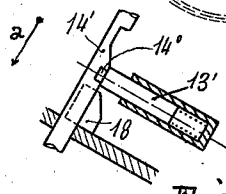
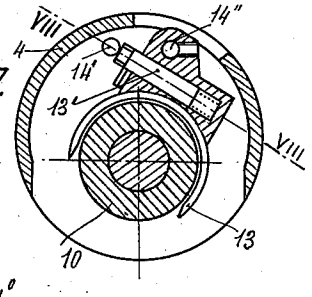




Fig. 6

Fig. 7.



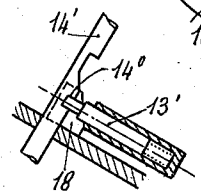




Fig. 8

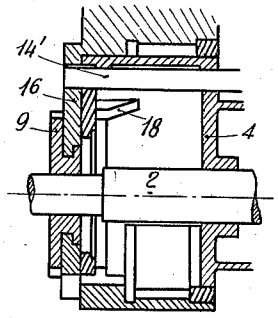



Fig. 10

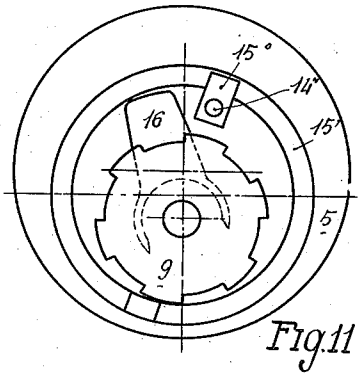



Fig. 11

Fig. 12

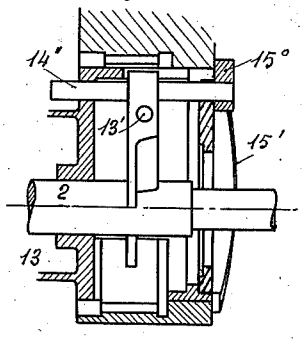



Fig. 9

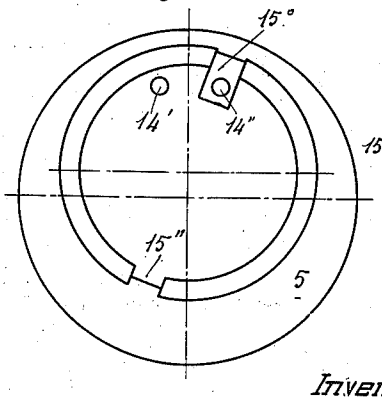
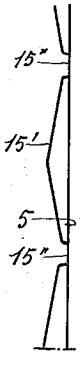



Fig. 13




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# UNITED STATES PATENT OFFICE

2,057,415

## WHEEL FOR ROAD AND RAIL TRANSPORT

Edoardo Capo, Torino, Italy

Application August 28, 1933, Serial No. 687,221
In Germany August 29, 1932

4 Claims. (Cl. 180—15)

The present invention relates to wheels for road and rail transport and more particularly wheels comprising two elements adapted to be brought alternatively into operative position.

The object of my invention is to provide a wheel of that kind in which either of these elements can be quickly and easily brought into its operative position while the other element is brought back into its inoperative position.

To this effect, according to my invention, one of these elements is keyed directly to the driving axle of the vehicle and the other element is carried by a support adapted to be brought into either of two positions: one for which it is in concentric relation with the driving axle, and the other for which it is eccentrically positioned with respect to said driving axle so that said second element is lifted off the ground.

According to an essential feature of my invention, the above mentioned support of the second wheel element consists of an eccentric disc journalled on a bearing itself eccentrically positioned with respect to the driving axle. The eccentricity of the wheel support with respect to the bearing is equal to the eccentricity of said bearing with respect to the axle. With this arrangement, for one position of the support, the eccentricity of the bearing is compensated for by the eccentricity of said support, so that the latter is concentrically positioned with respect to the driving axle and the two wheel elements are in concentric relation with respect to each other. On the contrary, when the eccentric support has been turned through 180° around the eccentric bearing, the eccentricities of these two parts are added together and the second wheel element is in its eccentric position with respect to the first wheel element. My device therefore comprises clutch means for causing the eccentric support of the second wheel element to turn around the eccentric bearing under the action of the driving axle.

When the two wheel elements are in concentric relation with respect to each other, they are angularly keyed together, while when they are eccentrically positioned with respect to each other the wheel element that is lifted off the ground can rotate freely.

The device according to my invention can also be adapted to the case in which a simple wheel must be eventually lifted off the ground and simultaneously uncoupled; it may also apply to the case in which the wheel must be lifted off the ground without being stopped.

In both of these cases the device will comprise only one of the above mentioned wheel elements, that is to say either the wheel element that is directly keyed to the driving axle or the wheel element that is carried by the eccentric support.

Preferred embodiments of my invention will be hereinafter described with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is a sectional view on the line I—I of Fig. 2, the operating wheel being shown in operative position.

Fig. 1[a] is a similar view, the operating wheel being shown in inoperative position.

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

Fig. 3 is a sectional view of a modification showing the operating or driving wheel in operative position.

Fig. 3[a] is a similar view with the operating wheel in inoperative position.

Fig. 4 is a sectional view of a further modification, the operating wheel being shown in operative position.

Fig. 4[a] is a similar view, the operating wheel being shown in inoperative position.

Fig. 5 is a sectional view on the line V—V of Fig. 1, on a larger scale.

Fig. 6 is a sectional view on the line VI—VI of Fig. 5.

Fig. 7 is a sectional view on the line VII—VII of Fig. 1.

Fig. 8 is a sectional view on the line VIII—VIII of Fig. 7.

Figs. 9, 10 and 11 show constructional details of the controlling mechanism.

Fig. 12 is a sectional view on the line XII—XII of Fig. 5.

Fig. 13 is an explanatory diagram showing the outline of the cam disc.

Fig. 14 is a view in vertical section, partly in elevation, showing the use of the operative wheel of this invention in connection with a track-traveling wheel, relative to which track-traveling wheel the operating wheel of this invention is movable to a position to engage the ground surface or to a position free of that surface.

1 is a wheel of a known type adapted to run on a road surface which is provided with a tire either of the solid or hollow rubber type. Obviously, the tire illustrated may be substituted by a pneumatic tire if desired which is, of course, not necessary to illustrate. This wheel is keyed to the driving axle 2, which is supported by axle casing 3. Each of the outer ends of said axle casing 3 carries an eccentric bearing 4 on which

is journalled an eccentric disc 5. The eccentricity of disc 5 with respect to bearing 4 is equal to the eccentricity of bearing 4 with respect to axle 2.

Eccentric disc 5 acts as a support for the hub 6 of the second wheel element 7, which is provided on its outer periphery with transverse ribs for gripping the ground. Hub 6 carries the female part 8 of a clutch the male part 9 of which is slidably keyed on shaft 2.

Eccentric disc 5 is further provided with inwardly projecting teeth 5' meshing with a toothed wheel 10 adapted to turn freely on axle 2 but provided on either side with dog clutches 10' and 10'' respectively through which it can be coupled either with axle casing 3 or with a disk 11 keyed on axle 2.

A spring 12 normally keeps toothed wheel 10 coupled with axle casing 3 so that it prevents eccentric disc 5 from turning around bearing 4 and consequently maintains wheel element 7 in the position (either concentric or eccentric) into which it was previously brought. The displacement of toothed wheel 10 is controlled by a forked arm 13 keyed on a sliding shaft 14'' (see Figs. 5 and 7). This shaft 14'' carries a finger 15° extending transversely thereto (see Fig. 11) and bearing against the lateral edge of annular disc 5 which acts as a kind of cam the profile of which is shown developed at 15'—15'' in Fig. 13. Fork 13 is provided with a locking member 13' slidably and elastically mounted therein. Locking member 13' is adapted to engage a notch 14° formed in the shaft 14' as shown in Fig. 6. The shaft 14' extends parallel to the shaft 14'', as shown in Fig. 7 and it carries a fork 16 (see Fig. 10) for controlling the sliding movement of the male clutch element 9 along axle 2. The longitudinal sliding displacements of shaft 14' are controlled through a member (not shown in the drawings) disposed between the wheels.

The operation of the device above described is as follows:

It will be supposed that the wheel is first in the position shown in Fig. 1 for which the eccentricities of bearing 4 and of disc 5 are added together. Under these conditions, wheel element 7 is free to rotate and is held at a certain distance from the ground. Sliding shaft 14' is then moved in the direction of arrow *a*. Figs. 1 and 6.) As locking member 13', slidably carried by fork 13, engages into a notch 140 of shaft 14', said fork 13 and shaft 14'' to which it is keyed are also moved in the direction of the arrow *a*, so that the clutch 10' of toothed wheel 10 is disengaged and said wheel is now coupled with driving axle 2 through clutch 10'' and disk 11.

In the course of this movement, the lower portion of locking member 13' has come into contact with an inclined surface 18 integral with axle casing 3, thus disengaging locking member 13' from the corresponding notch of shaft 14'. Shaft 14'' and fork 13, which is keyed thereto, would then be free to slide back into their original positions under the action of spring 12 (thus disconnecting clutch 10'' and coupling wheel 10 with axle casing 3 through clutch 10') were it not for the fact that finger 15° (see Figs. 9 and 12) has been brought in the meantime into contact with the cam like surface 15' formed on the edge of eccentric disc 5.

As soon as wheel 10 was coupled with axle 2 through clutch 10'' and disk 11, eccentric disc 5 started turning around bearing 4 (thus keeping finger 15° applied against the cam-forming edge of disc 5, as above stated). After a rotation of 180°, disc 5 comes into a position for which its eccentricity is compensated for by the eccentricity of bearing 4 so that said disc 5 is now concentric with axle 2 and wheel 1. When this position is reached by disc 5, finger 15° engages a notch 15'' provided in disc 5 and then allows shaft 14'' to slide back to its original position under the action of spring 12 driving along wheel 10 together with it through fork 13. This disengages clutch 10'' through which wheel 10 was coupled with disk 11 and causes said wheel 10 to be coupled with axle casing 3 through clutch 10', so that eccentric disc 5 is now locked in its new position.

The male and female parts, 9 and 8 respectively, of the clutch adapted to connect hub 6 to axle 2 are now in coaxial relation and can be engaged one into the other so that wheel 7 is now rigidly connected to axle 2 (this position being shown on the left hand side of Fig. 1).

When it is desired to bring back the device into the position for which the vehicle rests on the ground through wheel 1 it suffices to push shaft 14' in the direction of arrow *a* (Fig. 1[a]) and to repeat the operations above described. Eccentric disc 5 is then caused to rotate through 180°, which brings it back to its original position, thus disconnecting wheel element 7 and lifting it off the ground, as shown in Fig. 1[a].

Obviously the operation which has just been described applies to all wheels of the vehicle which function in the manner described from passing over from road service to railroad or field service. Such operation is effected simultaneously for all the wheels or wheel groups. It may also take place for each wheel or each wheel group in sequence and this without regard to the number of axles incorporated in the vehicle.

Of course wheels 1 and 7 may be of a different type from those disclosed on the drawings. These wheels may carry no tire at all, or one of them might be provided with a flange similar to those carried by railway wheels, so that the vehicle might be utilized for running both on a road or on a railway track.

The embodiment shown in Figures 3 and 3[a] is applicable when the vehicle is supported by two systems of wheels, namely a stationary wheel system and a liftable wheel system. Thus, for example, there may be provided a series of wheels having road tires capable of being raised and lowered combined with a series of wheels designed to travel on a railroad track and fixed against being raised or lowered. Thus, one wheel of each group is raised or lowered with respect to the other wheel of the group without corresponding movement of such other wheel, at least with respect to the vehicle. Therefore, the invention contemplates a set of body supporting wheels which otherwise than as to rotation are fixed with respect to the body except, of course, in the usual spring play. Combined with this exactly in accordance with the mechanism described is a movable wheel for each fixed wheel capable of being raised and lowered with respect to the body for service as a body supporting wheel in contact with the surface when lowered or wholly free of any surface contact when raised.

The track-traveling wheels are not illustrated in Fig. 3 but only the wheels designed for vertical bodily movement according to the present invention. Of these bodily movable wheels constructed and operated according to the present

invention, Fig. 3 shows at the left the wheel in lowered or surface contacting position and at the right the wheel in elevated or non-surface contacting position. The particular cooperation of the operating wheel forming the subject-matter of the present invention, in connection with a track-traveling wheel, is illustrated more particularly in Fig. 14, the operating parts being shown partly in section and partly in elevation, it being understood that such parts are identical with those described in connection with Fig. 1.

The operation of the device of Figs. 3 and 14 is exactly the same as that of the first embodiment.

On the contrary, the embodiment disclosed in Figs. 4 and 4*a* comprises only wheel element **31**, which is directly keyed on the driving axle **32**. The hub **36**, instead of supporting another wheel element as in the first embodiment, is fixed to axle casing **33** and bearing **34** can rotate freely with respect to the axle, but is prevented from rotating by a stop **150**. In this case, the mechanism contained in the hub is intended merely to rotate eccentric disc **35** so as to move the wheel element **31** upwardly or downwardly, said wheel remaining angularly keyed to driving axle **32**. The other elements are similar to those in the first embodiment.

While I have described what I deem to be practical and efficient embodiments of my invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of my invention as comprehended within the scope of the appended claims.

What I claim is:

1. In a vehicle including a driving axle and a casing for said axle, a device of the type described, which comprises in combination, a wheel element keyed to said axle, a bearing fixed in an eccentric position with respect to said axle, an eccentric disc journalled on said bearing, the eccentricity of said disc with respect to said bearing being equal to the eccentricity of said bearing with respect to said axle, a hub journalled on said eccentric disc concentrically therewith, a second wheel element carried by said hub, a toothed wheel slidably keyed on said axle, a plurality of teeth on the inner periphery of said eccentric disc adapted to mesh with said toothed wheel, clutch means for locking said toothed wheel with respect to said axle casing, clutch means for operatively connecting said toothed wheel with said axle, means for controlling said clutch means so as to bring the first mentioned clutch means into operative position and to disconnect the second mentioned clutch means in either of two positions of said disc with respect to said bearing for which the axes of the disc, of the bearing and of the axle are in the same plane, and means for manually disconnecting the first mentioned clutch means and bringing the second mentioned clutch into operative position when it is desired to reverse the position of the wheel elements with respect to each other, the device further comprising clutch means for coupling said hub to said axle when the hub is concentrically positioned with respect to the axle.

2. In a vehicle including a driving axle and a casing for said axle, a device of the type described, which comprises in combination, a wheel element keyed to said axle, a bearing fixed in an eccentric position with respect to said axle, an eccentric disc journalled on said bearing, the eccentricity of said disc with respect to said bearing being equal to the eccentricity of said bearing with respect to said axle, a hub journalled on said eccentric disc concentrically therewith, a second wheel element carried by said hub, a toothed wheel slidably keyed on said axle, a plurality of teeth on the inner periphery of said eccentric disc adapted to mesh with said toothed wheel, clutch means for locking said toothed wheel with respect to said axle casing, clutch means for operatively connecting said toothed wheel with said axle, a spring urging said first mentioned clutch means into operative position, a shaft parallel to said axle slidably mounted in said bearing, a fork carried by said shaft for transmitting the sliding displacements of said shaft to said toothed wheel, a cam surface on the lateral edge of said eccentric disc, a finger carried by said shaft and adapted to cooperate with said cam surface, a second shaft parallel to said axle slidably mounted in said bearing, elastic means for connecting said two shafts together for a portion of their displacements against the action of said spring, said cam surface being so traced as to keep the second mentioned clutch means in operative position for a rotation of 180° of the eccentric disc and then to allow the first mentioned shaft to slide back under the action of the spring, and clutch means for coupling said hub to said axle when these two parts are concentrically positioned.

3. In a vehicle including a driving axle and a casing for said axle, the combination of a primary wheel element keyed to said axle, a bearing fixed eccentric to said axle, an eccentric disc journalled on said bearing, the eccentricity of said disc to said bearing being equal to the eccentricity of said bearing to said axle, a hub journalled on said eccentric disc concentrically therewith, a secondary wheel element carried by said hub, a toothed wheel splined on said axle, the inner periphery of said eccentric disc having teeth adapted to mesh with said toothed wheel, clutch means for locking said toothed wheel with respect to said axle casing, clutch means for operatively connecting said toothed wheel with said axle, means for controlling said clutch means so as to bring the first mentioned clutch means into operative position and to disconnect the second mentioned clutch means in either of two positions of said disc with respect to said bearing for which the respective axes of the disc, bearing and axle are in the same plane, means for manually disconnecting the first mentioned clutch means and bringing the second mentioned clutch into operative position when it is desired to reverse the relative positions of the wheel elements, and clutch means for coupling said hub to said axle when the hub is concentric to the axle.

4. In a vehicle including a driving axle and a casing for said axle, the combination of a primary wheel element keyed to said axle, a bearing fixed eccentrically to said axle, an eccentric disc journalled on said bearing, the eccentricity of said disc to said bearing being equal to the eccentricity of said bearing to said axle, a hub journalled on said eccentric disc concentrically therewith, a secondary wheel element carried by said hub, a toothed wheel splined on said axle, the inner periphery of said eccentric disc having teeth adapted to mesh with said toothed wheel, clutch means for locking said toothed wheel with respect to said axle casing, clutch means for operatively connecting said toothed wheel with said axle, a spring urging said first mentioned clutch

means into operative position, a shaft parallel to said axle slidably mounted in said bearing, a fork carried by said shaft for transmitting the sliding displacements of said shaft to said toothed wheel, a cam surface on the lateral edge of said eccentric disc, a finger carried by said shaft and adapted to cooperate with said cam surface, a second shaft parallel to said axle slidably mounted in said bearing, elastic means for connecting said two shafts together over a portion of their displacements against the action of said spring, said cam surface being so traced as to keep the second mentioned clutch means in operative position for a rotation of 180° of the eccentric disc and then to allow the first mentioned shaft to slide back under the action of the spring, and clutch means for coupling said hub to said axle when these two parts are concentrically positioned.

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