Feb. 14, 1933. A. F. FORD 1,897,555

GEARLESS DIFFERENTIAL

Filed Jan. 21, 1932 2 Sheets-Sheet 1

Fig. 1.

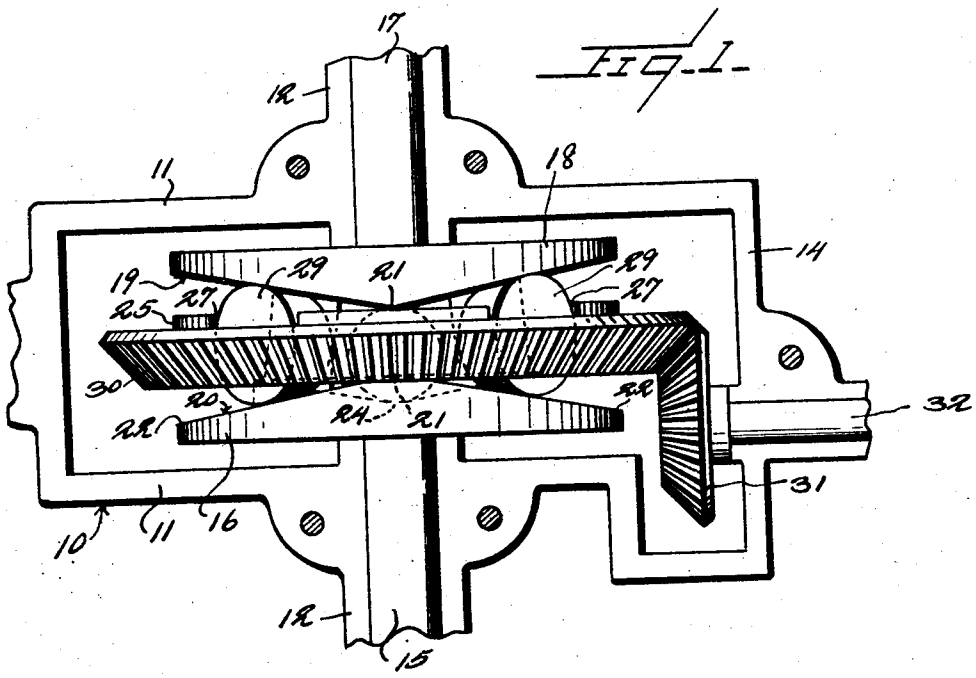
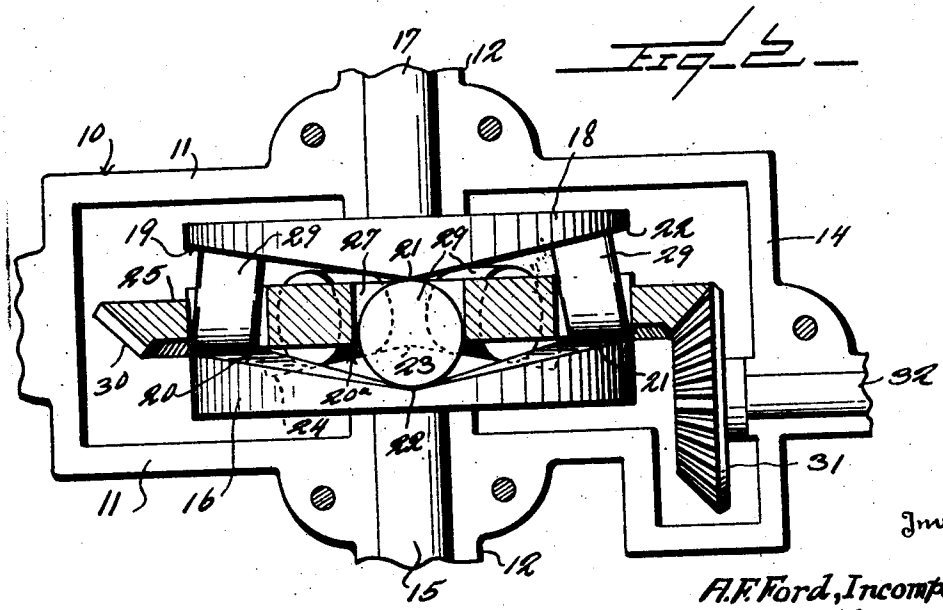


Fig. 2.



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Filed Jan. 21, 1932 2 Sheets-Sheet 2

Fig. 3.

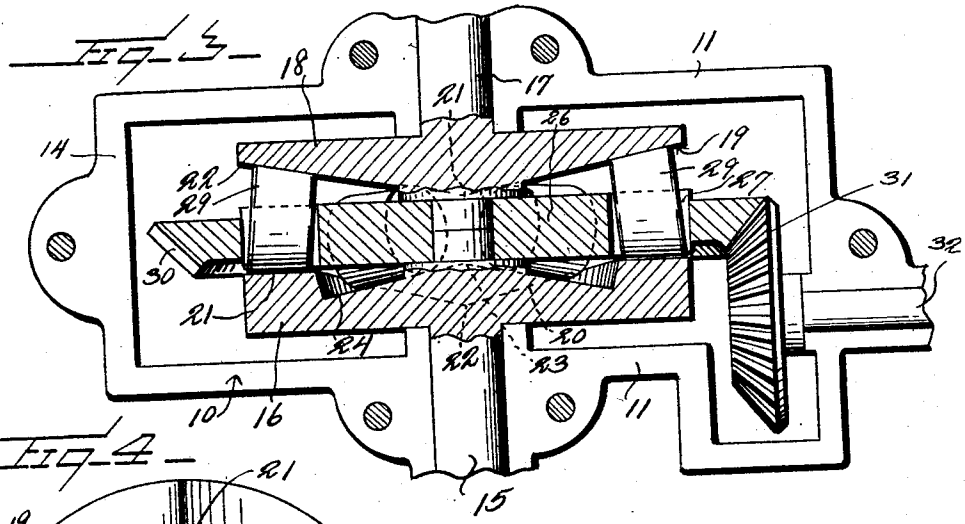


Fig. 4.

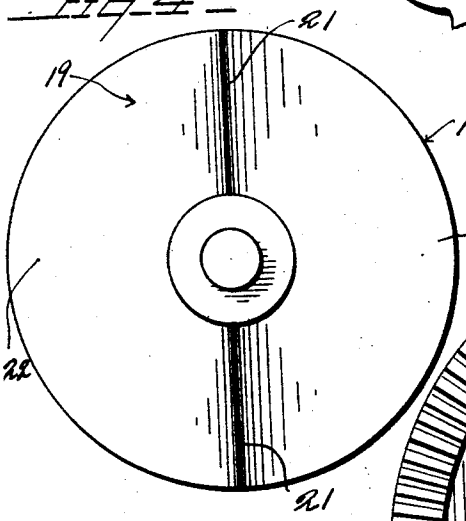


Fig. 5.

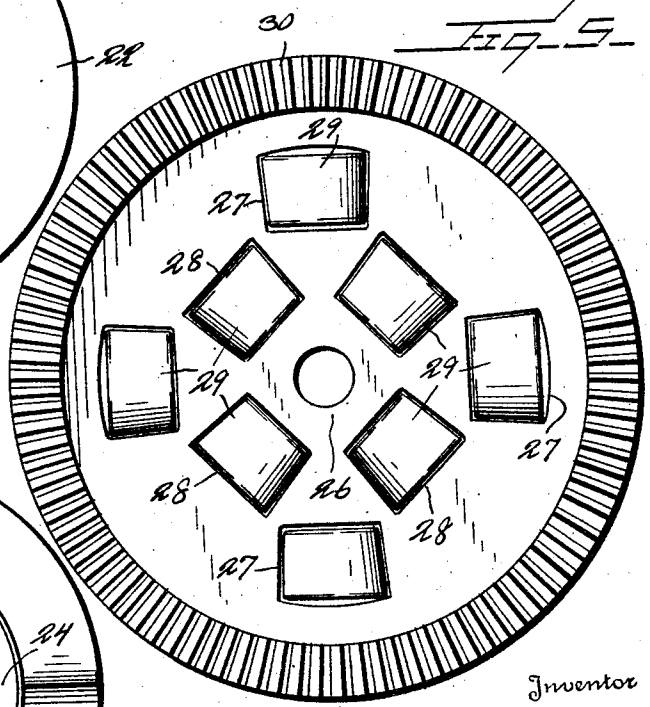
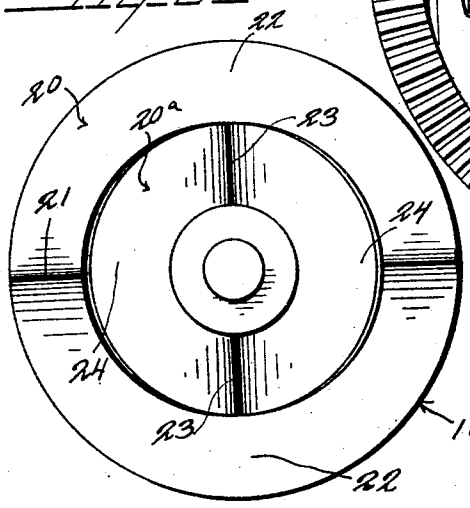


Fig. 6.



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1,897,555

UNITED STATES PATENT OFFICE

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GEARLESS DIFFERENTIAL

Application filed January 21, 1932. Serial No. 588,016.

This invention relates to gearless differentials working on the general principle disclosed in my Patents 1,336,950 granted April 13, 1920 and 1,365,586 granted January 11, 1921.

The general object of the invention is to provide, of course, a differential so constructed that it will do away with the use of usual gear wheels commonly found in differentials and which will provide power to both driven elements and which is so constructed, of course, that one of the driven elements may rotate at a faster or slower speed than the other driven element.

A further object is to provide a differential of this character which is very compact, relatively simple in construction and which is positive in its operation.

The invention is illustrated in the accompanying drawings, wherein:—

Figure 1 is a top plan view of the differential, the upper half of the casing being removed;

Figure 2 is a like view to Figure 1, the driving element being shown in section and the parts being shown in racing position;

Figure 3 is a like view to Figure 2 but showing the driving and driven elements in section;

Figure 4 is a face view of one of the driven elements;

Figure 5 is a face view of the driving element;

Figure 6 is a face view of the other driven element.

Referring to these drawings, 10 designates generally the housing of the differential, this housing including the two side walls 11 provided with the outwardly projecting tubular hub portions 12. The two side walls may be part of any suitable housing and the differential be mounted in any desired manner. Preferably, of course, the two side walls of the housing will be connected by the usual circumferentially extending web 14.

Extending through one of the side walls 11 is a driven shaft 15 carrying upon it a disk-like element 16. Extending through the hub 12 of the opposite side wall is a driven shaft 17 which carries upon it the disk-like element 18. The elements 16 and 18 are generally of the same character in that each of these elements is formed on its inner face with cam tracks or series of cams. The element 18 has a single cam track 19 while the element 16 has two cam tracks 20 and 20a.

The shaft 17 projects inward beyond the inner face of the central portion of the disk 18. The cam track 19 is illustrated as formed with two opposed protuberant portions 21 and 2 opposed valleys 22, the faces on each side of the elevations 21 extending gradually downward to the valleys 22. The cam track 20 is provided with two elevated portions 21 and two valleys 22, the elevated portions 23 and the valleys 24 of the inner track 20a being staggered with relation to the elevated portions of the outer cam track 20. The elevations 23 of the inner series are staggered with relation to the elevations 21 of the outer series. Thus the elevations 23 of the inner series are directly opposite to or in line with the valleys 22 of the outer series.

Disposed between the driven elements 16 and 18 is the driving element designated generally 25. This has a central hub 26 apertured to receive the inwardly projecting ends of the shafts 15 and 17. This driven element 25 has the general form of a cage and is formed with an outer series of pockets 27 and an inner series of pockets 28 staggered with relation to the pockets 27, the pockets 27 and 28 extending entirely through the driving element 25 and opening upon the opposite faces thereof. In these pockets 27 and 28 are disposed the wedging elements 29 which as illustrated have the form of truncated cones. The peripheries of these cones roll against the cam faces 19 and 20. The periphery of the driving element 25 is shown as provided with a bevel gear 30 adapted to be engaged by a bevel gear 31 mounted upon a shaft 32 which constitutes the driving shaft of the differential. It is, of course, to be connected to the driving shaft of the automobile in any manner desired, the two shafts 15 and 17 being, of course, connected to the rear wheels of the automobile in the usual manner.

The operation is as follows:—

In driving straight ahead, it will be evident that certain of the wedges of each series will be forced into the constricted space between the crests of opposite cams and will lock the driving element to the driven elements. Thus both of the driven elements will be rotated at the same speed. Inasmuch as the cams of the inner circle of the driving element and of one of the driven elements are staggered with relation to the cams of the outer circle of cams of these elements, it follows that it is impossible for both series of wedge blocks to race at the same time. If, however, one of the driven elements is caused to move at a greater speed than that of the driving shaft as in turning movement, the relative position of the cam faces of the driving and driven elements will be changed and the driven element attached to the shaft which is moving at a greater speed will move ahead with the wedge blocks or rollers, the driving element at this time positively driving that driven element which is moving at a slower speed.

While there has been illustrated and described the construction provided with driving and driven elements having cams provided with two elevated portions and two depressed portions, it is to be understood that this number and the particular shape of the cam faces may be varied without departing from the spirit of the invention as defined in the appended claims. With this construction when power is applied in either direction, both driven wheels will turn with an equal application of power. However, when one wheel itself is turned faster than the driving element is turning, it is released and at the end of its movement induced by outside means, it is again locked into place for transmission of power from the machine when the speed of the wheel becomes the same as that of the driven element. In turning a corner, this construction does not in any respect interfere with the operation of an automobile, but permits one wheel to move faster than the other as is necessary in such an operation. Any number of rollers may be used corresponding to the number of cams and, therefore, it is understood that it is not limited to the number of rollers and number of cams to be used.

The claims:—

1. A gearless differential including two confronting rotary driven elements and an intermediate driving element, the driving element having an inner series of pockets and an outer series of pockets staggered with relation to the first-named series, one of the driven elements having its inner face formed to provide two series of concentric cams, the elevations of one series being staggered with relation to the elevations of the other series, the other driven element having a single series of cams, the series having a width equal to both series of cams on the other driven element, and wedging rollers disposed radially in said pockets and bearing against the confronting faces of the driven elements, said rollers being frusto-conical in form.

2. A gearless differential including two confronting rotary driven elements and an intermediate driving element having gear teeth, a driving gear wheel engaging said gear teeth and having a shaft adapted to be operatively connected to the driving shaft of an automobile, said driving element having an inner series of radial pockets and an outer series of radial pockets, the outer series being staggered in relation to the inner series, one of said driven elements having on its inner face a single series of cam elevations and depressions extending radially entirely across the two series of pockets, the opposite driven element being formed to provide two series of concentric cams upon its inner face corresponding to the two series of pockets, the elevations of one series of cams being staggered with relation to the elevations of the other series, and wedging rollers disposed in said pockets and bearing against the confronting faces of the driven elements.

3. A gearless differential including two confronting rotary driven elements and an intermediate driving element, a housing including side walls, the driven elements having shafts extending through said side walls, said shafts extending inward past the inner faces of the driven elements, the driving element having a central opening into which the inner ends of the shafts of the driven elements are received, said driving element having an inner series of radial pockets and an outer series of pockets and being formed with gear teeth, a driving gear wheel engaging said gear teeth, one of the driven elements having its inner face formed to provide a single series of cam depressions and elevations having a width equal to the width of the two series of pockets on the driving element, the opposite driven element being formed to provide two series of concentric cams upon its inner face corresponding to the two series of pockets, the cam elevations of one series being staggered with relation to the cam elevations of the other series, and wedging rollers disposed in said pockets and having their axes radial to the center of motion of the driving element, the rollers bearing against the confronting faces of the driven elements.

In testimony whereof I hereunto affix my signature.

IVA WALLS,
Guardian of Andrew Francis Ford, incompetent.