

June 19, 1928.

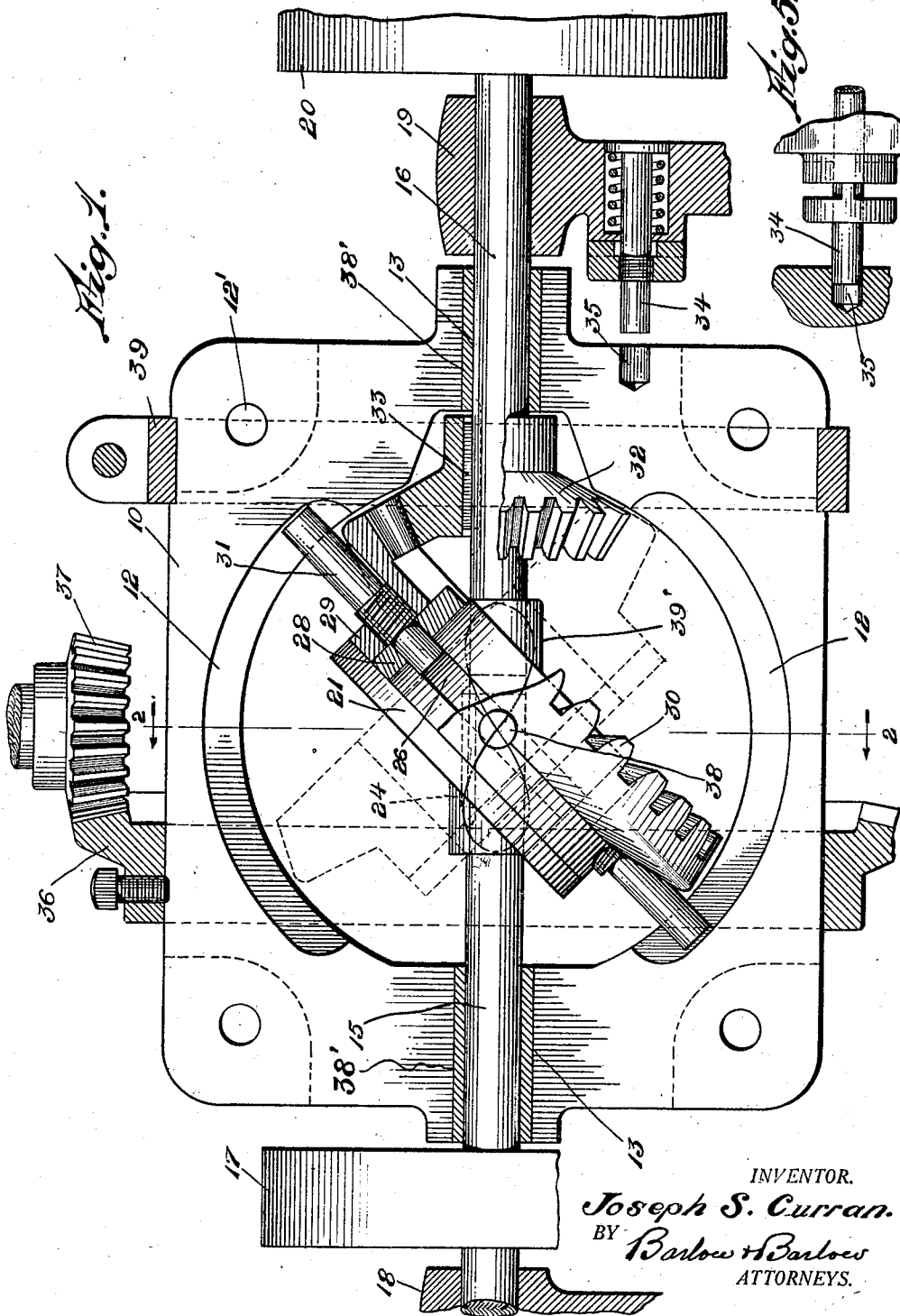
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1,674,355

DIFFERENTIAL MECHANISM

Filed Oct. 5, 1925

2 Sheets-Sheet 1



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Fig. 2.

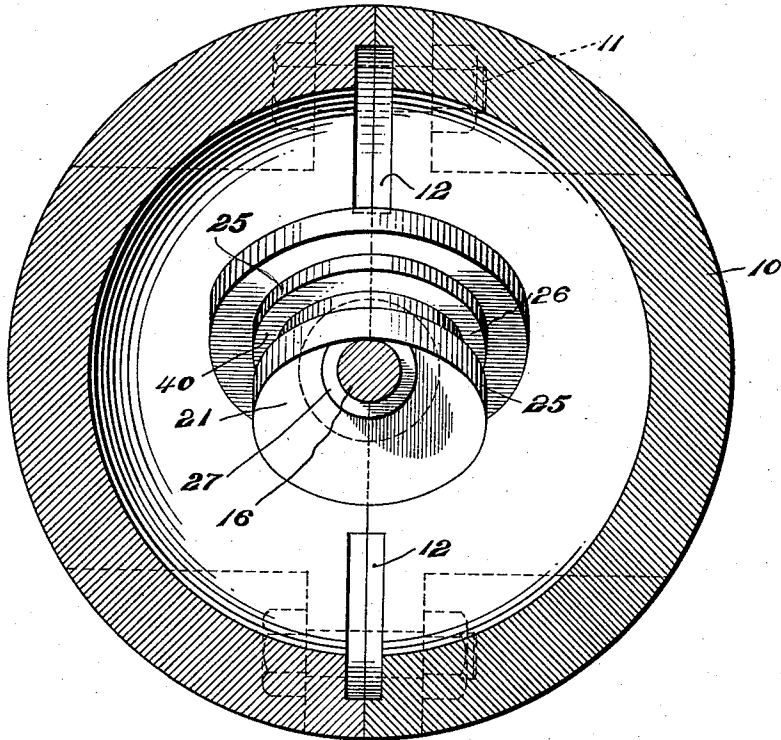


Fig. 4.

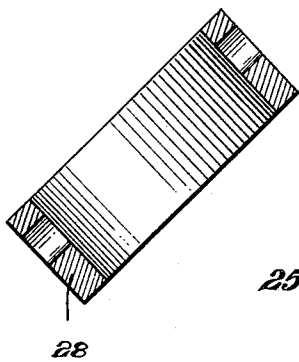
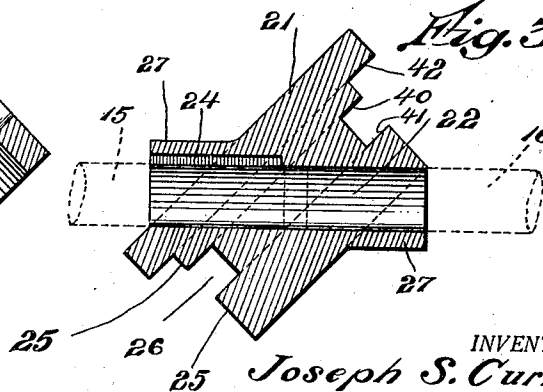


Fig. 3.



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DIFFERENTIAL MECHANISM.

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This invention relates to an improved mechanical movement; and has for its object to provide mechanism by which I obtain certain mechanical movements to be utilized for purposes for which they may be adapted, this mechanism includes a cam head mounted on and driven by a shaft, the working face of this cam head being set on an angle to the axis about which it rotates and on this cam head I mount a gear which rotates on the periphery of the cam head member being held against axial rotation relative to its casing by a guide which permits a longitudinal motion of the guided portion thereof during the rotation of said cam head.

A further object of the invention is the provision of a differential mechanism including a rotatably mounted casing having a longitudinally-disposed guide therein and in this casing is mounted a cylindrical cam head which is fixed to a driving shaft and on this cam head I have mounted a gear which serves to impart a rotating motion to a pinion mounted on a second shaft, whereby the rotation of either of these shafts will rotate the other in an opposite or reverse direction when the casing is held, or a rotation of the casing will transmit rotation to either or both of said shafts.

With these and other objects in view, the invention consists of certain novel features of construction and operation, as will be more fully described, and particularly pointed out in the appended claims.

In the accompanying drawings:

Figure 1 is a side elevation of my improved mechanism with one of the halves of the casing removed showing the mechanism mounted therein.

Figure 2 is a sectional view on line 2—2 of Figure 1, showing the angularly-disposed cam head as mounted on one of the shafts.

Figure 3 is a sectional side elevation of the cam head member as mounted on the two shafts, shown in dotted lines.

Figure 4 is a sectional side elevation of a bushing as removed from the gear or casing.

Figure 5 shows the lock pin in engaged position.

It is found in the practical construction and operation of certain machinery in which certain movements are required to accomplish certain results that in order to obtain these different movements by mechanism housed within a given space and to operate in time with other portions of the mechanism, of advantage to provide a mechanism which is very simple in its construction and yet which is capable of performing differential movements between the two shafts on which it is mounted, that portions of the mechanism shall also be adapted to impart reverse motion, also a motion similar to that of the figure 2, and the mechanism may also if desired be employed as a whole as a differential gearing in combination with the rear axle of motor vehicles, or for any other purpose for which it is adapted; and the following is a detailed description of the present embodiment of my invention and showing one construction of mechanism by which these advantageous results may be accomplished:—

With reference to the drawings, 10 designates the casing for my improved mechanism which may be cylindrical in cross section, as best illustrated in Figure 2, the casing being preferably made in halves and the halves secured together by bolts 11 passed through the holes 12'. This casing has a spherically-shaped central opening and in the upper and lower walls thereof, preferably at the parting line, I have formed guide slots 12 for the purpose presently described, and the ends of this cylindrical casing are bored to receive bushings 38, forming bearings 13, one for the shaft 15 and the other for the shaft 16.

Shaft 15 is herein shown as being provided with a driving or driven pulley 17, as the case may be, and is provided with an outer bearing 18, while shaft 16 is provided with an outer bearing 19 and a drive or driven pulley 20. A friction band 39 or a lock pin 34 may be employed for holding the casing against rotation when desired. On the inner ends of these two shafts 15 and 16 is mounted a cam head 21 which is provided with hubs 27 bored as at 22 to receive the ends of shafts 15 and 16. Shaft 15 is keyed as at 24 to this cam head while the end of shaft 16 runs free therein. This cam head is set with its working or peripheral face 25 at an angle to the axis of the shafts on which it is mounted, and its working, peripheral face is herein shown as being provided with an annular guide groove 26, which perform the function of two cam surfaces 40 and 41 parallel to the cam surface 42. On this cam head 21 I have mounted a removable bushing 28 and on this bushing I have mounted the hub 29 of the larger

beveled gear 30, which latter hub is herein shown as being secured to the bushing by the guide pin 31. The inner end of this pin extends down into the cam groove 26 in the cam head and its outer end engages the guide slot 12 in the casing, whereby the gear is held against revolving relatively to the casing 10 but is permitted a swinging or twisting rotary oscillating movement at right angles to the axis of the shaft, and the casing may be held against rotation by a lock pin 34, or by a suitably operated friction band 39 and also by the ring gear 36 fastened thereto and pinion 37 meshing with said ring gear, when desired.

When the casing is held or rotated and the shaft 15 and cam head 21 are rotated, the larger gear 30 which is mounted on the cam, receives a wobbling motion, thus causing the teeth of this gear which engage those of the pinion 32 keyed to the shaft 16, to rotate this pinion 32 in the opposite or reverse direction and through it drive the shaft 16 at the same speed as the driving shaft 15, and by using shaft 16 as the driver, the same speed imparted by that shaft will be transmitted through the gears and cam head to shaft 15 in the opposite or reverse direction.

When it is desired to impart a rotating movement to the casing I release the friction band and withdraw the stop pin 34 therefrom if the latter should also be used and move the outside beveled gear 36 into engagement with the driving pinion 37, then the casing will be rotated and serves to impart a similar rotation to both of the shafts 15 and 16, and when either one of these shafts is held against rotation the other will receive a rotation relative thereto in the same direction as is the case with other differential mechanism. In other words, one shaft will rotate at the expense of the other to produce a differential movement between them.

When it is desired to use shaft 16 as the driver, with the casing free to revolve independently of its drive gears 36 and 37, assuming shaft 15 is held, the pinion 32 is caused to rotate gear 30 in an oblique plane as a skew gear, and through pin 31 rotate the casing at one-half the speed of the driving shaft 16 because of the gear ratio one to two. but if shaft 16 and pinion 32 are held and power is applied through shaft 15 to cam head 21, a wobbling, oblique or skew motion will be transmitted to gear 30 which revolves the casing through pin 31 at one-half the speed of the driving shaft 15 because of said wobble and gear ratio.

A figure 8 movement is imparted by this mechanism to trunnion 38 fixed to gear 30, which trunnion extends in a direction at a right angle to the guided portion thereof when the casing is held and gear 30 is wobbling, in which case the center of this trunnion 38 will describe a perfect figure 8, as

illustrated by dot-dash lines at 39', in Figure 1, due to the swinging of the gear 30 through the trunnion as well as swinging at the same time about an axis at right angles thereto, which motion may be utilized for obtaining various results in certain mechanisms to which it may be attached. My improved mechanical movement or differential mechanism is extremely simple in its construction and by its use a great variety of results not heretofore obtained, may be readily produced.

It will be noticed that when the shaft 16 is held against rotation and the shaft 15 is driven and the casing is allowed to revolve freely the pin 31 describes a circle in a plane oblique to the axis of the shafts 15 and 16 in a counter-clockwise direction as viewed from the right hand end of Figure 1, while the trunnion 38 will describe a circle in the same direction of rotation and in a plane at right angles to the plane of rotation of the pin 31 and likewise oblique to the axis of these shafts.

By the term "gear" in the specification and claims, I mean either a gear with teeth or a gear blank, or a construction which does not have teeth cut thereon. By the term "casing" I mean an inclosure for the cam-head and its adjacent structure, or a skeleton frame structure which is adapted to have mounted thereon a beveled gear 36 for driving the same.

The foregoing description is directed solely towards the construction illustrated, but I desire it to be understood that I reserve the privilege of resorting to all the mechanical changes to which the device is susceptible, the invention being defined and limited only by the terms of the appended claims.

I claim:

1. In a differential mechanism, a sectional casing, means for rotating said casing, an internal arcuately shaped longitudinally disposed guide groove in said casing, a shaft journaled in said casing, a cylindrical cam head fixed to said shaft, the working periphery of which is disposed at an angle to the axis of said shaft, a gear rotatably mounted on said cam head, a guide pin fixed to said gear to engage said groove which is substantially parallel with the axis of said shaft to rotate said gear, a second shaft journaled in said casing, a pinion gear fixed to said second shaft connecting said shaft to said toothed gear, bearings in said casing to maintain both shafts in axial alignment, whereby a rotation of the casing will transmit rotation to either or both shafts.

2. In a differential mechanism, a sectional casing, means for rotating said casing, longitudinally disposed guide grooves in said casing, a shaft journaled in said casing, a cylindrical cam head fixed to said shaft, the working periphery of said cam head being

disposed at an angle to its axis of rotation, a toothed gear rotatable on said cam head, means coacting with said groove for holding said gear from rotation relative to said casing but adapted to impart a unitary motion to said gear with said casing, a second shaft journaled in said casing, a pinion gear connecting said second shaft to first said shaft through said cam head and toothed gear, means for holding said casing against rotation, whereby a rotation of either shaft will rotate the opposite shaft in the opposite direction when the casing is held or rotated, at a speed relative to the speed of the first said rotated shaft and its attendant structure and coacting stationary or rotated casing.

3. In a differential mechanism, a rotatably mounted casing having a longitudinally disposed guide therein, means for driving said casing, a shaft journaled in said casing, a cylindrical cam head fixed to said shaft, the working periphery of said cam head being disposed at an angle to its axis of rotation, a toothed gear mounted on said cam head, a pin for holding said gear against rotation relative to said casing by engagement with said guide, a second shaft journaled in said casing with its end also journaled in said cam head, a pinion gear connecting said second shaft to said toothed gear, whereby a rotation of the casing will transmit rotation to either shaft at different speeds or both of said shafts in the same direction at the same speed as that of the casing according to the inverse of the torque resistance on said shaft.

4. In a differential mechanism, a casing having a longitudinally disposed guide therein, a bevel gear secured to said casing, a pinion for driving said gear, a shaft journaled in said casing, a cylindrical cam head fixed to said shaft, the working periphery of said cam head being disposed at an angle to its axis of rotation, a toothed gear rotatably mounted on said cam head and having means engaging said head to prevent relative lateral movement thereon and having means in engagement with said guide to prevent rotation relative to said casing, a second shaft journaled in said casing and said head, a pinion gear connecting said second shaft to said toothed gear, whereby rotation of either shaft will rotate the casing or a rotation of the casing will transmit rotation to either of said shafts at different speeds or both shafts at same speed as that of said casing.

5. In a differential mechanism, a sectional casing, means for rotating said casing, means for holding said casing against rotation, longitudinally disposed guide grooves in said casing, a drive shaft journaled in said casing, a cylindrical cam head fixed to said shaft, the working periphery of said cam head being disposed at an angle to its axis

of rotation, a toothed gear rotatable on said cam head, means coacting with said grooves for holding said gear from rotation adapted to impart a unitary motion to said gear with said casing, a second shaft journaled in said casing, a pinion gear connecting said second shaft through said toothed gear and cam head to first said shaft, whereby rotation of either shaft will rotate the casing and attendant ring gear and pinion, or rotation of said pinion will transmit rotation to either of said shafts at different speeds or both shafts at same speed as that of said casing.

6. In a mechanical movement, a cylindrical cam head member mounted on and driven by said shaft with its working peripheral face set diagonally to its plane of rotation, a gear rotatably mounted on said cam head, a guide pin in said gear, a means substantially parallel with the axis of said shaft to receive said pin and hold the gear against rotation but permit a longitudinal swinging movement of said guided portion thereof and permit an oscillating and swinging movement, a trunnion extending outwardly from said gear at right angles to said pin, whereby said trunnion is caused to describe a figure 8 during a complete revolution of the shaft and cam head.

7. In a mechanical movement, a casing, a guide groove in said casing, a shaft in said casing, an obliquely disposed cam head fixed to said shaft, a toothed gear mounted on said cam head, a pin fixed to said gear to engage said groove, a second shaft in said casing, a pinion gear fixed to said second shaft connecting said shaft through said toothed gear and cam head to first said shaft, a trunnion fixed to said toothed gear at right angles to said pin, whereby rotation of said shaft and cam head will rotate the casing through said toothed gear and pin, said pin being rotated in an oblique plane and said trunnion rotated in an oblique plane at right angles to the plane of rotation of said pin, or rotation of the shaft and pinion will rotate the casing through said toothed gear and pin, said pin and trunnion being rotated in the same oblique plane.

8. In a one way clutch mechanism, a casing, means for rotating said casing, longitudinally disposed guide grooves in said casing, a shaft in said casing, a cylindrically shaped cam head fixed to said shaft the working periphery of said cam head being disposed at an angle to said shaft, a toothed gear slidably and rotatably mounted on said cam head, means coacting with said grooves for holding said gear from rotation relative to said casing but adapted to impart a unitary motion to said gear with said casing, means for holding said casing against rotation, a second shaft in said casing, a pinion gear connecting said second shaft to first said shaft through said toothed gear and

cam head, whereby a combined unitary rotation of either shaft and casing will rotate the other shaft in the same direction at the same speed, or with a suitable arrangement
5 of gear ratio and angle of adjustment a rotation of the shaft and cam head will not transmit rotation to the casing or other shaft.

9. In a two way clutch mechanism, a casing, means for rotating said casing, longitudinally disposed guide grooves in said casing, a shaft in said casing, a cylindrically shaped cam head fixed to said shaft the working periphery of said cam head being
15 disposed at an angle to said shaft, a toothed gear slidably and rotatably mounted on said cam head, means coacting with said grooves for holding said gear from rotation relative to said casing but adapted to impart a unitary motion to said gear with said casing,
20 a second shaft in said casing, means for holding said casing against rotation, a pinion gear connecting said second gear to the first said shaft through said toothed gear
25 and cam head, whereby a combined unitary rotation of either shaft and casing will rotate the other shaft in the same direction at the same speed, or rotation of either shaft when the casing is held against rotation will

rotate the opposite shaft at the same speed
30 in the opposite or reverse direction.

10. In a clutch mechanism, a casing, means for rotating said casing, longitudinally disposed guide grooves in said casing, a shaft in said casing, a cylindrically shaped
35 cam head fixed to said shaft the working periphery of said cam head being disposed at an angle to said shaft, a toothed gear slidably and rotatably mounted on said cam head, means coacting with said grooves for
40 holding said gear from rotation relative to said casing but adapted to impart a unitary motion to said gear with said casing, means for holding said casing against rotation, a
45 second shaft in said casing, a pinion gear connecting said second shaft to the first said shaft through said toothed gear and cam head, whereby a combined unitary rotation of either shaft and casing will rotate the
50 other shaft in the same direction at the same speed, or with suitable arrangements of gear ratios and angles of adjustment, rotation of the shaft and cam head when the casing is held against rotation transmits rotation to
55 the other shaft at any desired speed in the opposite or reverse direction.

In testimony whereof I affix my signature.
JOSEPH S. CURRAN.