No. 708,228

Patented Sept. 2, 1902.

E. G. HOFFMANN.

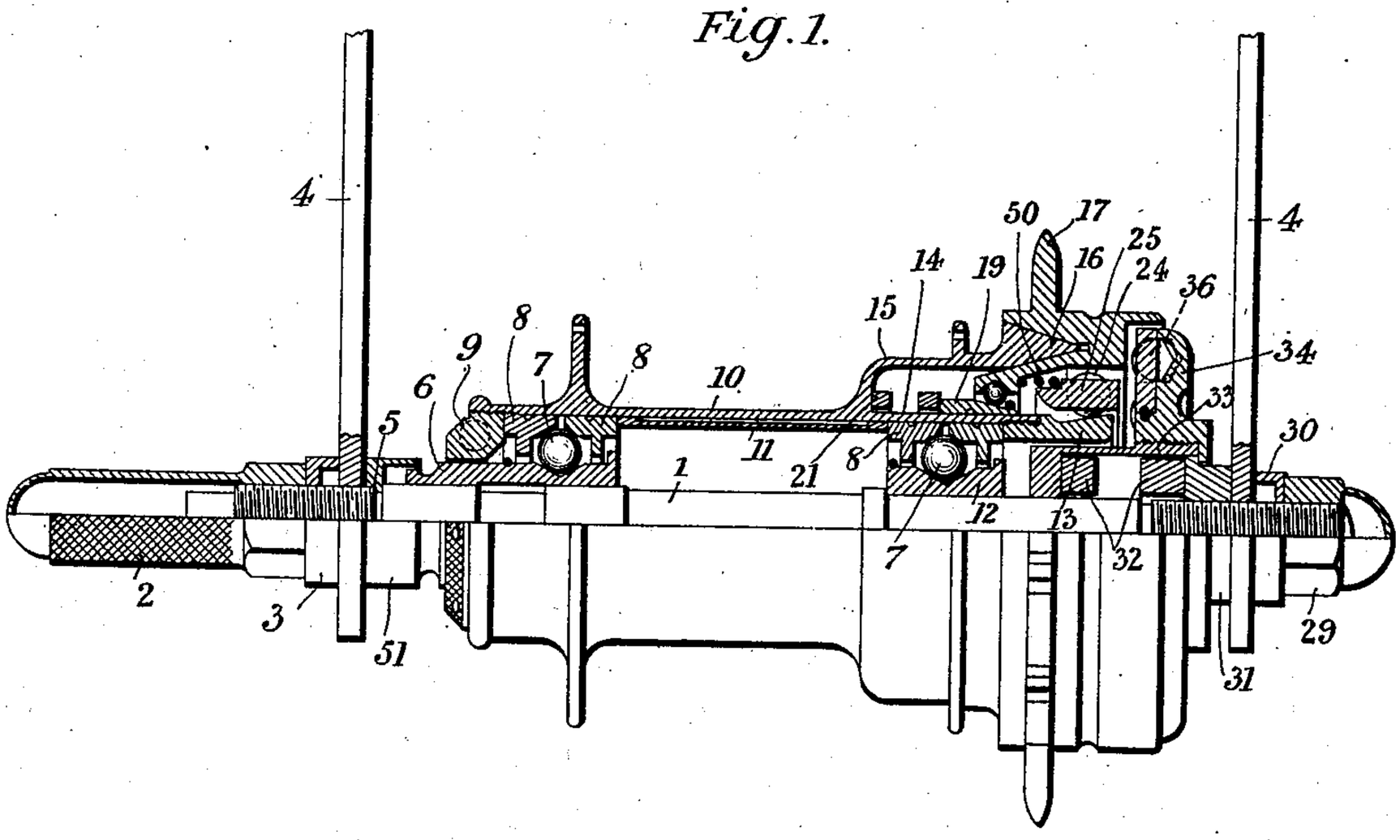
BACK PEDALING BRAKE.

(Application filed May 10, 1900.)

(No Model.)

3 Sheets—Sheet 1.

Fig. 1.



WITNESSES.

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(No Model.) 3 Sheets—Sheet 2.

Fig. 2.

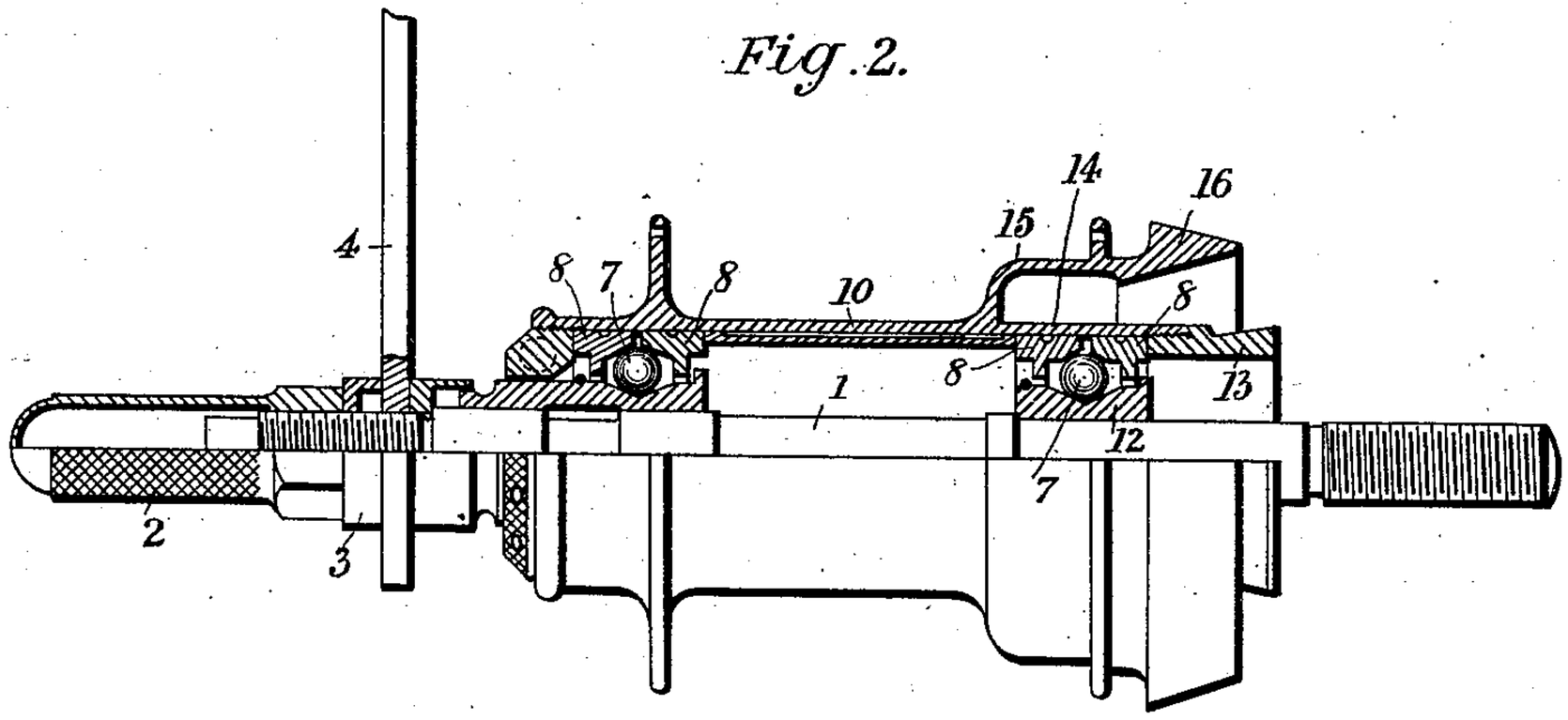

Fig. 3.

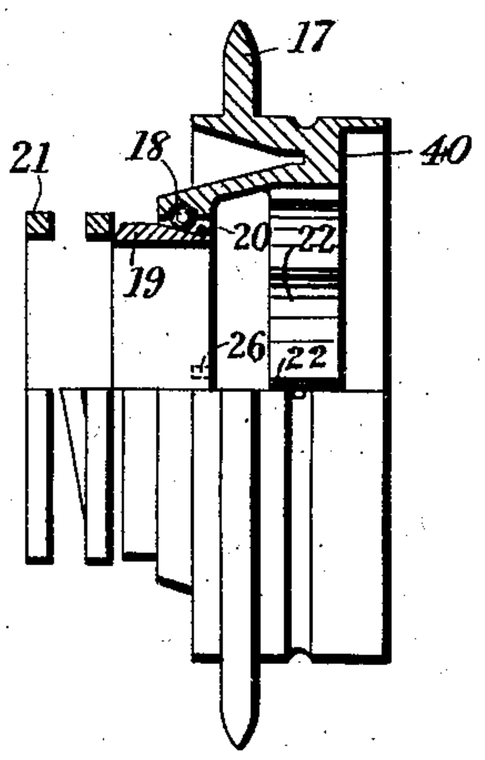

Fig. 4.

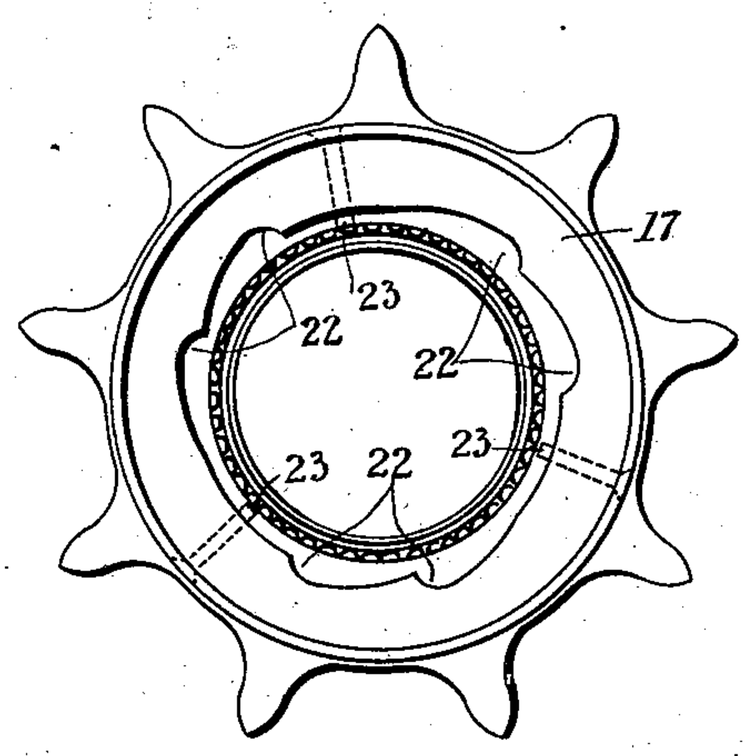

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Fig. 5.

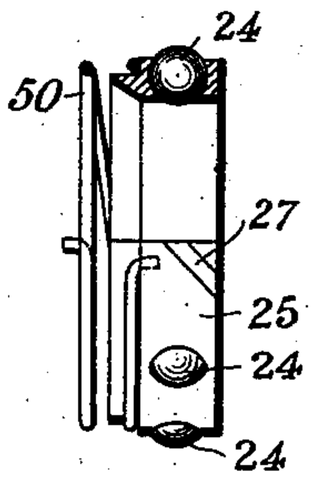


Fig. 6.

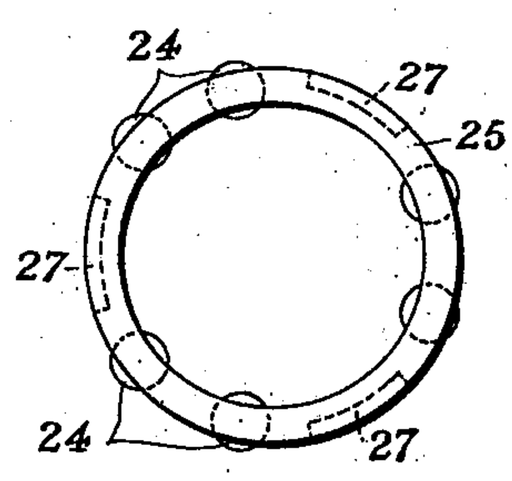


Fig. 7.

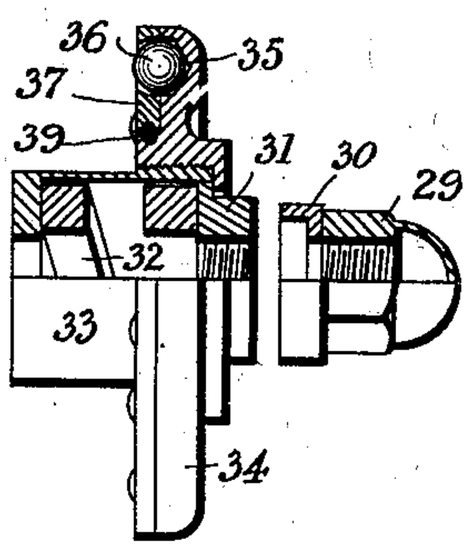
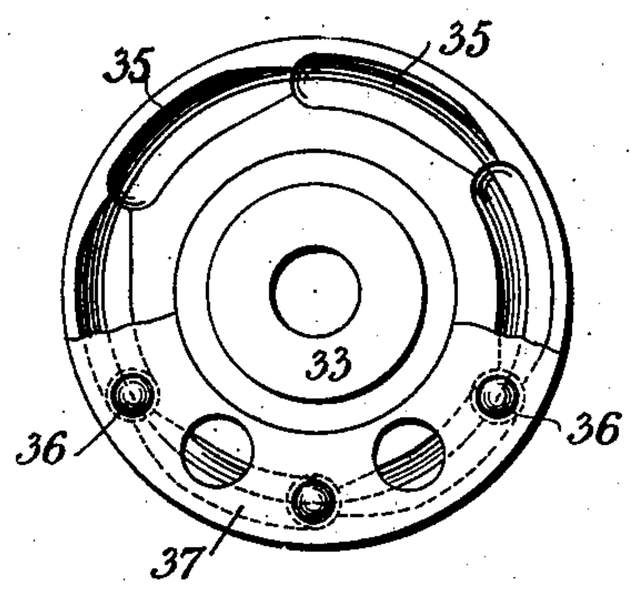


Fig. 8.



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UNITED STATES PATENT OFFICE.

ERNST GUSTAV HOFFMANN, OF CHELMSFORD, ENGLAND.

BACK-PEDALING BRAKE.

SPECIFICATION forming part of Letters Patent No. 708,228, dated September 2, 1902.

Application filed May 10, 1900. Serial No. 16,147. (No model.)

To all whom it may concern:

Be it known that I, ERNST GUSTAV HOFFMANN, a subject of the German Emperor, residing at Chelmsford, in the county of Essex, England, have invented a certain new and useful Back-Pedaling Brake, of which the following is a specification.

My invention relates to certain improvements in the form of driving and brake mechanism frequently employed for cycles and usually known as "free-wheel" mechanism, one of the objects of my invention being to produce mechanism which is self-contained, so that the wheel-hub carrying same may be applied to existing wheels, the braking portion of the device necessitating no connection with the frame of the vehicle, as is the case with some forms of these devices.

In carrying out my invention I cause the driving and the braking action to take place between the same members, which in the construction I am about to describe as an illustration are the sprocket-wheel or equivalent part driven from the pedals and a surface carried by the hub.

I have illustrated in the accompanying drawings the form which I consider at the present time the most suitable for carrying my invention into effect, though it will be understood that there are various other ways in which the parts may be arranged and the requisite movements obtained.

In the drawings, Figure 1 is a longitudinal elevation, one-half being in section, of a wheel-hub having my invention applied thereto. Fig. 2 is a similar view, but with the sprocket-wheel and attached parts removed. Fig. 3 is a part elevation and part section of the sprocket-wheel and spring-controlled bearing detached. Fig. 4 is an end elevation of the sprocket-wheel. Fig. 5 is a part elevation and part section of the ball-cage which effects the driving. Fig. 6 is an end elevation of same. Fig. 7 is a part elevation and part section of the brake-cam and connected parts which effect the braking; and Fig. 8 is a face view of the disk portion of same to show the cam-surfaces, the other parts being partially removed.

In the drawings, 1 is the usual spindle carrying the foot-step 2, screwed up to washer 3 against the frame-fork 4, which is held against the washer 51, which abuts against a shoulder 5 on the spindle. On the spindle is a sleeve 6, having two conical faces forming a race for a series of balls 7, the adjusting-cones of which consist of rings 8 8, adjustable by means of a lock-nut 9 of some suitable type. Such rings and lock-nut are contained in the cylindrical hub-body 10, and the adjustment obtained by the lock-nut for the ball-bearing described is communicated by means of the sleeve 11 to similar cone-rings 8 8 at the other end of the hub, the balls 7 bearing on which run on a double-cone-faced sleeve 12 on the spindle. The outer ring of the last two rings 8 abuts against a ring 13, having a conical face, which is screwed to an extension 14 of the hub 10. The hub has also an enlarged or expanded extension 15, carrying a double cone 16, which in the case shown is formed in one with the hub, but which may be formed of phosphor-bronze or some other suitable metal or be faced with leather in order to allow it to grip a correspondingly-shaped surface formed in the sprocket or other wheel 17. This sprocket-wheel consists of a chambered ring having a race for a series of balls 18, such race having a double-coned face, while the balls bear upon a conical sleeve 19, capable of sliding on the extension 14, such part 19 being prevented from slipping away from the balls when the sprocket-wheel is detached, as shown in Fig. 3, by a spring-wire 20, sprung into a groove in the end of same and the projection of which above its surface is sufficient to hold the parts together. A coil-spring 21 seats in the recess of the hub formed between the extensions 14 15 and tends to press the sleeve 19 forward. Inside the chambered portion of the sprocket-wheel are a series of cam-surfaces 22, and projecting into spaces between such cams are pins 23. Bearing on the conical face of the ring 13 and between same and the cam-surfaces 22 is a series of balls 24, held in a cage 25, into a hole in which is turned one end of a coil-spring 50, as seen in Fig. 5, the other end of which is similarly turned into a hole in the chambered portion of the sprocket, as shown at 26 in Fig. 3. The cage is provided on its

outer periphery with three spiral or angular grooves 27, as shown in Figs. 5 and 6, with which grooves engage the pins 23. Screwed upon the other end of the spindle 1 is a nut 29, having a washer 30 between it and the other fork 4, which in turn is held against a washer 31, which is screwed to the spindle and abuts against an extremely powerful spring 32, contained in a box 33, surrounding the spindle. To this box is screwed a disk 34, (see Figs. 7 and 8,) having a series of cam-surfaces 35 formed in a groove in same, such cam-surfaces gradually decreasing in depth from one end to the other. A ball 36 rests on each cam-surface and is held in place by a cage 37, as shown in Fig. 7, such cage consisting of a ring having openings therein, the edges of which are burred over or otherwise, so as to prevent the largest diameter of the ball passing through. This cage is retained in the disk by a split ring of wire 39, which is sprung into grooves partly formed in the disk and partly in the edge of the cage, as shown. The balls when at the highest points of the cam-surfaces project and are then in contact with the surface 40 of the sprocket-wheel.

It will be seen that upon removing one of the nuts at the ends of the spindle the latter can be unscrewed from the washer 31 and withdrawn, so that all the parts may be removed separately from the hub, as shown in Figs. 3, 5, and 7.

The position shown in Fig. 1 is that of driving. In this case an increased or a forward movement of the sprocket-wheel over that of the wheel-hub will cause the balls 24 to rise up the cam-surfaces 22 radially; but as they also travel upon the conical surface 13 the movement is changed as the balls reach their highest point to a longitudinal or lateral motion, which forces the cage 25 to the left, partly rotates the spring 50, and drives the conical surfaces of the sprocket-wheel 17 into engagement with the part 16 of the hub, so that both rotate together. This motion of the sprocket-wheel coming into engagement with the hub is a spiral one or similar to that of a high-pitch screw-thread, the radial and lateral movements of the combined balls, which together produce the spiral motion, imparting the same motion to the sprocket, the cage following such motion the balls begin to grip between the cam-surfaces, while the spring 50 causes the balls guided by the cage to be always ready for action or for forward engagement. As soon as the hub runs faster than the sprocket, which is the position when the pedals are held stationary by the feet, the spring 21 forces the sleeve 19, ball-bearing sprocket-wheel, and cage to the right, so that the reverse spiral movement takes place. The sprocket 17 is accordingly withdrawn from contact with part 16, and the hub and wheel run freely, the sprocket being thus brought with its surface 40 into contact with the balls 36 of the disk 34, which I call the "brake-cam," but without any action on same save that of rotating the balls. When braking is desired, the sprocket is rotated, necessarily in the reverse direction, with the result that the movement of same acting on the balls 36 causes them to travel toward the highest point of the cam-surfaces 35, so that the sprocket is moved back laterally into contact again with part 16 (which, it will be seen, acts both for driving and braking) and united firmly therewith, so that the hub and sprocket again come into contact and the sprocket acts with a retarding effect upon the hub, the action being controlled by the pedals, with the result that the braking action is analogous to back-pedaling in an ordinary machine, being done by holding back upon the pedals by the feet in the usual way, which thus holds the sprocket, with the result that the friction of same against the balls of the disk causes the latter in their rotation to rise up their cam-surfaces and force the sprocket laterally back against the forwardly-rotating hub portion, so that such hub portion and wheel have their momentum checked to an extent which is regulated by the pressure placed by the foot upon the pedals. It will be understood that the disk 34 for this purpose should be rigidly fixed upon the spindle 1 in order to give the necessary fixed abutment to receive the thrust of the balls 36, and this is practically the case in the arrangement described; but I have found it necessary in providing means for allowing the cycle or vehicle to be moved backward to avoid a possible engagement of the sprocket with the balls of the brake-cams whereby the pressure may become excessive in a longitudinal direction upon the disk 34. This is therefore provided for by the spring 32, which is sufficiently strong to hold the disk in position as an abutment firmly enough for braking purposes, but which will allow it to yield slightly to prevent it or any of the parts breaking by an excess of pressure exerted between the disk and the sprocket, as the balls may, if the disk 34 yields sufficiently, rise up the length of each cam-surface and drop into the next one or may cause the disk 34 and box 33 to rotate backwardly around the spindle 1 at the same speed as the hub and wheel.

It will be understood that the spring 32 is sufficiently strong to hold the disk 34 against any pressure used in back-pedaling, so that during this action the disk is practically one with the spindle, and that such disk only yields to allow the wheel to travel backwardly, as such backward movement of the wheel starts by causing a jamming of the balls against the surface 40 of the sprocket, which would prevent the wheel from rotating backwardly and probably fracture the parts if such a yielding means were not provided. In considering this relief action of spring 32 it should be realized that in back-pedaling the disk 34 acts practically as a fixed part and

does not yield by the spring coming into action, as in back-pedaling, because the force applied has first to overcome the forward motion of the rotating wheel, and hence no pressure which can be exerted in this way is sufficient to cause the spring and disk to yield, which would fail to provide the necessary fixed part, while in back-wheeling from a stationary position the sprocket and hub come at once into engagement and, moving back together, move the balls on the fixed part, which rise on their cams and would jam if the relief-spring did not come into operation under the powerful pressure so exerted.

What I claim is—

1. In a driving and braking mechanism, the combination with a hub having a flange on same, and a spindle on which the hub can rotate, of a free driving member, means carried by the hub for obtaining a lateral motion of such member to bring it into contact with the flange on the hub for driving purposes and means carried by the spindle for obtaining a similar lateral motion of such member to bring it also into contact with the flange on the hub for braking purposes.

2. In a driving and braking mechanism, a hub, a spindle on which same can rotate, a free driving member at the extremity of said hub having interior cam-surfaces, a projection carried by the hub having a conical face, a cage inside such free driving member and movable over such conical face, a flange on the hub coöperating with the free driving member and movable parts in such cage cooperating with the conical face and the cam-surfaces of the free driving member whereby aforward movement imparted to the free driving member will produce a movement of the cage and impart a lateral movement to said free driving member to bring it into frictional contact with the flange on the hub.

3. In a driving and braking mechanism, a hub, a spindle on which same can rotate, an abutment carried by the spindle having cam-surfaces, movable parts on such cam-surfaces, a free driving member between the hub and the abutment having interior cam-surfaces, a flange on the hub coöperating with the free driving member, a projection carried by the hub having a conical face, a cage inside such free driving member and movable over such conical face, movable parts in such cage, coöperating with the conical face and the cam-surfaces of the free driving member whereby a forward movement imparted to the free driving member will produce a spiral movement of the cage and impart a lateral movement to said free driving member to bring it into frictional contact with the flange on the hub for driving while a backward movement of the free driving member causes the movable parts on the abutment to rise up the cam-surfaces and also force the free driving member frictionally against the flange on the hub for braking.

4. In a driving and braking mechanism, the combination with the hub of a free driving member, a series of cam-surfaces on the interior of same, a conical face carried by the hub, and rolling parts between the conical face and the cam-surfaces whereby a forward movement given to the free driving member will give the rolling parts a tendency to travel up the conical face the movement of the free driving member also causing them to roll on the cam-surfaces of such member the combined movement producing a spiral movement of the free driving member in the direction of the hub with which it then engages.

5. In a driving and braking mechanism, a hub, a flange on same, a spindle on which same can rotate, a disk-shaped abutment on the spindle having cam-surfaces and rolling parts thereon, a free driving member between the hub and the abutment having a series of cam-surfaces in the interior of same, a projection carried by the hub having a conical face, and rolling parts between such conical face and the cam-surfaces of the free driving member whereby a forward movement imparted to the free driving member will also act to produce in it a spiral movement to bring it into frictional contact with the flange on the hub for driving, a backward movement of the free driving member causing the rolling parts on the abutment to rise up the cam-surfaces thereof and also force the free driving member frictionally against the flange on the hub for braking.

6. In a driving and braking mechanism, and in combination, a hub having an expanded extension 15, a projection 14, a conical ring carried thereby, a spindle on which such hub can rotate, a disk-shaped abutment on the spindle having a series of cam-surfaces thereon, a rolling part for each cam-surface, a free driving member between the abutment and the hub having a series of cam-surfaces in the interior of same, balls between the cam-surfaces of such free member and the conical ring, a ball-bearing for such free member, a conical sleeve 19 adapted to slide on the projection 14 and forming part of such bearing, and a spring for pressing such sleeve 19 forwardly so that adjustment of the bearings is constantly maintained.

7. In a driving and braking mechanism, the combination with a hub, a flange on same, a spindle on which said hub can rotate, an abutment on the spindle having cam-surfaces and rolling parts thereon and a free driving member between the hub and its abutment having cam-surfaces inside same, of a projection 14 on said hub, having a conical surface 13, a loose cage between such surface and the free driving member, balls carried by such cage adapted to contact with the conical surface 13 and the cam-surfaces of the free driving member and a coil-spring engaging with the free member and with the cage whereby

the latter will be kept in a position so that the balls will be forced into the narrowest point between the cams on the free driving member and the conical surface so that the free driving member is always ready for forward driving.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

ERNST GUSTAV HOFFMANN.

Witnesses:
ALLEN PARRY JONES,
HERBERT ARTHUR MARSHALL.