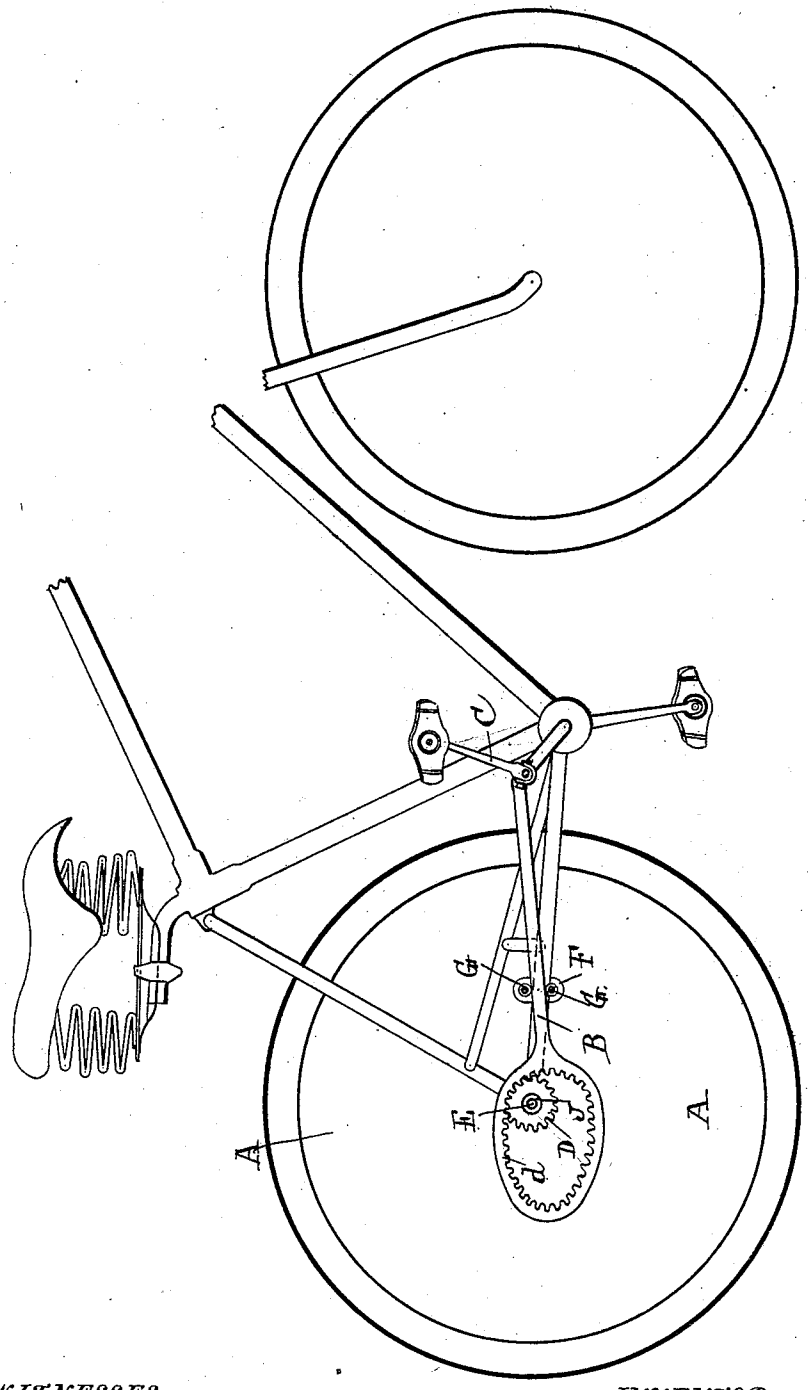
(No Model.) 5 Sheets—Sheet 1.

# G. S. WEBB.

## DRIVING MECHANISM FOR BICYCLES.

No. 527,568. Patented Oct. 16, 1894.

FIG. 1.

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## DRIVING MECHANISM FOR BICYCLES.

No. 527,568. Patented Oct. 16, 1894.

FIG. 2.

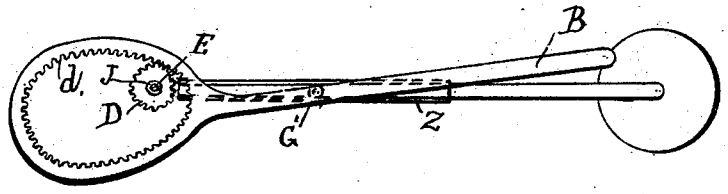


FIG. 3.

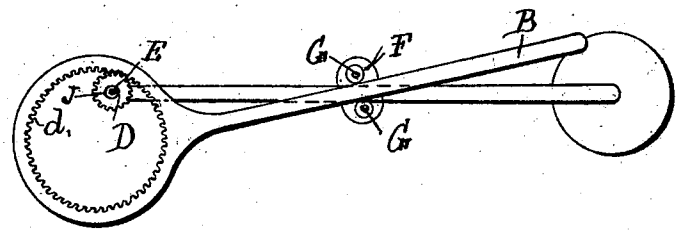


FIG. 4.

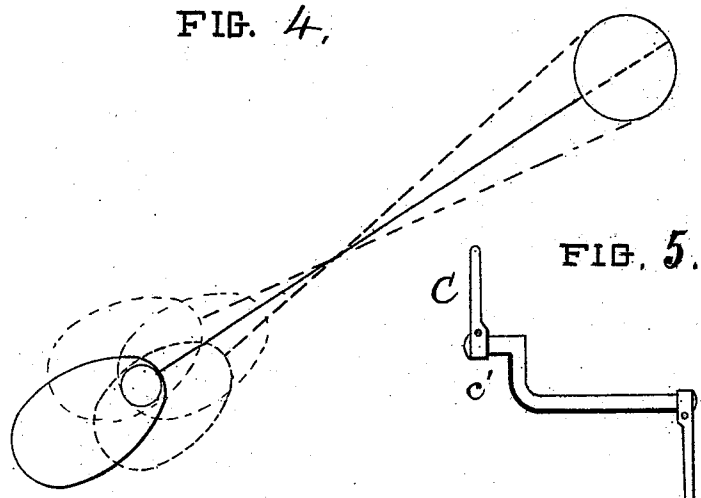

FIG. 5.




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# G. S. WEBB.

## DRIVING MECHANISM FOR BICYCLES.

No. 527,568. Patented Oct. 16, 1894.

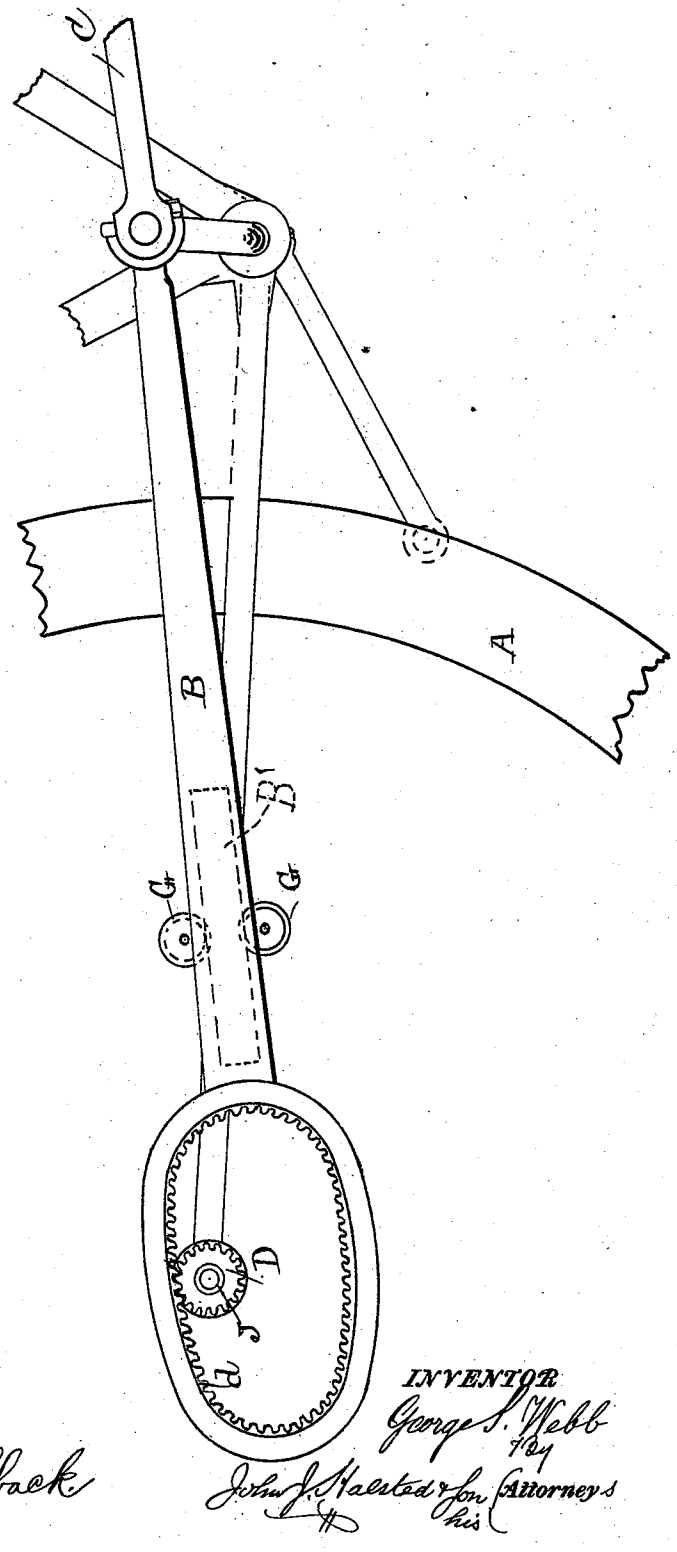


FIG. 6.

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(No Model.) 5 Sheets—Sheet 4.

# G. S. WEBB.

## DRIVING MECHANISM FOR BICYCLES.

No. 527,568. Patented Oct. 16, 1894.

FIG. 28. FIG. 29. FIG. 30. FIG. 31. FIG. 32

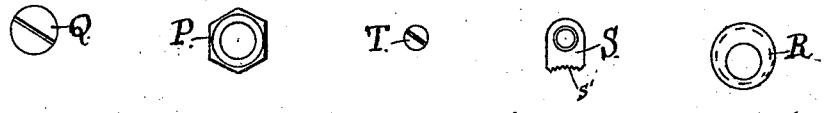



FIG. 33.

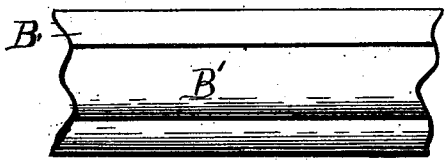



FIG. 34.

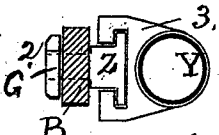



FIG. 35.

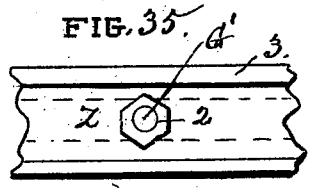



FIG. 36.

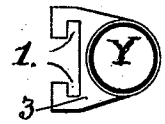



FIG. 37.

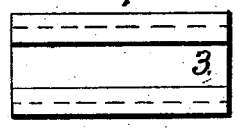



FIG. 7. FIG. 8. FIG. 38. FIG. 39.

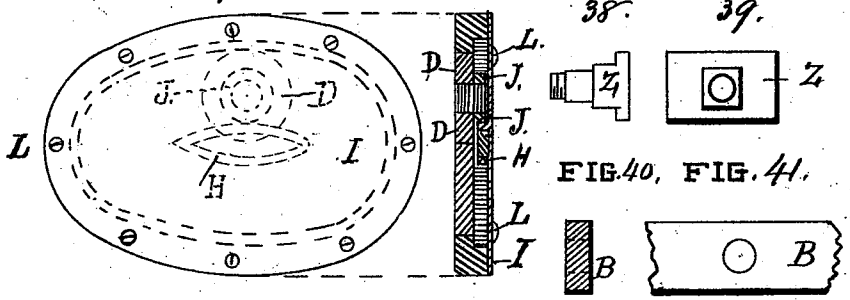



FIG. 40. FIG. 41.




FIG. 9. FIG. 10.

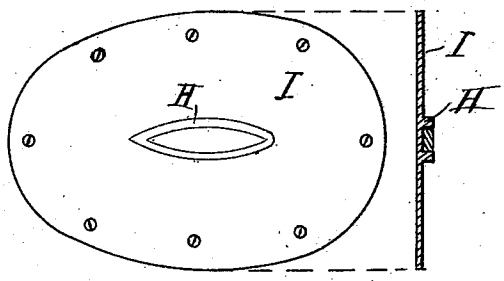
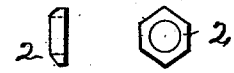



FIG. 42. FIG. 43.

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(No Model.) 5 Sheets—Sheet 5.

# G. S. WEBB.

## DRIVING MECHANISM FOR BICYCLES.

No. 527,568. Patented Oct. 16, 1894.

FIG. 11.

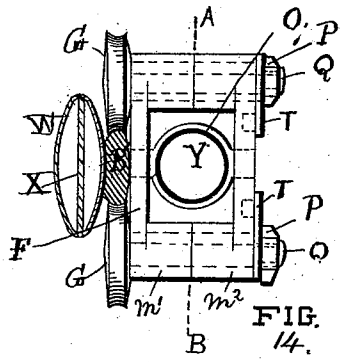



FIG. 12.

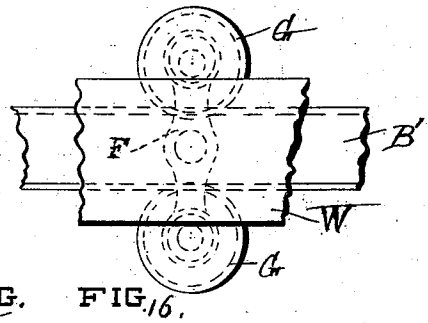



FIG. 13.

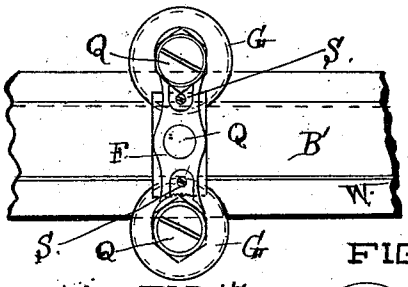



FIG. 14.


FIG. 15.


FIG. 16.


FIG. 23.

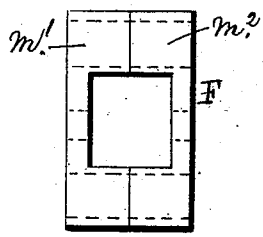



FIG. 17.


FIG. 18.

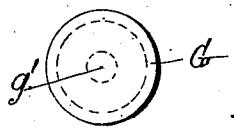



FIG. 19.

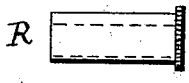



FIG. 20.


FIG. 22.


FIG. 21.


FIG. 24.


FIG. 26.

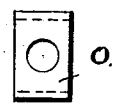



FIG. 25.

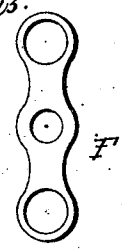
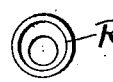



FIG. 27.

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# UNITED STATES PATENT OFFICE.

GEORGE S. WEBB, OF AURORA, ILLINOIS.

## DRIVING MECHANISM FOR BICYCLES.

SPECIFICATION forming part of Letters Patent No. 527,568, dated October 16, 1894.

Application filed March 23, 1893. Serial No. 467,382. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE S. WEBB, of Aurora, in the county of Kane and State of Illinois, have invented certain new and useful Improvements in Driving Mechanism for Bicycles, &c.; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to the driving mechanism of velocipedes, more especially of bicycles, and consists of a special novel means for this purpose, much simplified as to the number of parts required and dispensing with sprocket wheels and chain in bicycles, and as will now be described.

The greatest drawback to the modern safety bicycle is universally acknowledged to be the chain. As the chain is unprotected from the dust and mud, it consequently wears very fast, and is continually annoying the rider by stretching, because the accumulations of grit and mud soon work into the joints thus wearing parts of the chain. This mud and dirt have about the same effect as emery, so that the chain soon becomes too long and the rider has to take out one or more links. The pitch of the chain is changed in consequence of its wearing, and very soon it has to be replaced with a new one. It goes without saying that a wheel without a chain is greatly needed, and would be appreciated by wheelmen.

In the drawings: Figure 1. shows sufficient of a bicycle to illustrate the general character of my improvements. Figs. 2. and 3. respectively show a slight variation in the form of the internal gear of the rod which I employ to connect the treadle crank with the axle of the driving wheel; Fig. 2. showing also a variation in the bearings of the rod; Fig. 4., a line sketch merely illustrative of changes of position of the internal gear and connecting rod, on its forward and back "dead centers," and the upper and lower quarters; Fig. 5., a detached view of the treadle arms, and their crank shaft; Fig. 6., a fragmentary view, merely to show the cranks and gear in a different position. Figs. 7 and 8. show respectively the right side, and a central vertical section of the internal gear, the pinion or small gear and its roller, a central track for the same and a cover for them. Figs. 9. and 10., a back view of the cover and track, and a central section of the same. Fig. 11. is a sectional elevation; Fig. 12., a right side elevation, and Fig. 13. a left side elevation of the details of construction of one of my means of applying to the machine, the bearing rollers for the rod of the internal gear, to permit the shifting of the fulcrum; Figs. 14 to 33., inclusive, parts of the same detached. Figs. 34 and 35 are respectively a sectional elevation, and a right side view of a simpler form of shifting fulcrum and track with adjacent parts; Figs. 36 and 37., a sectional view and a right side view of the track; Figs. 38. and 39., a front view, and right side view of the slide which runs in the track; Figs. 40. and 41., a front cross-section and a right side view of the shaft bar or rod which carries the internal gear, and Figs. 42. and 43. views of the nut which holds this rod or shaft on the slide.

Instead of employing sprocket chains and sprocket wheels to impart motion from the treadle cranks to the driving wheel A., I employ a connecting rod B. connected at one end to the treadle crank C., and at its other end this tube or rod B is provided with a continuous internal series of gear teeth *d.* which engage the teeth of a pinion or toothed gear D. secured to the axle E. of wheel A.; and for the purpose of guiding this rod, there is provided at any desired point between its extremities a fixed bearing frame or plate F. having friction rollers G. between which the rod may turn or swing during its motions, as if upon a fulcrum: though necessarily, owing to the longitudinal movements of this rod, the distance of the bearing point of the lever from the extremes of its throw, is constantly varying when the machine is in action: in other words its rocking, or fulcrum-bearing point is constantly changing when in operation. Under general conditions, the movements of that end of the rod which has the internal series of teeth *d.*, would be in a path nearly of an elliptical or oval form, but with one of its ends as the case may be, somewhat

narrowed, so that the line of teeth would be in egg-form, as shown in Figs. 1 and 2.

The predetermined precise form is ascertainable in any given class of cases, by a skilled mechanic, and must of course be somewhat dependent on the size of the bicycle and its wheels, the length of throw of the crank, the distance therefrom of the bearing plate and its rollers G., &c.: as will be readily understood. Usually I make the rollers G, with a peripheral groove as seen in Fig. 11. The bearing point of the lever on the rollers insures the correct travel of the internal gear, and its location determines the size of such gear and consequently the relative speed of the crank and driving wheel. In each and every case, there is no making and breaking of engagement of the internal gear *d.* with the pinion D. but on the contrary the action is such that they are kept always in positive engagement: so that no loss of time or power is suffered from such a cause, and any danger of injury of breaking the teeth, in attempting to re-engage, or sudden stoppage of the machine, or jerking of the mechanism, is avoided: the action being a smooth and continuous one throughout; no jerks or shocks.

The pinion gear is so arranged in relation to the cranks that it is always engaged in one end of the internal gear while the crank is at its dead center point as regards the rider, thus throwing the crank past the dead center point at a greater velocity, thus partially overcoming the dead center.

The rod B. instead of moving between the anti-friction rollers G, may be pivoted on a slide or pin Z. (see Figs. 2, 34 and 35.) running in any suitable straight slot or guide in the frame. The action of the rod is the same in either case.

If the internal gear be made in the form shown in Fig. 3. the speed of the crank would be more nearly the same at all points, that is, the relative speed; but with the other or elliptical forms of gear, when the cranks are nearly on their "dead-centers," with reference to the shape of the gear the rider can keep up the same speed of wheel while the cranks pass their so-called dead centers at a greater velocity.

If the bearing point of the rod B. on its pin (or rollers as the case may be) be located nearer to the crank, it will be seen that the internal gear would need to be correspondingly broader, and to have more teeth; and this, while it would not cause an increase of speed of the crank in such machine, yet it would increase the speed of the pinion on the shaft, and consequently that of the driving wheel. If on the contrary the bearing point be nearer to the pinion, the opposite effect will be produced, giving a smaller and different shape to the internal gear.

When the relative proportion desired as to speed between the crank and the driving-wheel pinion, has been determined for any set of machines to be made, the location of the intermediate bearing or pivot for the connecting rod, as also the shape and size of the internal gear, are readily ascertainable by "construction."

In Figs. 7., 8., 9. and 10. are shown my means for protecting the internal gear *d.* and pinion D. from dust or other exposure, and consequently from undue wear, and they also show a central track H. I. is a cover or plate secured over this gear and pinion. J. is a roller on the inner side of the pinion, D., and running on the track, and L. L. are screws for securing the cover to place.

In Figs. 11. to 32. are shown in full and in detail the grooved bearing rollers G., the rod B. serving as a track, which runs between the rollers and their immediate connections as I prefer to construct them and apply them to the bicycle. The frame F is made or cut into two parts $m'$. $m^2$. which meet at the line A. B. as seen in Figs. 11. and 23.: this division into parts being for the purpose of putting the frame on the hanger O. The parts $m'$ $m^2$. are held together by a nut P. on the end of each spindle or shaft $g'$. of rollers G, and by a check screw Q. which enters the end of such roller shaft. These spindles $g'$ are each placed within a sleeve R. having its bore eccentric (see Figs. 19. and 20.) so that by turning the sleeve or sleeves in the frame it will adjust either or both rollers as may be desired, relatively to the rod B. To hold these sleeves to place when so adjusted, I employ dogs S. (see Figs. 13., 14. and 31.) having a curved, serrated, or roughened edge $s'$ adapted to engage with the edge (preferably milled) of the end of sleeves R., and through this dog S. passes a screw T. into the frame to hold the dog to place.

W is a section of the lever B which is in this case a tube and X is a piece of sheet metal to strengthen this tube which connects the internal gear and the crank. The track B′ is connected to the lever B and moves between the stationary rollers G.

In Fig. 2, the track is stationary and the connecting tube has a projection on its back which fits into and slides on the track.

Y. is a tubing of the bicycle frame on which frame F. is supported.

In Figs. 34 to 43. I show a modified form of shifting fulcrum, which is simpler than that just above described, and may be used as a cheaper means for supporting the rod B. between its extremities, Z. being a slide secured by thread and nut 2. to said rod, such slide being adapted to run in the grooves 1. 1. of a guide bar 3. secured to tubing Y.

The principle, and novel action, and the results of the internally geared rod or shaft, are the same in every case above described.

Among the advantages of this improved construction, may be named the following.

The practicability of my invention which dispenses with the chain and sprocket wheels, will be readily seen. Its wearing qualities cannot be questioned. It has many advan-

tages over the chain with none of its disadvantages; among which are the following, namely: With my internal gear I have a direct transmission of power, because there is no lost motion, as with a chain. While a chain is constructed with from two hundred and thirty to four hundred and seventy-five separate pieces, my internal gear is constructed of one piece, and has a dust proof cover.

Another advantage is the elliptical gear which gives to the crank a variable speed: and the advantages of this are, first, that the highest gear is in operation when the propelling power is exerted to the greatest advantage; second, the speed of the machine being practically constant, the cranks must revolve at a varying velocity, this velocity being greatest when the cranks are at dead-points and the power least; and least, when they are at their best positions and the power greatest. This allows a longer time to exert the propelling power, causing an acceleration of movement of the cranks or pedals around the "dead-centers," or in other words it reduces the effects of the "dead-center" to a minimum. This has none of that uneven tension which is so noticeable in elliptical sprockets with chains. The connecting rod is so fastened to the cranks, that the crank stands at an angle of ninety degrees to the longest diametric line of the internal gear, when the crank is at its most advantageous position for the rider to exert his power. Thus it will be seen that when the pedal is at its highest point, the rider begins to apply his power and continues it until the pedal nears the lowest point, and during this time the pinion gear has passed the long side of the ellipse, and has passed the short curve at the end of the ellipse so that the straighter part of the gear will carry the pedal past its so-called "dead-center" point at a greater velocity. This is equivalent to having a low gear at the "dead-center" points, and a high gear where the rider can apply his power.

Among the other advantages of my construction, may be briefly named, simplicity, durability, no chain adjustment, increased speed with less power, less friction, less noise, no lost motion. The economical advantage of this internal gear I estimate to be at least twenty per cent. over the common chain and sprocket.

I claim—

1. The described lever having a shifting fulcrum and provided at one of its ends with an endless internal gear, in combination with and driven by the foot treadles and cranks, and with a pinion on the wheel shaft, and kept in continuous engagement with said gear, as and for the purposes set forth.

2. In combination with the gear on the axis of the main wheel, and with the pedal driving-crank, the connecting rod or tube B. provided with the continuous internal gear, and having a supporting bearing between its extremities, and on which it rides and rocks, substantially as shown and described.

3. In a bicycle a driving lever having a continuous internal gear, such gear meshing with a gear on the axle of the main wheel, and a shifting fulcrum pin or bearing point for said lever, whereby the lever has the described longitudinal movements, and also the described vibratory movements on such shifting fulcrum.

4. In combination, the reciprocating lever of the first order, having the endless set of interior teeth as described, and applied to the driving crank and to the gear on the wheel axle as set forth, whereby when the lever is at the extremity of its longitudinal movements, and consequently at its dead points, the crank shall be in position to exert its maximum leverage to overcome such dead points.

5. In combination with the cranks the internally-geared connecting rod or tube B. made, applied and operating as described, and with the pinion on the axle in constant engagement therewith, anti-friction bearings G. on the frame and serving as a fulcrum for the rod, all substantially as set forth.

6. In combination with the internal gear, and with the pinion engaging therewith, the roller J., track H, and cover I, substantially as shown and described.

7. In combination with the internal continuous gear, its connecting rod or tube and pinion, the crank arm set as shown and described, a little forward of the dead center relatively to the rider, and operating as and for the purpose set forth.

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Witnesses:
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