No. 737,675. PATENTED SEPT. 1, 1903.

J. J. H. STURMEY.

VARIABLE SPEED GEAR.

APPLICATION FILED MAR. 10, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

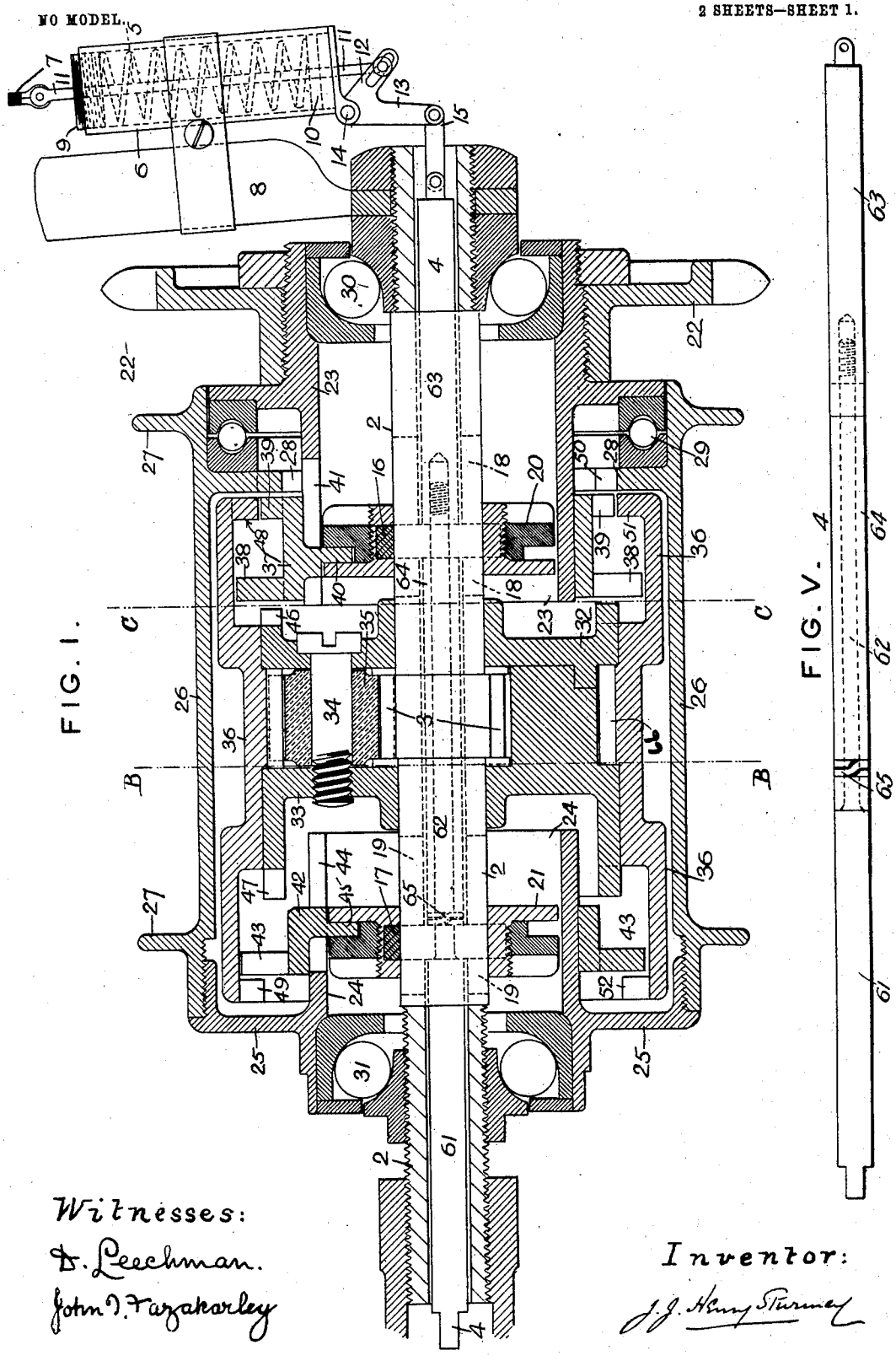


FIG. I.

FIG. V.

Witnesses:
A. Leechman.
John J. Farrakerley

Inventor:
J. J. Henry Sturmey

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 737,675. PATENTED SEPT. 1, 1903.

J. J. H. STURMEY.

VARIABLE SPEED GEAR.

APPLICATION FILED MAR. 10, 1902.

NO MODEL. 2 SHEETS—SHEET 2.

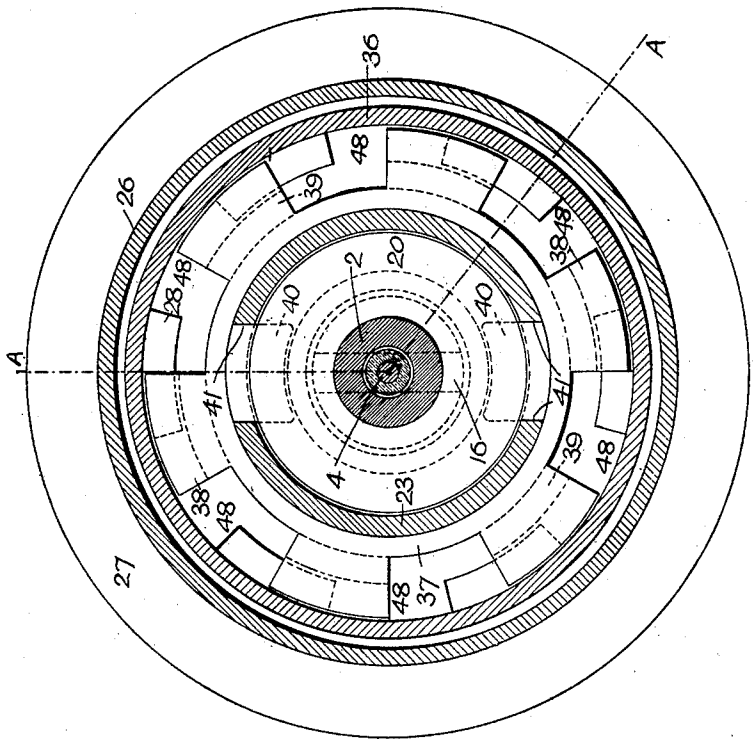


FIG. III.

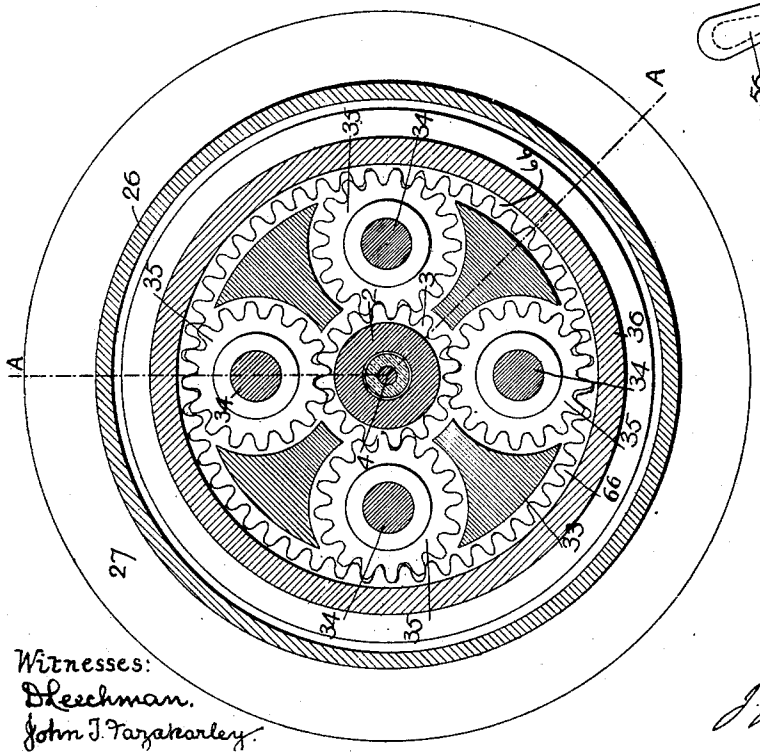


FIG. II.

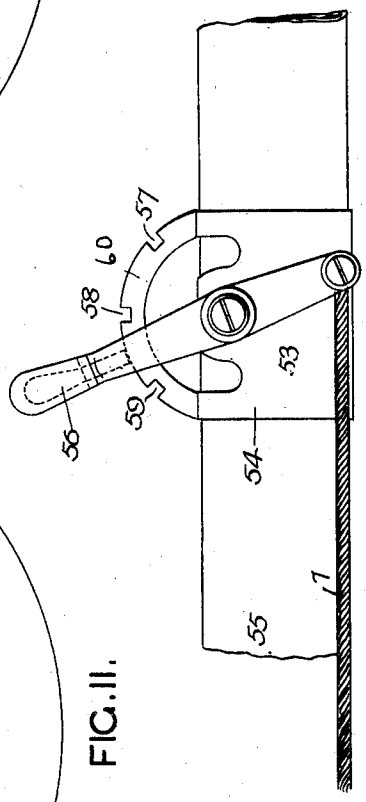


FIG. IV.

Witnesses:
D. Leechman.
John J. Tazaker Farley.

Inventor:
J. J. Henry Sturmey

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 737,675. Patented September 1, 1903.

UNITED STATES PATENT OFFICE.

JOHN J. HENRY STURMEY, OF COVENTRY, ENGLAND.

VARIABLE-SPEED GEAR.

SPECIFICATION forming part of Letters Patent No. 737,675, dated September 1, 1903.

Application filed March 10, 1902. Serial No. 97,618. (No model.)

To all whom it may concern:

Be it known that I, JOHN JAMES HENRY STURMEY, a subject of the King of Great Britain, residing at Coventry, in the county of Warwick, England, have invented a new and useful Variable-Speed Gear, of which the following is a specification.

My invention relates to variable-speed gears for bicycles and other machinery, and has for its principal object to provide mechanism that will afford three variations of speed with the transmission direct on the intermediate gear.

I attain my object by the mechanism shown in the accompanying drawings, which represent it as applied to the driving-wheel hub of a safety-bicycle; but it may be applied to other suitable mechanism in a substantially similar manner.

Figure I is a longitudinal section of the mechanism on the line A A in Figs. II and III. Fig. II is a vertical transverse section on the line B B in Fig. I. Fig. III is a vertical transverse section on the line C C in Fig. I. Fig. IV is a side elevation of an actuating-lever and appurtenant parts. Fig. V is an elevation of an actuating-pin and appurtenant parts.

The same numerals refer to the same parts throughout the several views.

In carrying out my invention I provide the stationary wheel-spindle 2 with a fixed spur-wheel 3 at or near the center thereof. I make the spindle 2 hollow and fit a sliding pin 4 therein. The said pin may be moved lengthwise by any suitable means, such as the extension-spring 5, mounted in the cylindrical case 6, and the cord 7. The case may be supported in any suitable manner on the frame 8 of the machine. The spring 5 abuts at one end against the top 9 of the case 6 and at the other end against a disk 10, mounted on a pin 11, which passes through the spring 5 and out through the said top of the case. A bell-crank lever 12 13 is pivoted to the case 6 at 14. The arm 12 of the bell-crank lever is jointed to the pin 11, and the arm 13 of the said bell-crank lever is jointed by means of the link 15 to the pin 4. The cord 7 is secured to the other end of the pin 11. The spring 5 tends to push the pin 4 to the left by means of the disk 10, pin 11, bell-crank lever 12 13, and the link 15. Instead of the spring 5, I may employ a spring within the cylinder 23, acting upon the collar 20, or at the back of or surrounding the part 61 of the pin 4, to act directly or indirectly upon the said pin. Any suitable means may be employed for adjusting the spring 5. Thus the top 9 of the case may be made as a screw-plug for this purpose. The cord 7 is adapted to pull the said pin 4 in the other direction against the action of the said spring 5.

On the pin 4 are mounted two keys 16 17, which project through slots 18 19, cut in the spindle 2, one on each side of the spur-wheel 3. Each key 16 17 engages with an externally-grooved collar 20 21, respectively, mounted loosely on the spindle 2.

The sprocket 22 (which may be a free wheel or a fixed wheel) is secured to the outer end of a hollow cylinder 23, the inner end of which stops short of the middle of the hub. A second cylinder 24, corresponding to 23, is united by a suitable end piece 25 to the corresponding end of the hub-shell 26, which carries the spoke-flanges 27 and always rotates with the said second cylinder 24. The end of the hub-shell 26 nearer the sprocket-wheel 22 has an inwardly-directed flange 28, and a ball or other suitable bearing 29 is provided between this end of the hub 26 and the cylinder 23. The hub as a whole is supported on (preferably ball) bearings 30 31, introduced between the spindle 2 and the cylinders 23 and 24, respectively.

On the wheel-spindle 2 are mounted loosely two annular plates 32 33, one against each side of the spur-wheel 3. These annular plates are connected by, say, four transverse bolts 34, on each of which is mounted a pinion 35, gearing with the spur-wheel 3 on the spindle. The said pinions 35 also gear with internal teeth 66, provided in a sleeve 36, introduced between the cylinders 23 24 and the hub-shell 26 and supported upon the above-mentioned annular plates 32 33. The said plates, with the bolts 34 connecting them, form a kind of cage.

Upon the cylinder 23 is mounted a ring 37, having, say, four external projections or dogs 38 39 on each part, the dogs 38 projecting farther than the dogs 39. The ring 37 is caused to rotate with the cylinder 23 by one or more internal projections 40 on the said

ring passing through a corresponding number of longitudinal slots 41 cut in the said cylinder, and these internal projections engage with the grooved collar 20. A similar ring 42, but having only one set of dogs 43, is mounted on the cylinder 24 and is caused to rotate therewith by internal projections 45, passing through slots 44 cut therein, and these projections engage with the grooved collar 21. The dogs 38, 39, and 43 are adapted to engage with notches 46, 47, 48, 49, and 50, formed on the outer side of the annular plates 32 33, in internal flanges 51 52 on the ends of the sleeve 36 and in the internal flange 28 in the hub-shell 26, as hereinafter described.

The action is as follows: When the pin 4 in the spindle is moved by the spring 5 from the position shown to the left, the dogs 43 on the ring 42 engage with the notches 49 in the flange 52 of the sleeve 36, the dogs 38 on the ring 37 engage with the notches 46 in the plate 32 of the cage, and the dogs 39 on the said ring are left free. The rotary motion of the sprocket-wheel 22 and cylinder 23 is then transmitted through the ring 37 to the cage, and the pinions 35, rotating on their own axes, as well as around the axis of the spindle 2, rotate the sleeve 36 at a higher speed than the sprocket-wheel 22, and the hub-shell 26 is made to rotate at the same augmented speed because the ring 42 causes the cylinder 24 and hub-shell to rotate turn for turn with the said sleeve. This gives the highest speed. If the pin 4 be now pulled by the cord 7 toward the right against the action of the spring 5 past the position shown into its middle position, the dogs 39 on the ring 37 will engage with the notches 50 in the internal flange 28 in the hub-shell 26, and all the other dogs will be free. Rotary motion is now transmitted from the sprocket-wheel 22 and cylinder 23 through the ring 37 directly to the hub 26, and the intermediate speed is obtained. To obtain the low speed, the pin 4 is pulled farther toward the right, when the dogs 43 on the ring 42 will engage the plate 33 of the cage, the dogs 38 on the ring 37 will engage the notches 48 in the internal flange 51 of the sleeve 36, and the dogs 39 on the said ring will again be free, having passed through the notches 50 into the space within the bearing 29. The rotary motion of the sprocket-ring 22 and the cylinder 23 is now transmitted through the ring 37 to the sleeve 36, and the plates 32 33 of the cage are driven by the said sleeve through the pinions 35 and bolts 34, the pinions rotating on their axes, as well as around the spindle 2, and the hub-shell 26 is made to rotate at this reduced speed because the ring 42 by engaging with the plate 33 now causes the cylinder 24 and the said hub-shell to rotate turn for turn with the said plate and cage.

The cord 7 is preferably led up to an actuating-lever situated in some position convenient to the hand of the user. In Fig. IV the actuating-lever 53 is shown as pivoted to a clip 54 on the top tube 55 of the cycle-frame. The lever is provided with a finger-catch 56 adapted to engage in any one of three notches 57, 58, 59 cut in a rack 60. Notch 57 corresponds to the low gear, notch 58 corresponds to the intermediate or normal gear, and notch 59 corresponds to the high gear.

For convenience of construction the pin 4 may be built up of three parts, 61, 63, and 64. The part 61 has an extension of reduced diameter 62, screw-threaded at its free end. The part 63 is bored and tapped at one end to receive the screwed end of the extension 62, and it is jointed at the other end, as already described, to the link 15. The part 64 is a distance-piece. The keys 16 and 17 are arranged in position in the spindle 2 with the distance-piece 64 between them. The part 63 is passed into one end of the said spindle, and the part 61 is passed into the other end thereof, the extension 62 passing through first the key 17, next the distance-piece 64, and then the key 16, and lastly being screwed into the part 63. The keys 16 17 are thus held between the ends of the distance-piece 64 and the shoulders formed by the nearer ends of the parts 61 and 63.

To facilitate the engagement of the dogs on the rings 37 42 with their respective notches, a small amount of variation in the distance between the said two rings may be provided for, so that each set of dogs may engage directly it is ready to do so. For this purpose a short spring 65 may be introduced between one of the keys—say 17—and the distance-piece 64.

What I claim as my invention, and desire to secure by Letters Patent of the United States, is—

1. In a variable-speed gear, the combination of a fixed central spur-wheel; an internally-toothed sleeve; a cage; pinions carried by the said cage and adapted to gear both with the said spur-wheel and the said sleeve; a driving element; a driven element; means for coupling the driving element directly to the driven element; means for coupling the driving element to the cage, and the driven element to the sleeve, simultaneously; and means for coupling the driving element to the sleeve, and the driven element to the cage, simultaneously.

2. In a variable-speed gear, the combination of a stationary spindle; a spur-wheel fixed to the said spindle; an internally-toothed sleeve; a cage; pinions carried by the said cage and adapted to gear both with the said spur-wheel and the said sleeve; a driving element; a driven element; one engaging piece adapted to lock the driving element to the cage, or to the sleeve, or to the driven element; another engaging piece adapted to lock the cage or the sleeve to the driven element; and means for moving the said engaging pieces.

3. In a variable-speed gear, the combination of a stationary hollow spindle having radial slots; a spur-wheel fixed to the said spin-

dle; an internally-toothed sleeve; a cage; pinions carried by the said cage and adapted to gear both with the said spur-wheel and the said sleeve; two collars loose on the said spindle; a pin within the said spindle; means for moving the said pin lengthwise of the said spindle; keys carried by the said pin, passing through the said slots, and engaging the said collars; a driving-cylinder having radial slots; a shell; a cylinder fixed to the said shell and having radial slots; a ring; internal projections on the said ring adapted to pass through the slots in the driving-cylinder and engage one of the collars; two sets of dogs on the said ring; internal projections on the said other ring adapted to pass through the slots in the cylinder fixed to the shell and engage the other collar; dogs on the said other ring; and notches in the cage, sleeve and shell adapted to receive the said dogs.

4. In a variable-speed gear, the combination of a stationary hollow spindle having radial slots; a spur-wheel fixed to the said spindle; an internally-toothed sleeve; a cage; pinions carried by the said cage and adapted to gear both with the said spur-wheel and the said sleeve; two collars loose on the said spindle; a pin within the said spindle; a case having a top; a pin movable in the said case; a disk on the said movable pin; an extension-spring inclosed within the said case and adapted to bear at one end against the top of the case and at the other end against the said disk; a cord connected to the said movable pin, a link jointed to the pin in the hollow spindle; a bell-crank lever jointed by one arm to the said link and by the other arm to the pin in the case, keys carried by the pin in the hollow spindle, passing through the said slots, and engaging the said collars; a first cylinder having radial slots; a gear-wheel fixed to the said first cylinder; a shell; a second cylinder having radial slots and having an end piece adapted to connect the second cylinder to the said shell; spoke-flanges on the said shell; an internal flange on the said shell; internal flanges in the said internally-toothed sleeve; notches in the several internal flanges and in the said cage; a bearing between the first cylinder and the said shell; bearings between the two cylinders and the stationary hollow spindle; a ring; internal projections on the said ring adapted to pass through the slots in the first cylinder and engage one of the collars; two sets of dogs on the said ring; another ring; internal projections on the said other ring adapted to pass through the slots in the second cylinder and engage the other collar; and dogs on the said other ring.

5. In a variable-speed gear of the kind herein described, the combination with the hollow spindle having radial slots, and keys in the said slots, of a pin part having a screw-threaded extension; a pin part having a tapped hole; and a distance-piece.

6. In a variable-speed gear of the kind herein described, the combination with the hollow spindle having radial slots, and keys in the said slots, of a pin; and means for allowing for a certain movement of the said keys to and from one another.

7. In a variable-speed gear of the kind herein described, the combination with the hollow spindle having radial slots, and keys in the said slots, of a pin part having a screw-threaded extension; a pin part having a tapped hole; a distance-piece, and a spring.

8. In a variable-speed gear of the kind herein described, the combination with the hollow spindle, the pin in the said spindle, the case, the spring and pin in the case, and the cord, of a lever; a toothed rack and a finger-piece on the said lever.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

J. J. HENRY STURMEY.

Witnesses:
DOUGLAS LEECHMAN,
JOHN T. FAZAKARLEY.