No. 702,804. Patented June 17, 1902.

G. M. LILBURN.

BICYCLE.

(Application filed Apr. 18, 1899.)

(No Model.) 6 Sheets—Sheet 1.

Fig 1

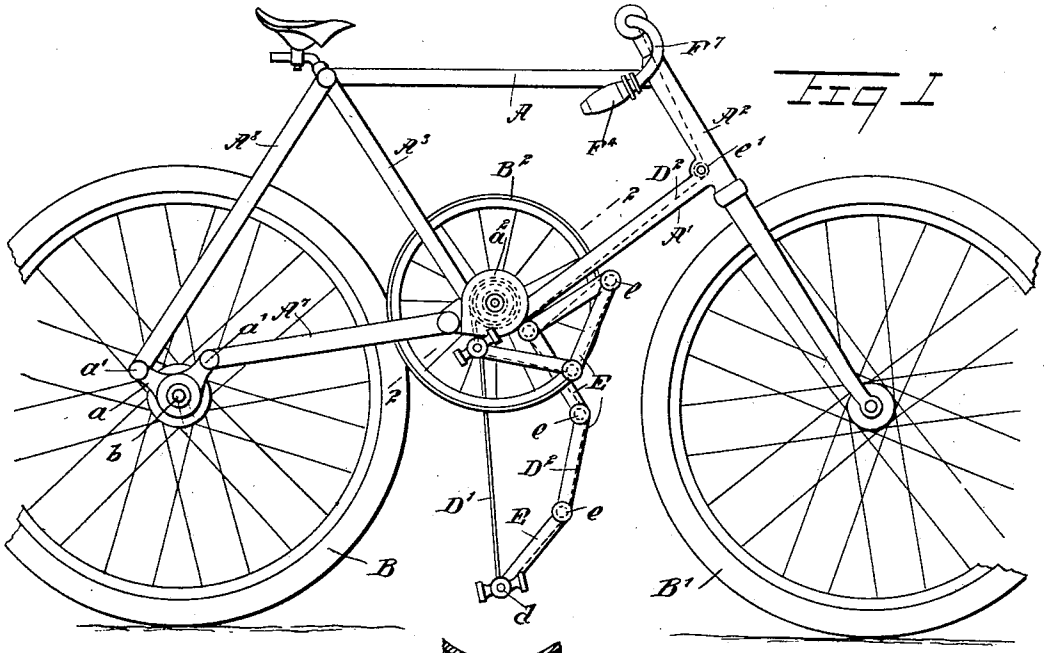
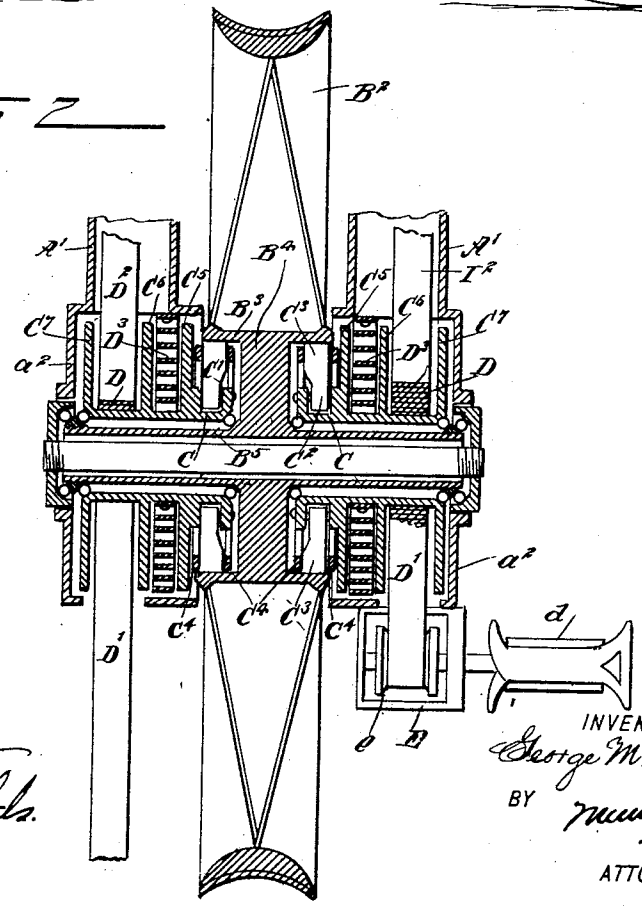


Fig 2



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

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Fig 3

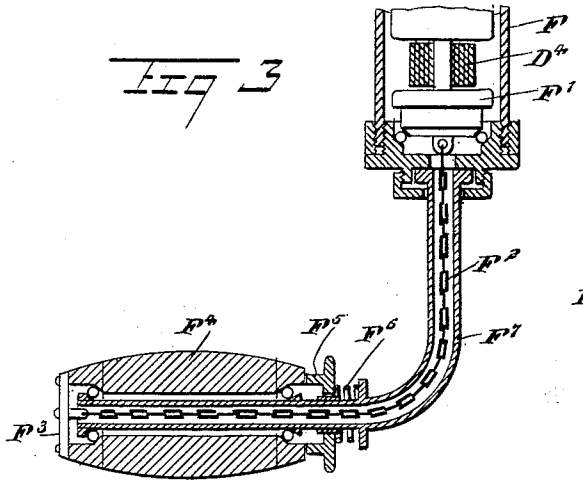


Fig 4

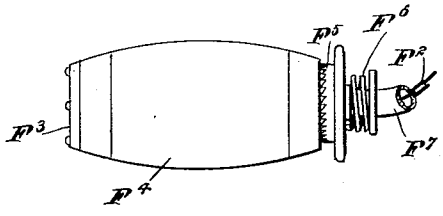


Fig 7

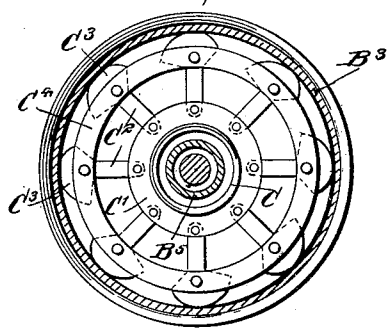


Fig 5

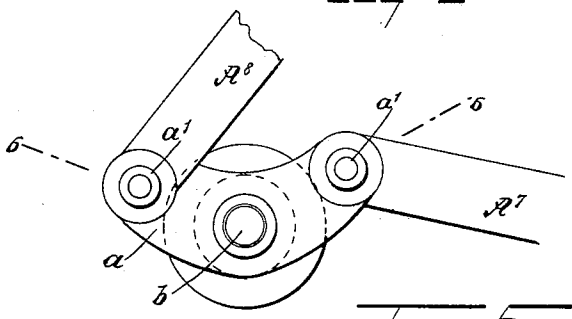


Fig 6

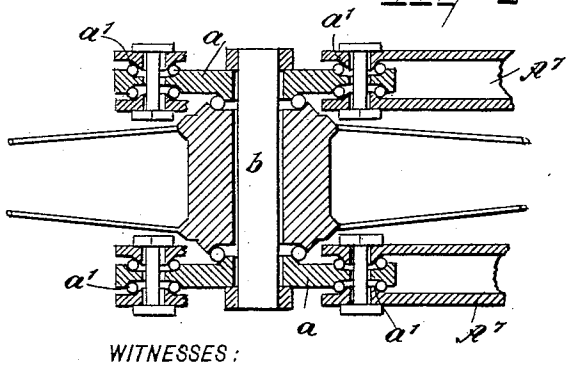
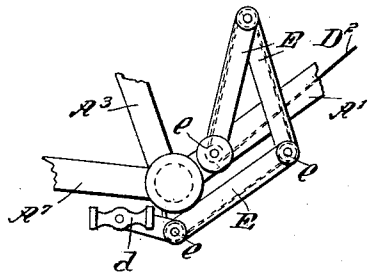


Fig 8



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(No Model.) 6 Sheets—Sheet 3.

Fig 9

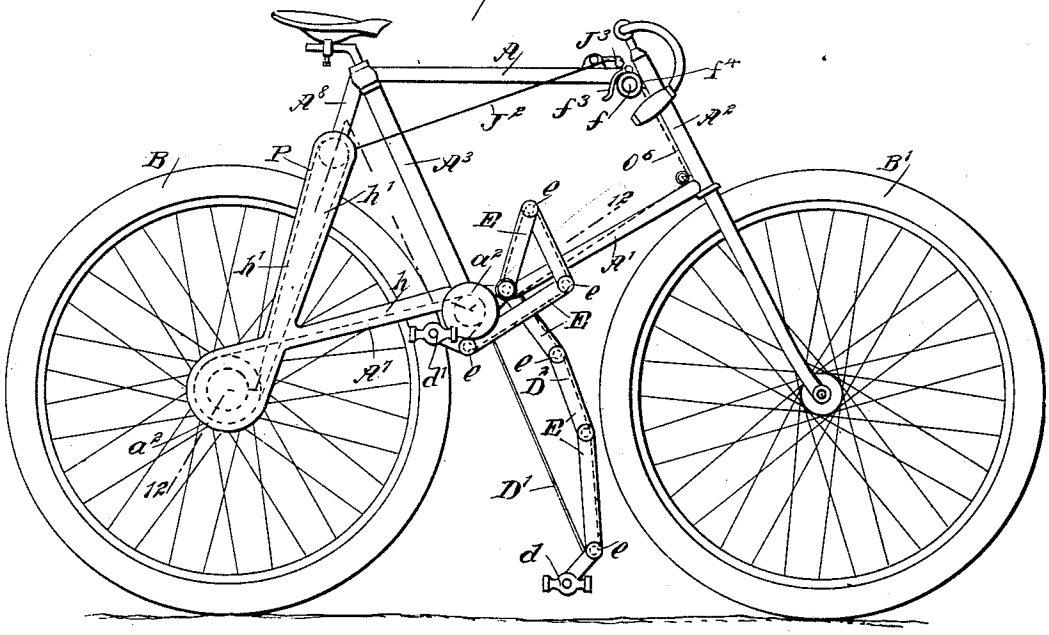


Fig 10

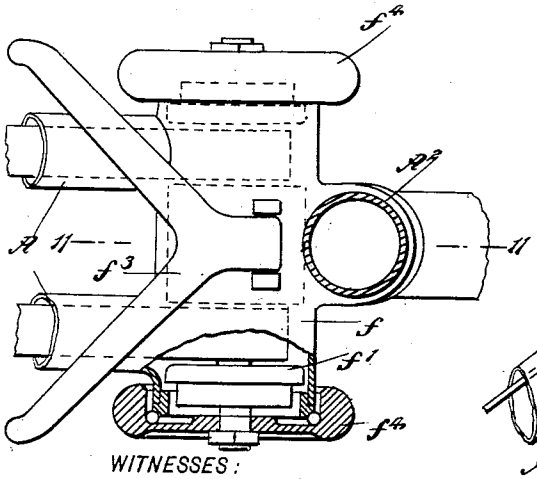
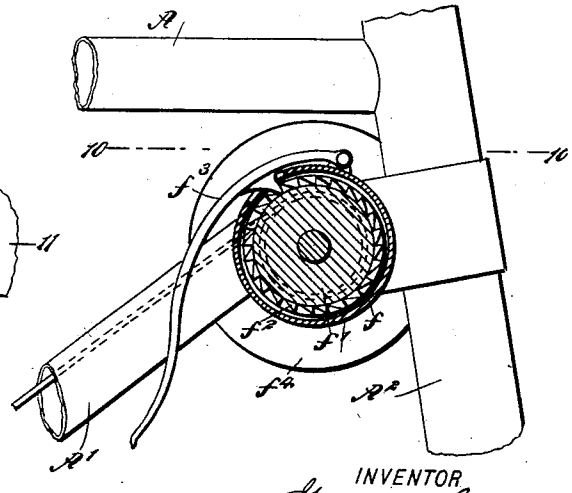


Fig 11



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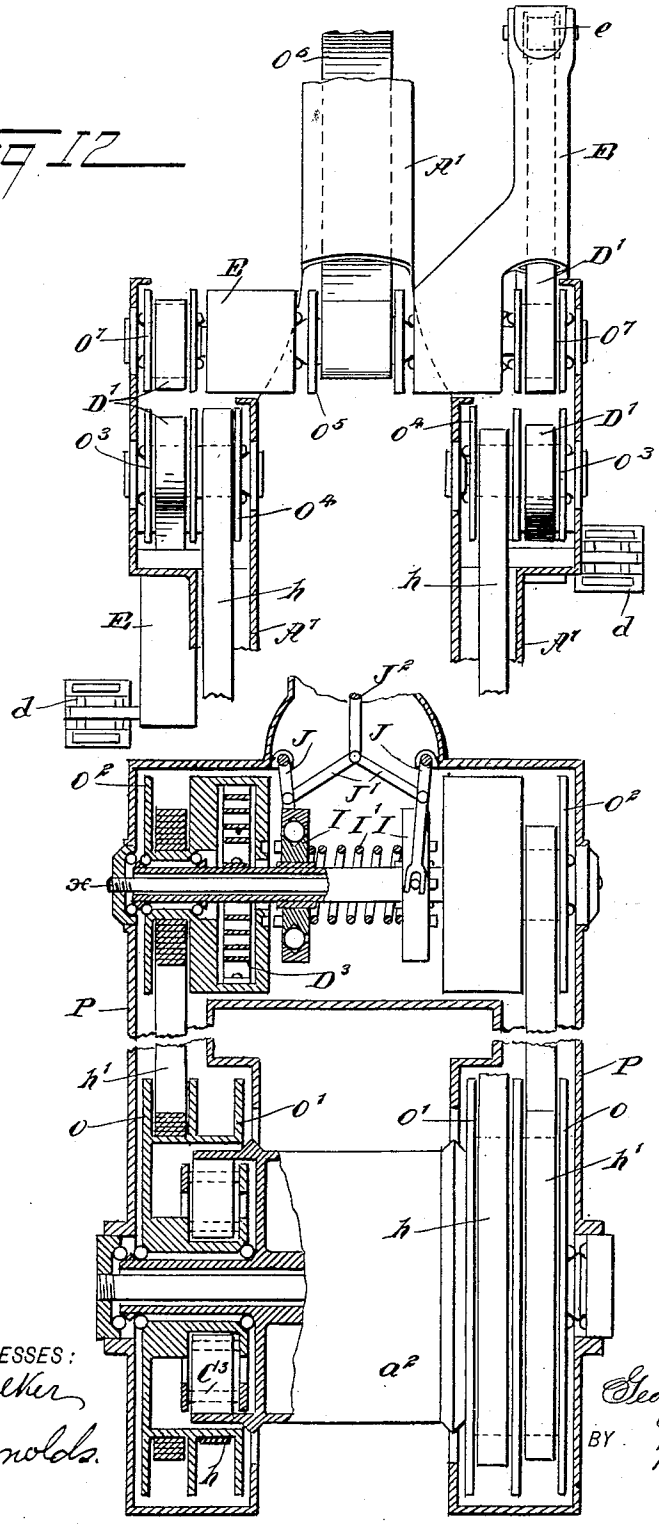
(No Model.) 6 Sheets—Sheet 4.

Fig 12



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(No Model.) 6 Sheets—Sheet 5.

Fig 13

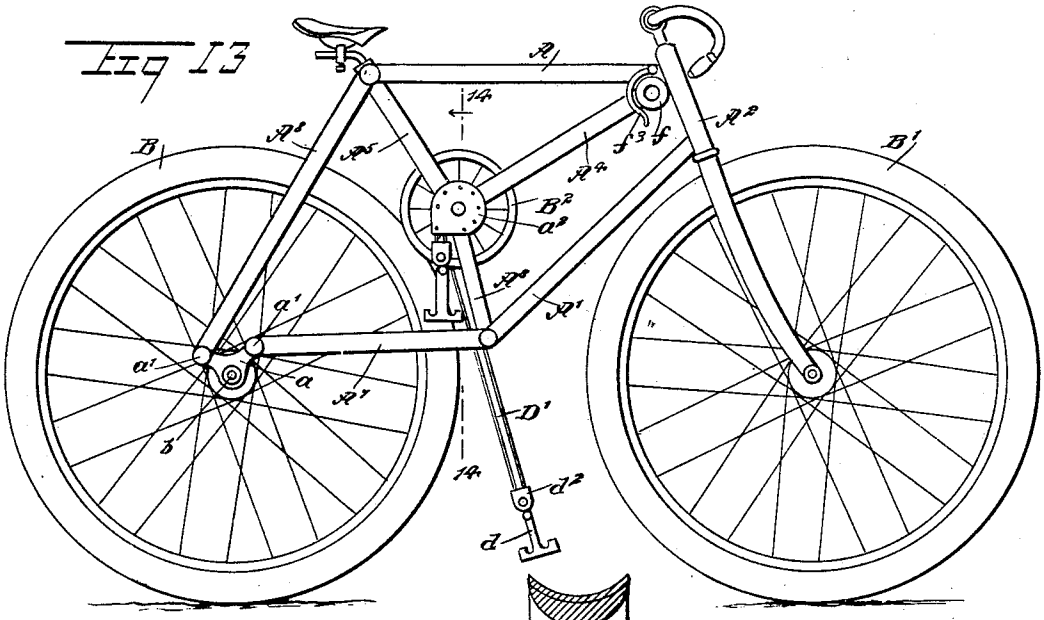


Fig 14

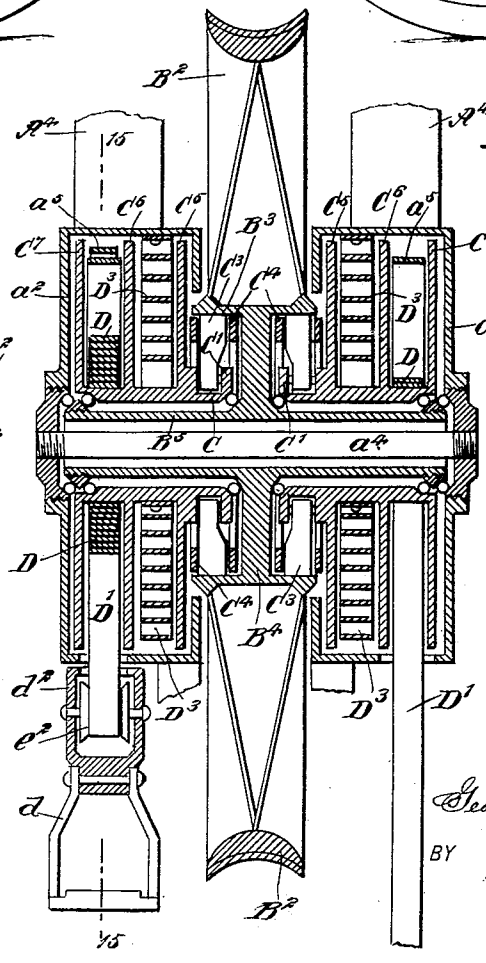
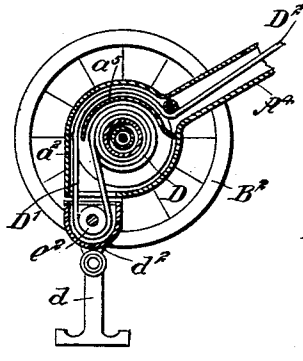


Fig 15.



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(No Model.) 6 Sheets—Sheet 6.

Fig 16

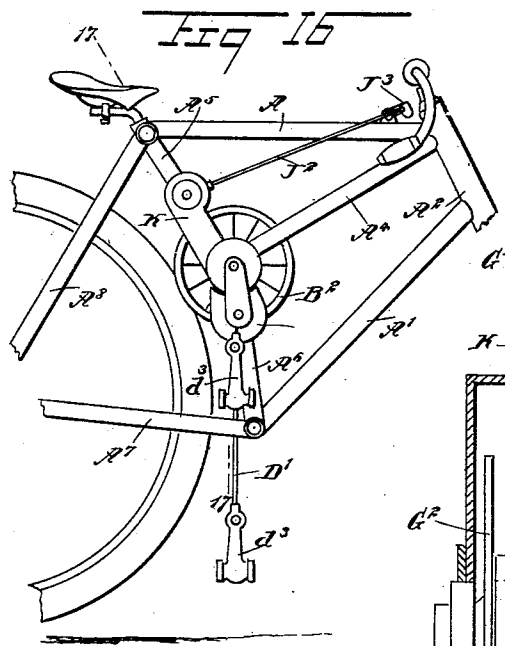


Fig 17

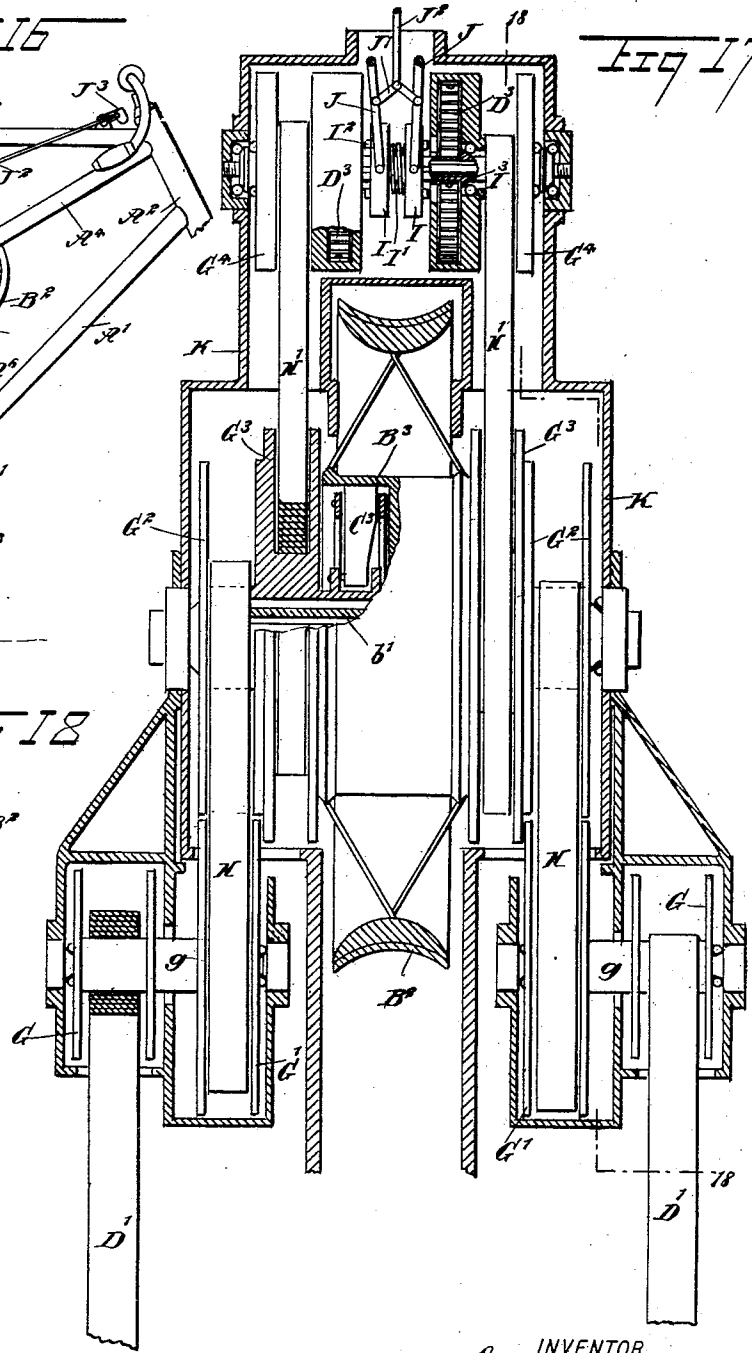
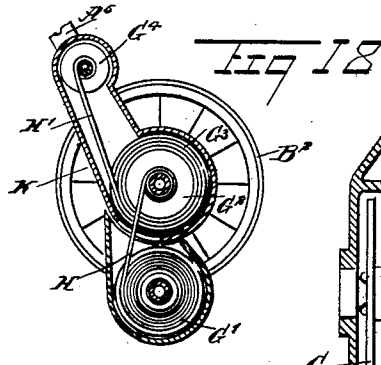
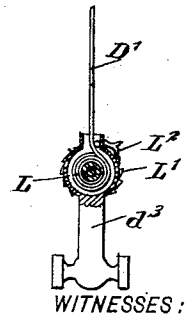


Fig 18





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UNITED STATES PATENT OFFICE.

GEORGE MUNN LILBURN, OF HAVERSTRAW, NEW YORK.

BICYCLE.

SPECIFICATION forming part of Letters Patent No. 702,804, dated June 17, 1902.

Application filed April 18, 1899. Serial No. 713,446. (No model.)

To all whom it may concern:

Be it known that I, GEORGE MUNN LILBURN, of Haverstraw, in the county of Rockland and State of New York, have invented a new and Improved Bicycle, of which the following is a full, clear, and exact description.

My invention relates to an improvement in the construction of the bicycle-frame and in the means used for driving the bicycle, and comprises novel features which will be hereinafter described and claimed.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a side elevation of the bicycle shown in one of its simple forms. Fig. 2 is a section taken upon the line 2 2 of Fig. 1. Fig. 3 is a section taken through the handle-bar and its attachment to the head, showing one manner of taking up and storing the strap or flexible band by means of which power is communicated from the pedal to the driving mechanism. Fig. 4 is an elevation of the grip and the mechanism for connecting it and disconnecting it with and from the handle-bar. Fig. 5 is a side elevation, and Fig. 6 is a sectional plan view on the line 6 6 of Fig. 5, showing the manner of mounting the rear or ground driving-wheel of the bicycle in the frame. Fig. 7 is a sectional elevation of the clutch connection between the driving mechanism and the friction-wheel. Fig. 8 is a detail view of a pedal and the links by which the pedal is carried to one extreme position. Fig. 9 is a side elevation of a bicycle having a slightly-modified form of construction, the essential principles thereof being, however, the same as shown in Fig. 1. Fig. 10 is a plan view, partly in section, on the line 10 10 in Fig. 11, of a storing-drum for the strap and the means for operating it. Fig. 11 is a sectional elevation of the same mechanism, taken upon the line 11 11 of Fig. 10. Fig. 12 is a sectional plan view through the hub of the rear driving-wheel of the bicycle, the clutch and storage mechanism for the strap, and the driving mechanism. Fig. 13 is a side elevation of a bicycle of a slightly-modified form of construction. Fig. 14 is a sectional elevation taken upon the line 14 14 of Fig. 13. Fig. 15 is a sectional elevation taken upon the line 15 15 of Fig. 14. Fig. 16 is a partial side elevation of a bicycle similar in construction to that shown in Fig. 13, excepting that a modified form of storage mechanism for the strap is shown. Fig. 17 is a sectional elevation taken upon the line 17 17 of Fig. 16, and Fig. 18 is a sectional elevation taken upon the line 18 18 of Fig. 17.

The object of my invention is to provide, first, a frame for a bicycle and a method of driving the bicycle which will reduce the size, and consequently the weight, of the frame and which will also enable the gearing of the bicycle to be changed while the rider is in motion to any gearing within the limit of the bicycle, said limit to be a wide one.

Another object is to produce a driving mechanism which shall have no part exposed to dust and dirt, thus avoiding one of the great difficulties in connection with the ordinary chain-driven bicycle.

The mechanism adopted for communicating power from the pedal to the rear or driving wheel of the bicycle is a strap or similar flexible band which is mounted so as to be connected with the pedal and is carried about a drum which is connected by a clutch mechanism with the rear or ground wheel of the bicycle either directly or through the intervention of other mechanism, said drum being returned to wind up the strap when the pedal rises either by a positive connection with the opposite pedal and its connected mechanism or by a spring, as desired. I have also adopted as a preferred means of communicating the power from the clutch of this mechanism to the driving-wheel a friction-wheel which is mounted in the frame and engages the periphery of the rear or driving wheel of the bicycle. The frame is also jointed in such manner that the weight of the rider serves to swing the parts so as to hold the friction driving-wheel against the periphery of the driving or ground wheel of the bicycle with a pressure proportioned to the weight of the rider.

I will first describe the particular construction shown in Fig. 1 and later describe the modifications thereof shown in the other figures. In this form the forward portion of the bicycle-frame, consisting of the top horizontal bar A, the head A^2, the lower forward

brace A′, and the seat-post A^3, is constructed substantially the same as an ordinary bicycle, excepting that the lower portion thereof, corresponding with the location of the ordinary crank-wheel, is at considerably greater elevation than in the ordinary bicycle. At the point where the crank-hanger of the ordinary bicycle is located is journaled a friction driving-wheel B^2, which engages with the periphery of the rear or driving wheel B of the bicycle, provided with the usual pneumatic tire. The shaft *b* of the rear driving-wheel is journaled within a frame consisting of the two levers *a*, which have pivotal connection at their ends at *a′* with the rods A^7 and A^8, forming, respectively, the lower and upper rear braces or forks of the frame, said rods being pivoted at their opposite ends to the forward portion of the frame.

The saddle is supported in the usual position upon the frame. By reason of the pivotal connection of the forward portion of the bicycle-frame with the levers which carry the rear or driving wheel B the weight of the rider acts to force the friction driving-wheel B^2 against the tire of the wheel B, thus making the pressure between the two correspond with the weight of the rider. This has another advantage in the fact that it interposes a yielding support between the rider and the ground, as the weight is supported upon the pneumatic tire at two points—namely, where the driving-wheel rests upon the ground and where the friction-wheel rests upon the driving-wheel—thus insuring a double yielding action when the bicycle passes over any obstruction. This results in making the bicycle ride a great deal easier than does an ordinary bicycle, resulting in the possibility of making the frame lighter for the same strength.

Pivotally secured to the lower portion of the frame at the point corresponding with the location of the crank-hanger of the usual bicycle are two sets of links E, located one upon each side of the bicycle and composed of tubes which are pivoted to each other and are provided with rollers *e* at their ends. The lower links E carry pedals *d*, and the lower ends of these links are also provided with rollers *e*. About the rollers *e* passes a strap or flexible band D′, which is connected at one end with a drum mounted to turn in the frame at a point corresponding with the location of the crank-hanger. At this point are mounted to turn two cylinders or sleeves C, one at each side, and each of which has three radial flanges C^5, C^6, and C^7, forming two drums containing, respectively, the spiral coiled springs D^3 and the wound-up portions D of the driving-strap D′. The spring D^3 is connected at one end to the drum and at the other end to the casing a^2, which surrounds the drums. This spring therefore promptly takes up the strap after it has been drawn out by the depression of the pedal, thus raising the pedal ready for another stroke.

Upon the inner side of the flange C^5 is mounted a clutch mechanism which is adapted to engage a circular flange B^3 upon the hub B^4 of the friction driving-wheel B^2. The hub of this friction driving-wheel has an axial sleeve B^5, which is mounted to turn on ball-bearings and which carries the sleeves or cylinders C and the clutch mechanism, said sleeves or cylinders being supported by ball-bearings. The clutch mechanism is shown in detail in Figs. 2 and 7. Carried upon each sleeve or cylinder C is a radial flange C′, which has pivoted thereto a series of links C^2, which carry at their outer ends friction-blocks C^3, adapted to engage the inner surface of the circular flange B^3, carried by the friction-wheel B^2. These arms and friction-blocks are supported at regular distances from each other by being pivotally connected to two rings C^4. This mechanism insures that the clutch shall positively engage the hub of the friction driving-wheel when turned in one direction and be freed therefrom when turned in the opposite direction.

In the form of the device shown in Fig. 2 the spring D^3, by which the strap-carrying drum is rotated to wind up the strap, is located between said drum and the clutch. It is possible, as will be hereinafter described, to locate this spring at another point. The strap after passing downward from its drum passes over the pulley at the pedal end of the links E and then through these links, which are tubular, over the pulleys *e* therein until it reaches the upper end of the links, when it passes, preferably, inside of the tube A′ of the frame, as shown at D^2, to the head of the bicycle, over a guide-pulley *e′*, and then upward to the storing-drum, which in the form shown in Fig. 1 is located at the upper end of the bicycle-head. This drum and the manner of operating it are shown in detail in Fig. 3. The drum F′ has a portion D^4 of the strap D′ wound thereon, the amount which wound upon the drum at any time depending upon the gear which it is desired the bicycle shall have. This storage-drum is inclosed within a casing F and is provided with ball-bearings at each end thereof. At one end it is provided with an ear, to which is connected one end of a chain F^2 or other flexible device by which the drum may be rotated. Any form of flexible shafting may be used for this purpose. This chain or flexible shafting F^2 passes through the hollow of one side of the handle-bar F^7 and at its outer end is connected with a plate F^3, which is secured to the outer end of the grip F^4. This grip is mounted to turn upon the handle-bar and has its inner end provided with a ring of ratchet-teeth, which ring is adapted to engage a similar ring of teeth upon a collar F^5, said collar being mounted to slide upon the handle-bar, but not to turn thereon. This collar is held in engagement with the end of the grip by means of a spring F^6, which surrounds the handle-bar and normally holds the clutch-collar against the grip.

Instead of making the ratchet-teeth in the

manner shown in the drawings it might be desirable in some cases to make the teeth in the form of a clutch, so that the grip could not be rotated in either direction without pressing the collar F^5 backward. When, however, the teeth are made as ratchet-teeth, as shown in Fig. 4, the grip may be rotated in one direction without touching the collar F^5; but when it is desired to rotate the grip in the opposite direction the collar F^5 should be pressed backward by the thumb. By this means it is possible to turn the drum F′ so as to wind the portion D^4 of the strap D′ thereon or to unwind it therefrom, as desired. The spring D^3, by which the strap-carrying or power drum is controlled, is of such strength that it will wind all of the strap thereon which it is possible to unwind from the drum F′. It is evident that if considerable of the strap D′ is wound upon the power-drum said drum will be of greater diameter than when the storing-drum F′ carries considerable of the strap. In such cases the driving-gear by which the bicycle is propelled will be more powerful than when only a small part of the strap is upon the power-drum, the bicycle being, in effect, of a lower gear, but having more power. By thus varying the amount of the strap which is stored upon the power-drum the gear of the bicycle may be changed to anything within wide limits, and it is possible to cause this variation while the rider is upon the bicycle.

The exact mechanism by which the strap is applied to rotate the bicycle may be varied considerably without changing the essential feature of the design—as, for instance, the links E, by which the pedals are carried upon the frame, may be dispensed with, as indicated in Figs. 13, 14, and 15. In this case the pedal *d* is swung immediately beneath a casing d^2, which carries a pulley e^2, over which the strap passes as a loop. By this means the travel of the strap is made twice that of the pedal, and the speed desired is secured either by a less number or by smaller drums than in the form shown in Fig. 1, in which the travel of the strap D′ is equal to the movement of the pedal. The strap is prevented from entanglement by the intervention of a guide or shield a^5. One end of the strap runs upward to the pulley which immediately rotates the friction driving-wheel B^2, while the other end passes to the storage-drum located within a casing *f*, which in this case is operated in a manner slightly different from that previously described. This drum *f*′ is shown in detail in Figs. 10 and 11. As therein shown, two drums are used, each one controlling the strap connected with the pedal upon its particular side. Each drum is provided with ratchet-teeth f^2, which are engaged by a tooth upon a lever f^3. The shaft of the drum extends through the end of the casing and has a grip-wheel f^4 secured thereto, by which the strap may be wound up when desired. These drums being located just back of the bicycle-head may be easily engaged by either hand when desired to wind up the strap, and thus to increase the effective gear of the bicycle. When it is desired to decrease the gear, the wheel f^4 may be engaged by the hand to check too rapid a backward motion and the lever f^3 raised by engaging it with a finger of the same hand. The spring located in what corresponds with the crank-hanger of the ordinary bicycle will wind up the strap D′ as fast as it is released from the storage-drum *f*′. A slightly-modified form of pedal is also shown in Fig. 9, in which the lower link E of the set which supports the pedal has an extension to which the pedal *d* is secured.

The mechanism shown in Fig. 14 by which the sleeves or cylinders C are connected with the friction driving-wheel B^2 is substantially the same as that previously described and shown in Fig. 2.

Fig. 9 illustrates the manner in which the strap-driving mechanism may be applied to the axle of the rear driving-wheel of the bicycle. In this case the friction driving-wheel B^2 (shown in Figs. 1 and 13) is dispensed with, and the strap is carried to the rear wheel of the bicycle.

Fig. 12 is a section through the parts shown in Fig. 9. In this construction the clutches are transferred from the position formerly described to the hub of the rear wheel. The drum O′, which is mounted upon the rear wheel, has a strap *h*, which passes forward through the portion A^7 of the frame to the drum O^4, which is mounted upon a shaft located at a point corresponding with the position of the crank-hanger of the usual bicycle. Alongside of the drum O′ and, in effect, forming a part thereof is a second drum O, which has a strap *h*′ passing upwardly through a casing P, which takes the place of the upper rear forks of the bicycle. Located above the wheel B is a shaft upon which is mounted a drum O^2, over which the strap *h*′ passes. The spring D^3, by which the strap is wound upon the drums when the pedal rises, is located at this point and is connected by one end with the drum O^2 and by the other end with a transverse shaft *x*. Upon this shaft are mounted two clutches I, which consist of two parts, a central disk and an outer ring, which are grooved upon their adjacent surfaces and have balls in said groove. The outer ring is connected with levers J, which are pivoted by one end to the framework of the bicycle and have two links J′ connected thereto in such manner as to form a toggle-joint, by which the clutches may be forced outward against the inner surface of the case within which the spring D^3 is mounted and which is secured to the drum O^2. The adjacent surfaces of the clutches and the spring-case are provided with supplementary projections and recesses by which the two may be locked together when desired. The two clutches I are normally held apart by a spring I′, which surrounds the central shaft and bears against their inner surfaces. The clutches

are pulled toward the center by means of the two links J′ and the controlling-rod J^2, which passes forward and is secured to a lever J^3, mounted upon the upper side of the tube A of the frame just back of the bicycle-head. When this lever is thrown in one position, the clutches are engaged with the spring-cases and the two pedals are connected positively, so that one must move up when the other moves down. To obtain this result, the strap h', which leads from the drum O to the drum O^2, is wound upon opposite sides of the drum at opposite sides of the wheel—that is, on one side of the wheel it runs upon the drum at its forward edge and at the other side of the wheel it runs upon the drum O^2 at its rear edge, as indicated by the dotted lines in Fig. 9. It will be obvious that the straps h and D′ practically form a single strap, having its intermediate portion secured to the auxiliary drums O^3 and O^4. The strap h, by which power is communicated from the pedals to the driving-wheel B, passes upon the drum O^4. Alongside of the drum O^4 and connected thereto so as to rotate with it is a drum O^3, upon which the strap D′, which leads to the pedals and from thence to the storing-drum, is mounted.

The storing-drums O^7 are mounted just forward of the drums O, and the two drums O^7 for the two sides are secured to the same shaft so that both turn together. The straps D′ are connected by their ends to the drums O^3 and O^7, the pedal being placed in the loop between either in the manner shown in Figs. 1 or 13. On the central portion of the shaft, carrying the drums O^7, is secured a drum O^5, upon which is mounted the strap O^6, which leads to a storage-drum mounted to operate in any of the manners described. By this construction a single storage-drum and strap is sufficient to adjust the gear on both sides of the bicycle.

Another modification which, however, embodies the same principles is shown in Figs. 16, 17, and 18. In these figures the pedal is at one end of the strap D′ instead of between the ends thereof, thus increasing the power, but decreasing the speed over the form shown in Figs. 13, 14, and 15. This strap passes over a pulley G, upon the shaft g of which is connected a second pulley G′, which carries a strap H, which leads over a pulley G^2 upon a shaft located above the shaft g. To one side of the pulley G^2 is secured another pulley G^3, which carries a strap H′, leading to a drum G^4, to the side of which is secured a casing containing the spring D^3 by which the straps are wound upon their drums and the pedals raised. The shaft upon which this casing and the drums G^4 are mounted also carries the clutching mechanism, previously described, by which the two pulleys may be connected, so as to make a positive and alternating connection between the two pedals, so that one pedal must go up when the other goes down. The clutch mechanism connecting the driving-drums with the friction-wheel B^2 is mounted within the hub of said friction-wheel, as clearly shown in Fig. 17. The storage-drum in this form is connected with the pedal, as clearly shown in Fig. 18. In this construction the pedal d^3 has a casing L secured above the same and containing a drum adapted to have the strap D′ wound thereon. This drum may be provided with a spring, so as to rewind the strap thereon, if desired, or the strap may be wound thereon by turning the drum by hand. The drum is provided with a ratchet-wheel L′, which is engaged by a pawl L^2, so as to prevent the strap from rewinding unless the pawl L^2 is disengaged. The other features of this construction are the same as have previously been described in connection with the other figures.

The form of the frame shown in Figs. 13 and 16 is slightly different from that previously described. In these figures the seat-mast is shown as divided into two parts A^5 and A^6, which at their point of union support the friction driving-wheel B^2 and are connected with the head by a tube A^4.

The mechanism herein described enables a rider to vary the gear of his bicycle to correspond with the condition of the roads over which he is running. When the roads are hilly, the rider can change the driving mechanism to a low gear, and thus mount the hills easily. When the road is level, the bicycle can be changed to a high gear, thus enabling speed to be made. This change can in all cases be made without stopping the wheel, and the changes can be made not to any one of two gears, but to any gear within the limit of the bicycle. The driving mechanism is also entirely incased, so that dust cannot get at it.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. A driving mechanism comprising a power-drum having a clutch driving device, a strap connection having one end secured to and winding upon and off said drum, an auxiliary drum on which an intermediate portion of said strap winds at one end and off which it winds at the other end to vary the diameter of the strap on said auxiliary drum and consequently the speed or power, said drum also forming a means for projecting a portion of the strap sidewise from the frame and clear of the operator's legs, a stirrup secured to and supported by another portion of said strap and by which the strap is unwound from the power-drum to rotate it in one direction, and means for reversing the motion of said power-drum to wind the strap thereon, substantially as described.

2. A driving mechanism comprising a power-drum having a clutch driving device, a strap connection having one end secured to and winding upon and off said drum, means for securing and holding stationary the other end of the strap, a stirrup having a roller

journaled therein immediately over the foot-opening of the same, and about which an intermediate portion of the said strap passes, and by means of which and of said stirrup the said strap is unwound from the power-drum to rotate it in one direction, and means for reversing, the motion of the power-drum to wind the strap thereon, substantially as described.

3. A driving mechanism comprising a power-drum having a clutch driving device, a strap connection having one end secured to and winding upon and off said drum, means for securing and holding stationary the other end of the strap, a set of jointed links pivoted at one end of the set to the frame and carrying a stirrup or pedal having a roller or pulley journaled therein at the other end of the set and about which an intermediate portion of the said strap passes and by means of which the said strap is unwound from the said drum to rotate it in one direction, and means for reversing the motion of said drum to wind the strap thereon, substantially as described.

4. A driving mechanism comprising a power-drum having a clutch driving device, a strap connection having one end secured to and winding upon and off said drum, means for securing and holding stationary the other end of the strap, a set of tubular jointed links having guide rollers or pulleys at their joints and pivoted at one end of the set to the frame and carrying a stirrup or pedal having a roller or pulley journaled therein at the other end of the set, an intermediate portion of said strap passing about said rollers or pulleys and through said tubular links, by means of which the said strap is unwound from said drum to rotate it in one direction, and means for reversing the motion of said drum to wind the strap thereon, substantially as described.

5. A driving mechanism comprising a power-drum having a clutch driving device, a strap connection having one end secured to and winding upon and off said drum, means for securing and holding stationary the other end of the strap, an auxiliary drum for projecting the strap clear of the frame on which drum portions of said strap wind, said drum, by the differing diameters of its end, affording means for meeting varying requirements of speed and power, a set of tubular jointed links having guide rollers or pulleys at their joints and pivoted at one end of the set to the frame, and carrying a stirrup or pedal having a roller or pulley journaled therein at the other end of the set, an intermediate portion of said strap passing about said rollers or pulleys and through said tubular links by means of which the said strap is unwound from said power-drum to rotate it in one direction, and means for reversing the motion of said power-drum to wind the strap thereon, substantially as described.

6. A driving mechanism having duplicate sets of driving means located upon each side of the part to be driven and each comprising a power-drum having a clutch driving device, a strap connection having one end secured to and winding upon and off said drum, means for securing and holding the other end of the strap connection, a footpiece engaging said strap connection and supported thereby and by which the strap is unwound from said drum to rotate it in one direction and means for positively connecting the duplicate sets of driving means to work reciprocally, so that the unwinding of the strap from the power-drum on one side will wind the strap upon the power-drum on the other side, substantially as described.

7. A driving mechanism having duplicate sets of driving means located upon each side of the part to be driven and each comprising a power-drum having a clutch driving device, a strap connection having an end secured to and winding upon and off said drum, means for securing and holding the other end of the strap connection, a footpiece engaging said strap connection and supported thereby, by which the strap is unwound from said drum to rotate it in one direction, and means whereby the duplicate sets of driving means can be positively connected to work reciprocally, so that the unwinding of the strap from the power-drum on one side will wind the strap upon the power-drum on the other side; or can be disconnected to work separately, so that each set is independent of the other entirely at the will of the operator, substantially as described.

8. A variable-speed driving mechanism, comprising a power-drum, means for imparting the forward motion of said drum to the part to be driven, a strap connection having one end secured to and winding upon and off said drum, a storage device receiving and holding the other end of the strap normally stationary, by which the amount of strap wound upon said power-drum is controlled, a footpiece engaging said strap connection and supported thereby, by which the strap is unwound from said power-drum to rotate it in one direction, and means for reversing the motion of the power-drum to wind the strap thereon, substantially as described.

9. A variable-speed driving mechanism having duplicate sets of driving means located upon each side of the part to be driven, and each comprising a power-drum having a clutch driving device, a strap connection having one end secured to and winding upon and off said drum, a storage device receiving and holding the other end of the strap normally stationary and by which the amount of strap wound upon the power-drum is controlled, a footpiece engaging said strap connection and supported thereby, by which the strap is unwound from the power-drum to rotate it in one direction, and a drum-reversing device, whereby the duplicate sets of driving means can be positively connected to work reciprocally, so that the unwinding of the strap from

the power-drum on one side will wind the strap upon the power-drum on the other side; or can be disconnected to work separately, so that each set is independent of the other at the will of the operator, substantially as described.

10. A drum-reversing device, comprising duplicate spring-drums having strap connections with duplicate sets of power-drums located upon each side of the part to be driven, said straps winding upon and off the respective drums on each side, duplicate spring-pressed clutches sliding upon splines or feathers upon a common shaft and having teeth adapted to engage similar teeth on said spring-drums, by means of which the said spring-drums and the power-drums are positively connected to work reciprocally or disconnected to work independently, and means for operating the said clutches with toggle-levers and handpieces conveniently located, substantially as described.

11. A clutch driving device, comprising a series of radial links pivoted at their inner ends to an axial sleeve extension of a power-drum and at their outer ends carrying friction-blocks adapted to engage a suitable extension of the part to be driven, said friction-blocks being forced into engagement with said sleeve extension upon the forward motion of said power-drum by the inertia of said links and blocks, by means of which the forward motion of the power-drum is imparted to the part to be driven, said links being pivoted intermediate of their ends to annular disks, by which the links are supported at equal distances apart and additional inertia obtained to force the said friction-blocks into engagement; the engaging faces of said blocks being formed to be freed from the sleeve extension upon a cessation or reversing of said motion of said power-drum, substantially as described.

12. A storage device, comprising a storage-drum journaled within an appropriate casing conveniently located, a strap connection having one end secured to and winding upon said drum, a power-drum to which the other end of the strap is secured and upon which it winds, a hand engageable rotative member or grip connected with said storage-drum to turn the same forward and backward to wind and unwind the strap thereon, and a ratchet-and-pawl locking arrangement, whereby the storage-drum is normally held stationary and the amount of strap wound upon the power-drum controlled and consequently the speed and power.

13. In a driving mechanism, the combination with duplicate clutch driving devices located on each side of and arranged to impart forward motion to, the part to be driven, and pedals having independent driving connections each with the clutch driving device on its respective side, of duplicate spring-drums conveniently located and each operatively connected with the clutch driving device on its respective side for causing the return stroke, and means by which the said spring-drums and two sets of driving means may be united to work reciprocally or be disconnected to work separately and independently at the will of the operator, substantially as described.

14. In a driving mechanism, the combination, with a driving-wheel and a friction-wheel engaging the driving-wheel, of a power-drum having a clutch driving connection with said friction-wheel, a strap connection having one end secured to and winding upon and off said drum, means for securing and holding the other end of the strap normally stationary, a footpiece engaging said strap connection and supported thereby, by which the strap is unwound from said drum to rotate it in one direction, and means for reversing the motion of said drum to wind the strap thereon, substantially as described.

15. In a bicycle, the combination, with a hollow handle-bar and a drum mounted in a casing carried by the handle-bar, of a grip mounted to turn on the handle-bar, and provided with ratchet-teeth at its inner end, a spring-pressed collar sliding upon a spline or feather on the handle-bar, and provided with teeth to engage the teeth of the grip, and a flexible shafting in the hollow handle-bar connecting the outer end of the grip with the drum, substantially as described.

16. In a bicycle, the combination with the frame carrying the front wheel, a friction-wheel and the saddle, of levers in which the axle of the rear wheel is mounted, of the rear fork having its upper end pivoted to the upper part of the frame and the lower ends of its fork to the rear ends of the said levers, and rear braces pivoted to the forward ends of the said levers and to the rear lower portion of the frame, substantially as herein shown and described.

17. A variable-speed driving mechanism, comprising a power-drum, means for imparting the motion of the drum to the part to be driven, a strap having one end secured to the drum and winding upon the same, a storing-drum to which the other end of the strap is secured and upon which more or less of the strap can be wound, said storing-drum being normally stationary, a pedal connected with and supported by the strap and by which the said strap is unwound from the power-drum to rotate it in one direction and without effecting the movement of the storing-drum, and means for turning the power-drum in the opposite direction to wind the strap thereon, substantially as described.

18. A variable-speed driving mechanism, comprising a spring-power drum having a clutch mechanism, a strap having one end secured to the said drum and winding upon the same, a normally stationary storing-drum to which the other end of the strap is secured, means for rotating the storing-drum to wind a portion of the strap thereon, and

a pedal connected with and supported by the strap between the said drums and by which the strap is unwound from the power-drum to rotate it in one direction and without effecting the movement of the storing-drum, substantially as described.

19. A variable-speed driving mechanism, comprising a spring-power drum having a clutch mechanism, a strap having one end secured to said drum and winding thereon, a normally stationary storing-drum to which the other end of the strap is secured, means for rotating the storing-drum to wind a portion of the strap thereon, and jointed links arranged between the said drums, the lowermost link carrying a pedal and a roller about which the strap from the power-drum to the storing-drum passes, substantially as described.

20. A variable-speed driving mechanism, comprising a spring-power drum having a clutch mechanism, a strap having one end secured to the said drum and winding thereon, a storing-drum to which the other end of the strap is secured and upon which a portion of the said strap can be wound to vary the amount of strap on the power-drum, and hollow jointed links through which the said strap passes, the lower link carrying a pedal and a roller about which the strap passes, substantially as described.

21. A variable-speed driving mechanism, comprising a spring-power drum having a clutch mechanism, a strap having one end secured to the drum and winding thereon, a storage-drum mounted upon the head of the frame and upon which a portion of the strap can be wound to vary the amount of strap on the winding-drum, means for operating the storing-drum from the grip of the handle-bar, and jointed hollow links through which the said strap passes, the lower link carrying a pedal, and a roller over which the strap passes, substantially as described.

22. A variable-speed driving mechanism for bicycles, comprising a friction-wheel engaging the rear wheel, a spring-drum having a clutch connection with the friction-wheel, a strap having one end secured to the drum and winding thereon and its other end secured to a support, and hollow jointed links pivoted to the frame and carrying a pedal at one end and a roller over which the said strap passes, substantially as described.

23. A variable-speed driving mechanism for bicycles, comprising a friction-wheel engaging the rear wheel, a spring-drum having a clutch connection with the friction-wheel, a strap having one end secured to the drum and winding thereon, a storing-drum to which the other end of the strap is secured, means for rotating the storing-drum to wind a portion of the strap thereon, and hollow jointed links pivoted to the frame, and through which the strap passes, the lower link carrying a pedal and a roller over which the strap passes, substantially as described.

24. A bicycle driving mechanism, comprising a set of tubular jointed links having guide-pulleys at their joints, and pivoted at one end of the set to the frame and carrying a pedal at the other end of the set, a flexible band or strap passing through the links and having one end secured to a support, and a pulley carrying the other end of the band and having a ratchet or clutch driving connection with the bicycle driving-wheel, substantially as described.

25. A bicycle driving mechanism, comprising a set of jointed links pivoted at one end of the set to the frame and carrying a pedal at the other end of the set, a pulley having a ratchet or clutch driving connection with the bicycle driving-wheel, a strap having one end secured to said pulley, and a storage-drum receiving the other end of the strap and adapted to be normally held stationary, the strap intermediate the pulley and drum being engaged by the pedal, substantially as described.

26. A bicycle driving mechanism, comprising a set of tubular jointed links having guide-pulleys at their joints and pivoted at one end of the set to the frame, a pedal carried by said links at the other end of the set, a pulley having a ratchet or clutch driving connection with the bicycle driving-wheel, a strap connected with said pulley to wind thereon, a storage-drum receiving the other end of the strap, and a strap intermediate the pulley and drum passing through the tubular links and about the pedal, substantially as described.

27. A bicycle, comprising a drum having a ratchet or clutch driving connection with a ground-wheel of the bicycle, a strap winding upon and off of said drum, means for winding the strap on said drum, a pedal or foot-piece engaging said strap, a storing-drum located on the bicycle-head and receiving the other end of the strap, a hand-engageable rotative member or grip connected with the storing-drum to turn it and a ratchet-and-pawl locking device for said drum for locking it stationary, substantially as described.

28. A bicycle, comprising a drum having a ratchet or clutch driving connection with a ground-wheel of the bicycle, a strap winding upon and off of said drum, means for winding the strap upon said drum, means with which the other end of the strap is secured and by which the amount of strap wound upon the drum is controlled, and a stirrup or pedal having a pulley or roller engaging the strap intermediate its ends, substantially as described.

29. A bicycle, having duplicate sets of driving means located one on each side thereof and each comprising a drum having a ratchet or clutch driving connection with a ground-wheel of the bicycle, a strap winding upon and off of said drum, means for securing and storing the other end of the strap, a stirrup having a pulley or roller-journals therein

immediately over the foot-opening of the stirrup and engaging a loop of the strap, and means for connecting the two sets of driving devices, whereby the unwinding of the strap from one drum will wind the strap upon the other drum, substantially as described.

30. A bicycle, having duplicate sets of driving means located one upon each side thereof, and each comprising a drum having a ratchet or clutch driving connection with a ground-wheel of the bicycle, a strap winding upon and off of said drum, a pedal or footpiece engaging said strap, a storing-drum located on the bicycle-head and receiving the other end of the strap, and a positive connection between the duplicate sets of driving mechanism, whereby the withdrawal of the strap from one driving-drum will wind it upon the other, substantially as described.

31. A bicycle, having duplicate sets of driving means located upon each side thereof, and each comprising a drum having a ratchet or clutch driving connection with a ground-wheel of the bicycle, a strap winding upon and off of said drum, a pedal or footpiece engaging said strap, a storing-drum located on the bicycle-head and receiving the other end of the strap, and a connection between the two sets of driving mechanisms containing a clutch by which they may be positively connected to work reciprocally or be disconnected to work separately, substantially as described.

32. In a bicycle, the combination with the frame, a spring-pulley, and means for operating the rear or drive wheel therefrom, of a strap having one end secured to the said pulley, a second pulley on the frame near the head thereof, and to which the other end of the strap is secured, means for operating the second pulley to wind the strap thereon, a pedal, and hollow links connecting the pedal with the frame and provided with pulleys, over which the strap in its passage through the said links to the second pulley passes, substantially as described.

33. In a bicycle, the combination with the rear wheel, and a friction-wheel engaging the rear wheel, of a spring-pulley, a clutch connection between the pulley and friction-wheel, a strap having one end secured to the pulley, a second pulley to which the other end of the strap is secured, said pulley being normally held stationary, means for turning the second pulley to wind a portion of the strap thereon, and a pedal carried by the strap for reciprocating it to turn the spring-pulley, substantially as described.

34. In a bicycle, the combination with the frame, the rear wheel, and a friction-wheel engaging the rear wheel, of a spring-pulley, a clutch connection between the pulley and friction-wheel, a second pulley to which the other end of the strap is secured, means for rotating the second pulley to wind the strap thereon, a pedal, and hollow links connecting the pedal with the frame and provided with pulleys, the said strap passing from the spring-pulley through the links and the forward brace of the frame to the second pulley, substantially as described.

35. In a bicycle driving mechanism, the combination with a driving-wheel, and a driving-pulley, of a series of links pivoted to the pulley, friction-blocks at the outer ends of the links and adapted to engage the hub of the driving-wheel, and means for supporting the links and blocks at regular distances apart, substantially as described.

36. In a bicycle driving mechanism, the combination with a driving-wheel having an axial sleeve and a flange on its hub, and a driving-pulley mounted on the sleeve of the driving-wheel, of a series of radial links pivoted at their inner ends to the pulley, friction-blocks secured to the outer ends of the links and adapted to engage the inner surface of the flange of the driving-wheel, and a ring to which the outer ends of the arms and the blocks are pivoted, substantially as described.

GEORGE MUNN LILBURN.

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