(No Model.) 3 Sheets—Sheet 1.

R. B. LAMBERT.

VELOCIPEDE.

No. 390,174. Patented Sept. 25, 1888.

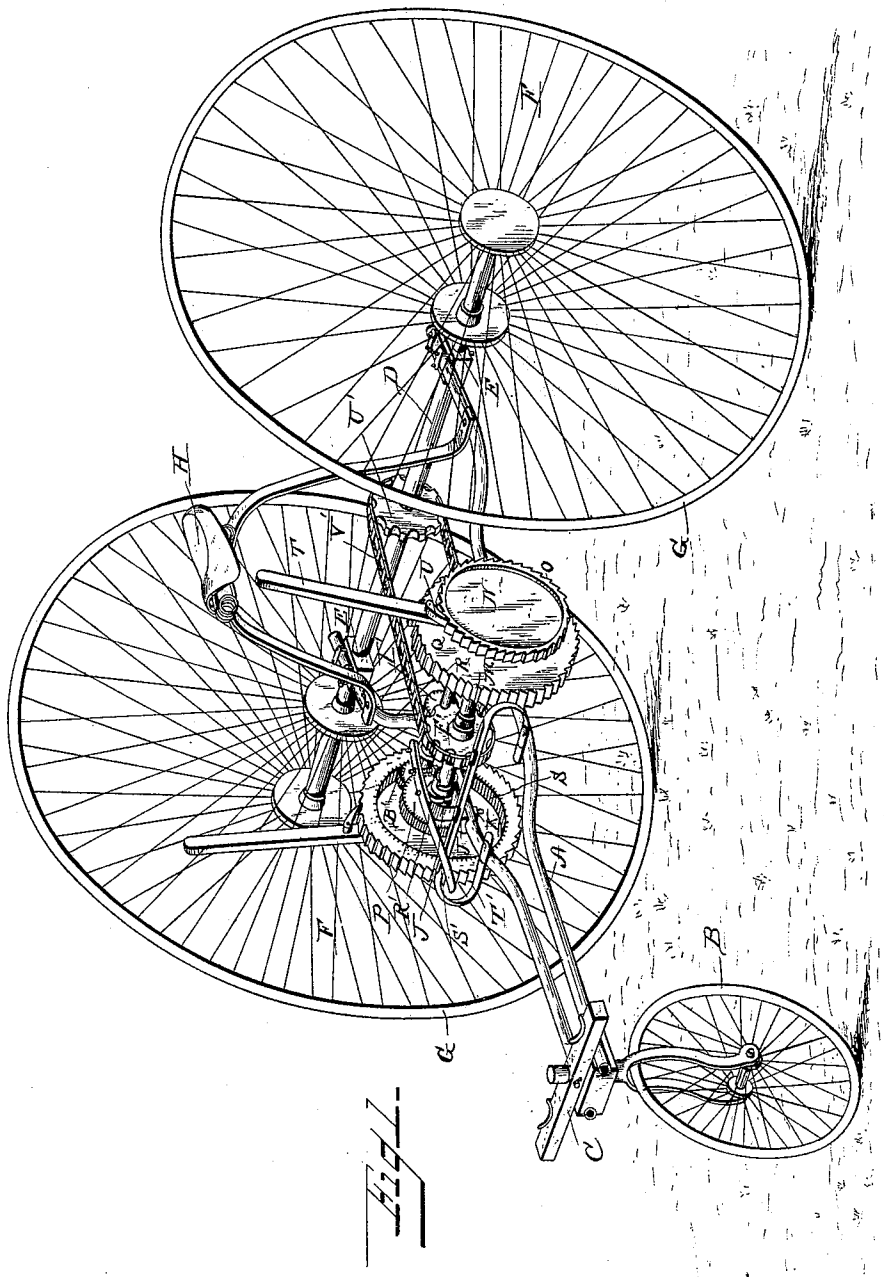

Fig. 1.

Witnesses
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(No Model.) 3 Sheets—Sheet 2.

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Fig. 2.

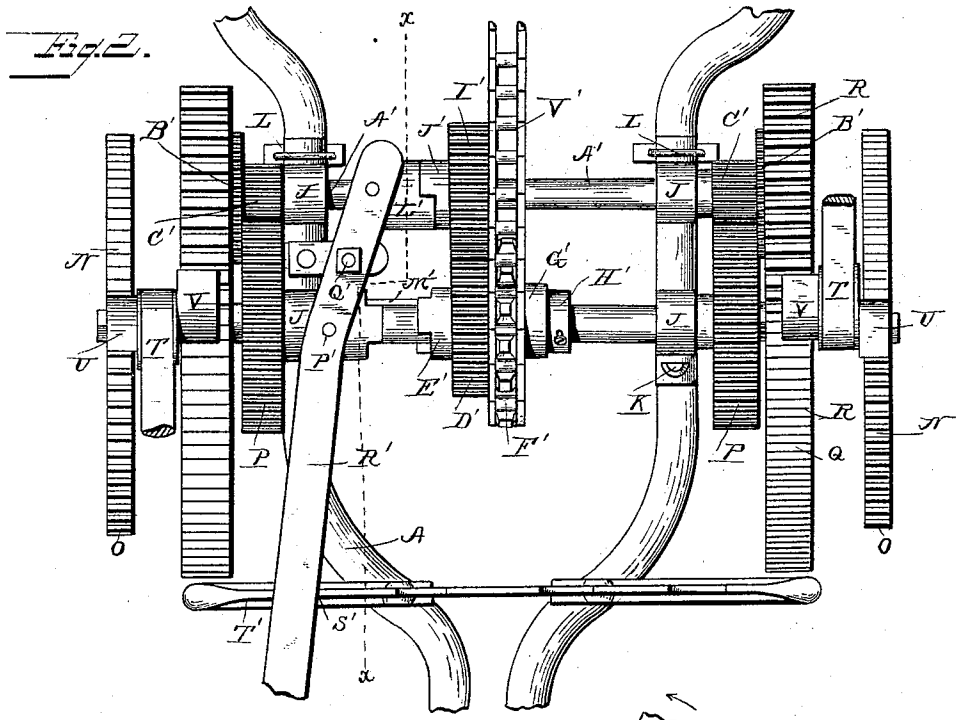
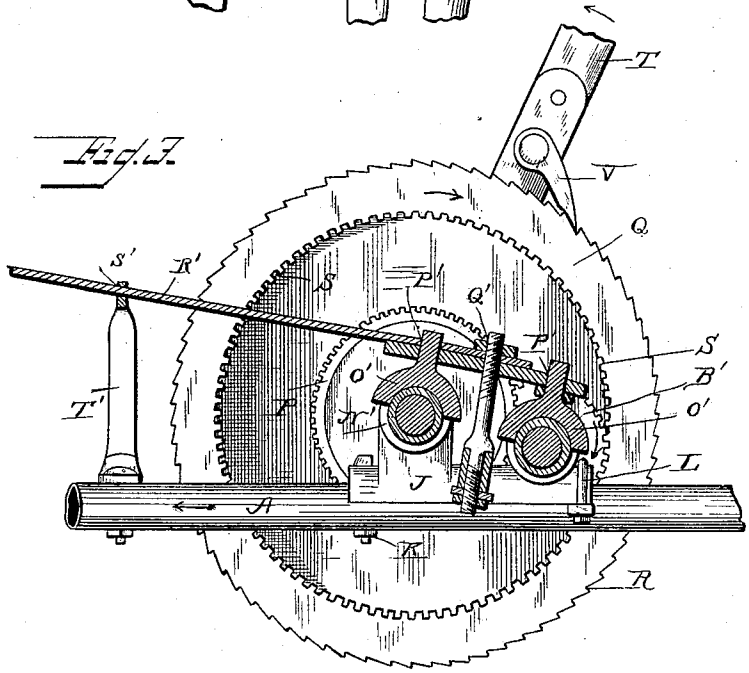


Fig. 1.



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(No Model.) 3 Sheets—Sheet 3.

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Fig. 4.

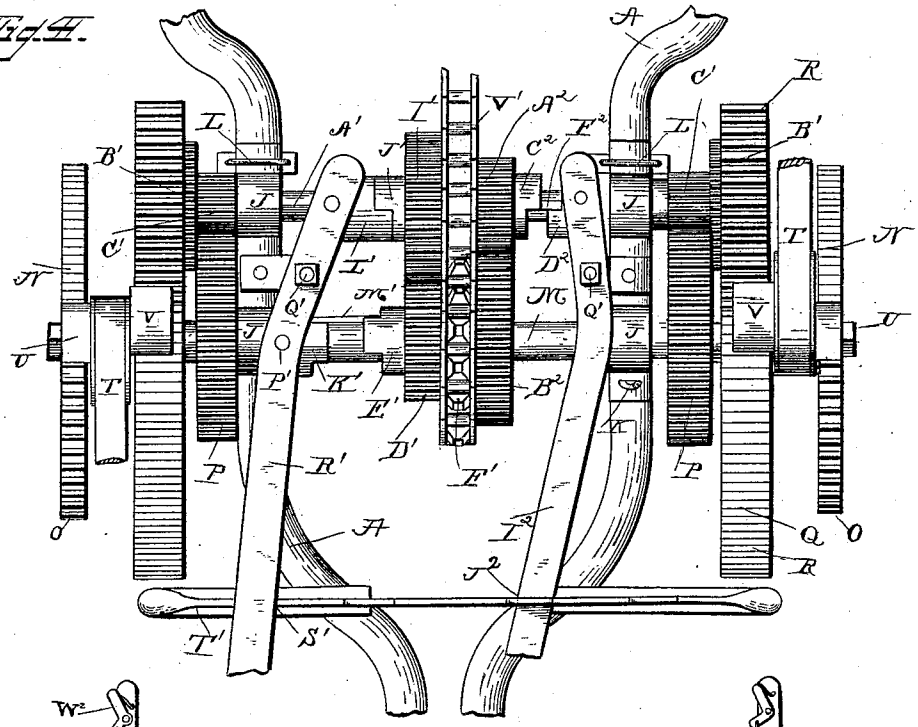


Fig. 5.

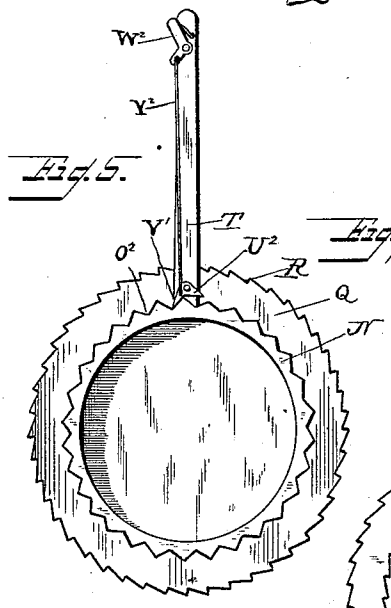


Fig. 7.

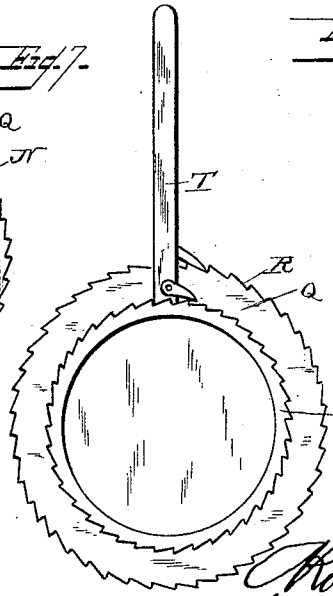
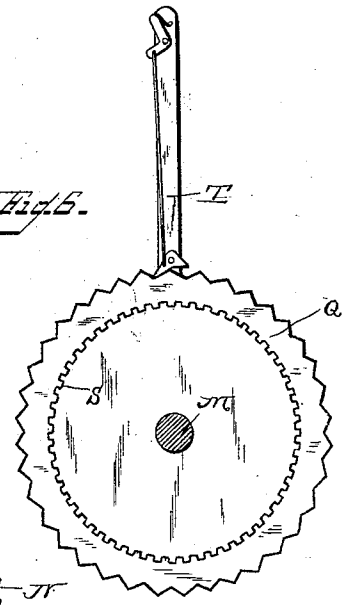


Fig. 6.



Witnesses
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UNITED STATES PATENT OFFICE.

ROBERT B. LAMBERT, OF WAYNESBOROUGH, VIRGINIA, ASSIGNOR OF ONE-HALF TO THOMPSON W. LAMBERT, OF SAME PLACE.

VELOCIPEDE.

SPECIFICATION forming part of Letters Patent No. 390,174, dated September 25, 1888.

Application filed March 28, 1887. Renewed December 27, 1887. Serial No. 259,071. (No model.)

To all whom it may concern:

Be it known that I, ROBERT B. LAMBERT, a citizen of the United States, and a resident of Waynesborough, in the county of Augusta and State of Virginia, have invented certain new and useful Improvements in Propelling Tricycles; 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, which form a part of this specification, and in which—

Figure 1 is a perspective view of my improved tricycle. Fig. 2 is a top plan view of my improved propelling mechanism. Fig. 3 is a vertical sectional view taken on line *x x*, Fig. 2, looking outward. Fig. 4 is a top plan view of my improved propelling mechanism, showing the gearing for obtaining an intermediate rate of speed when desired. Fig. 5 is a side elevation showing a slight modification of my invention; and Figs. 6 and 7 are detail views, the nature of which will be hereinafter specified.

The same letters of reference indicate corresponding parts in all the figures.

My invention consists in an improved hand propelling mechanism which is especially designed for propelling tricycles by hand, but which is also adapted for propelling any form or kind of vehicle or machine—such as a corn or other seed planter, or in fact any form of wheeled vehicle or machine which it may be desired to propel by hand; and the mechanism may also be used for rotating the drum or shaft of a derrick or other hoisting apparatus by hand, and in fact may be used for a vast number of purposes where a hand propelling-power is required.

The main object of my invention is to provide a driving mechanism which, as above specified, is especially designed for tricycles, although it may be applied to any vehicle which it is desired to propel by human agencies, and in which, by obviating all unnecessary movements, the fatigue attendant on its operation is reduced to the minimum. In my invention all dead-centers are entirely overcome and avoided—a great and conceded advantage, especially when the tricycle is climbing hills or traveling over rough, muddy, or sandy roads.

The formation of man's body is such that the arms freely admit or can be freely used in curved or circular motions with far less fatigue than the legs, the legs being only suited, in the main, for direct or straight movements, as in walking. The hand is suited to turning a crank. The foot is not. When we seek to rotate a crank-shaft entirely by the foot we will soon tire at it, as it will be seen that with every downward movement of the foot and leg, when they reach their lowermost point or farthest limit, we are necessarily compelled to lift the entire weight of the foot and leg back and up again to its former position or starting-point, repeating this movement at each stroke of the pedal in order to apply power again.

My invention, which will be hereinafter fully described and claimed, overcomes all of these difficulties by providing a mechanism in which the two operating-levers are reciprocated by hand, supporting the weight of the arms and hands, and in which the drive shaft is rotated in one direction both by the backward as well as by the forward movement or stroke of the hand lever or levers rotating continuously in one direction.

My invention further consists in means for changing or regulating the rate of speed in a device for causing the drive-shaft to be rotated backward as well as forward, in means for enabling the tricycle to be propelled by the simultaneous backward stroke or movement of both levers, employing the same movement as in rowing a boat, and in certain other details of construction, which will be hereinafter fully described and claimed.

Referring to the several parts by letter, A indicates the frame of a tricycle in which my invention is embodied, the frame being preferably made tubular, although any other suitable form of frame may be employed. The forward end of this frame is supported on the small forward wheel, B, which may be turned by means of the foot-rest C, so as to guide the machine by the feet. The rear end of the frame A is supported on the wheel-shaft D, which is preferably provided in the center with a compensating-gear of the ordinary construction, while upon the ends of the shaft or axle D are

secured the large main wheels F F, which are preferably of the ordinary construction of bicycle and tricycle wheels, having the rubber tires G. Upon the frame is also mounted the spring saddle or seat H, of ordinary construction.

The above-described parts may be made of any suitable or ordinary construction and form no part, *per se*, of my invention, as they are all of old and well-known forms.

I indicates my propelling mechanism, which when applied to a tricycle, as here shown, is secured upon the frame A in front of the saddle or seat H, the bearing-blocks J being recessed longitudinally on their lower sides to adapt them to fit upon the sides of the tubular frame A, and being secured thereon by the bolts K and clips L. Through these bearings passes the main drive-shaft M, which revolves in the said bearings, and upon the outer extremities of the projecting ends of this shaft are rigidly keyed the large ratchet-wheels N, which are usually constructed with the rearwardly-inclined teeth O.

Upon the drive-shaft M, immediately adjacent to the outer sides of the frame A, are rigidly keyed the cog-wheels P P, while upon the ends of the drive-shaft, outside of the cog-wheels P, are loosely mounted the large flanged wheels Q, having their peripheries or outer sides of their rim-flange formed with the series of forwardly-inclined teeth R, while the inner side of their flanges is formed with the series of straight teeth S.

Upon the outer ends of the main drive-shaft M, between the large ratchet-wheels N N and the flanged wheels Q, are pivotally or loosely mounted the lower ends of the two hand-levers T T, the upper ends of which are turned or rounded to form convenient handles, and upon the outer side of each hand-lever is pivoted at its upper end a pawl, U, the lower free end of which is adapted to engage with the rearwardly-inclined teeth of the large outer ratchet-wheel N on that end of the shaft, while upon the inner side of each hand-lever is pivoted at its upper end a similar pawl, V, the lower free end of which is adapted to engage with the forwardly-inclined teeth R of the loosely-mounted flanged wheel Q on that end of the shaft.

A′ indicates the auxiliary drive-shaft, which is also supported and turns in bearings in the blocks J J to the rear of the main drive-shaft M, but in such proximity to the main drive-shaft that its ends extend within the space inclosed by the rim-flange of the wheels Q Q, as shown, and upon these ends of the shaft A′ are rigidly keyed the cog-wheels B′ B′, the teeth of which mesh with the inner flange-teeth, S, of the loosely-mounted flanged wheels Q, while upon the outer portions of the shaft A′, between the said cog-wheels B′ and the outer side of the bearing-blocks J, are rigidly keyed the toothed pinions C′, the teeth of which engage with the teeth of the cog-wheels P.

Now it will be seen that as either (or both) hand-lever T is pushed forward at its upper end the lower free end of its outer pawl, U, will engage with the straight faces of the rearwardly-inclined teeth O of that ratchet-wheel N, thus turning the said wheel forward. As this wheel is rigidly keyed upon the main drive-shaft, the said drive-shaft is also rotated forward, carrying with it the cog-wheels P P, and as the teeth of these cog-wheels mesh with the teeth of the pinions C′ C′, which are fixed upon the auxiliary drive shaft, it follows that as the main drive-shaft is rotated forward by the forward push of the hand lever or levers it rotates the auxiliary drive-shaft backward, and that the cog-wheels B′, which are rigidly keyed upon the auxiliary drive-shaft, are thus rotated backward, as indicated by the arrow in Fig. 3. The teeth of these cog-wheels B′ mesh, as described, with the inner series of flange-teeth, S, of the loosely-mounted wheels Q, as described, and as the cog-wheels B′, with their shaft, are rotated backward they thus rotate the loosely-mounted flange-wheels Q backward, as indicated by the arrow in Fig. 3, the inclined rear sides of the outer series of teeth, R, of the wheel Q passing under and raising the lower ends of the inner pawls, V. Now, as the lever (or levers) is drawn back at the close of its forward stroke or movement, the lower free end of its outer pawl, U, slides over the inclined forward faces of the teeth O of that ratchet-wheel N, while the lower free end of the inner pawl, V, engages with the straight-forward faces of the forwardly-inclined outer series of teeth, R, of that loosely-mounted flanged wheel Q, thus rotating the said wheel Q backward on the main drive-shaft, and as the inner series of teeth, S, of the said flanged wheel mesh with the teeth of the cog-wheel B′ it will be seen that the auxiliary drive-shaft will be rotated backward, together with both of its cog-wheels B′ and pinions C′, and as these pinions mesh with the cog-wheels P P, which are rigidly keyed upon the main drive-shaft, it will be seen that as the auxiliary drive-shaft is thus rotated backward by the backward movement of the hand-lever or levers the cog-wheels P P, and consequently the main drive-shaft upon which they are rigidly keyed, will be rotated forward, and it will thus be seen that the main drive-shaft, which imparts motion to the main wheels F F of the tricycle, as herein described, will be continuously rotated in one direction forward, being revolved forward by the backward as well as by the forward movements of the hand-levers, and it will further be seen that the levers may be operated either separately, alternately, or simultaneously, both being pushed forward and drawn back together, as will be readily understood.

It will be seen by reference to the drawings that the diameter of the ratchet-wheels N and of the inner toothed flange of the loosely-mounted wheels Q is about the same, while the diameter of the pinions C′ is only about one-third of the diameter of the wheels N N. Thus, if the diameter of the ratchet-wheels N and of

the inner flange of wheels Q is nine inches, the diameter of the pinions C′ will be three; and, in order to prevent the main drive-shaft from being driven three times as fast on the back-strokes of the hand-levers as on the forward strokes of the same, to equalize the revolutions of the main drive-shaft on both movements, I reduce the diameter of the pinions C′ C′ on the auxiliary drive-shaft to one and one-half inch and make the cog-wheels P P on the main drive-shaft, with which these pinions mesh, four and one-half inches in diameter, by which arrangement, as will be readily understood, the main drive-shaft will be rotated continuously at the same rate of speed on the backward as well as on the forward stroke of the hand-levers.

Upon the central part of the main drive-shaft M is loosely mounted a cog-wheel, D′, which has formed on its right-hand side a clutch-hub, E′, and upon the said drive-shaft, to the left of the wheel D′, is also loosely mounted a sprocket-wheel, F′, which has preferably formed on its left-hand side a plain hub, G′, the outer end of which comes in contact with a fixed collar, H′, on the said drive-shaft, which holds the cog and sprocket wheels from slipping on the main drive shaft to the left. The cog-wheel D′ and the sprocket-wheel F′ are bolted together, or may be cast integral, if desired; and upon the central part of the auxiliary drive-shaft is loosely mounted a cog-wheel, I′, the teeth of which mesh with the teeth of the cog-wheel D′, the wheels I′ and D′ being of the same diameter (three inches each) when the other wheels are made of the diameters before given, and the right-hand side of the rear cog-wheel, I′, is formed with a clutch-hub, J′.

Upon that portion of the main and auxiliary drive-shafts between the right-hand bearing-block J and the clutch-hubs of the cog-wheels D′ and I′ are loosely mounted the clutch sleeves or rings K′ and L′, which are prevented from turning on the shafts by the feathers M′, and the clutch-rings are formed near their outer ends with the annular grooves N′, in which fit the yokes O′ O′, the upright stems of which pass loosely through openings P′ on each side, respectively, of the central pivot, Q′, of an adjusting-lever, R′, the free forward end of which is adapted to be engaged with either one of three recesses or notches, S′, cut in the upper edge of the rack or locking-bar T′, which is secured upon the machine-frame A in advance of the drive shafts, as shown.

Upon the wheel-shaft or axle D is rigidly mounted, in line with the sprocket wheel F′ on the main drive shaft, a sprocket-wheel, U′, and around these two sprocket-wheels passes the drive chain V′, which may be of any suitable construction, the drive-chain transmitting motion from the main drive shaft to the axle D, so that as the said drive-shaft is revolved it rotates the axle D through the drive-chain in the same direction, and consequently rotates the large main wheels F F in the same direction, thus propelling the machine or tricycle forward.

The adjusting-lever R′ is pivoted at Q′ at such a distance from the cog-wheels D′ and I′ that when the free forward end or part of the said lever is engaged with the central notch, S′, upon the locking-bar T′ both of the clutch-rings K′ and L′ are clear of and out of engagement with the clutch-hubs of the cog-wheels D′ and I′, so that the loosely-mounted cog-wheels D′ and I′ and the sprocket-wheel F′ are independent of the movement of the drive-shafts, will not turn with the same, and the machine can then be pushed back or forward by hand or readily turned without moving the hand-levers or the drive-shafts. By moving the forward end of the adjusting-lever R′ to one side of this central notch of the locking-bar T′ until it engages with one of the end notches, S′, the forward clutch-ring, K′, can be caused to engage with the clutch-hub of the cog-wheel D′ on the main drive-shaft, and by turning the said lever-handle to engage with the other end notch the rear clutch-ring, L′, is thrown into engagement with the clutch-hub of the cog-wheel I′ on the auxiliary drive-shaft, and by thus changing the gearing it will be seen that the rate of speed can be changed in a moment, by merely shifting the adjusting-lever from one side to the other, from fast to slow.

When it is desired to obtain a medium or intermediate rate of speed, I employ the additional gearing shown in detail in Fig. 4 of the drawings, consisting of a small cog-wheel or driver, A^2, which is loosely mounted upon the rear or auxiliary drive-shaft, and a larger cog-wheel, B^2, which is loosely mounted on the forward or main drive-shaft, being bolted or cast to the left hand side of the sprocket-wheel F′, and the left-hand side of the driver A^2 is formed with a clutch-hub, C^2, the diameter of the driver A^2 being only one-half of that of the loosely-mounted forward cog-wheel, B^2, and a clutch-ring, D^2, is loosely mounted upon the auxiliary drive shaft immediately to the left of the cog-wheel A^2, being prevented from turning by a feather, F^2, on the drive-shaft, on which it slides, the outer end of this clutch-ring being formed with an annular ring, G^2, in which fits a yoke, H^2, which is moved from side to side by means of the pivoted auxiliary adjusting-lever I^2, which engages at its forward free end with a notch, J^2, formed on the under side of the locking-bar T′, which the said handle springs up into. It will be seen that by this device or gearing an intermediate rate of speed may be obtained when desired in place of a rapid or comparatively slow rate of speed.

When desired, the outer pawls, U, of each lever can be swung or turned back on their pivots, as shown in the detail view, Fig. 7, so that their lower ends will not engage with the straight faces of the teeth of the outer ratchet-wheels, N N, so that the main drive-shaft will not be rotated on the forward movement of

the hand-levers, but will only be rotated as the said levers are drawn back, and the tricycle can now be propelled by drawing back the hand-levers simultaneously, the hand-levers swinging forward easily together, as their pawls do not then engage in any manner with the drive mechanism, while on the back-stroke both levers revolve the drive-shaft together, and it will be seen that the machine can thus be propelled by the same movement as that used in rowing a boat, leaning forward to get the grip on the propelling mechanism and drawing back both levers together on the recovery or back stroke, and the propelling mechanism can thus be operated and the tricycle driven forward with much greater power and speed than by any other manner of propulsion, as it is proved by statistics that comparing the power obtained by working eight hours per day, in pounds raised one foot per minute, is for a man when using the same movement as in rowing four thousand pounds, while by turning the crank or handle the power is only two thousand six hundred pounds. Thus it will be seen that by merely throwing or turning the outer pawls, U, over backward the degree of power obtained can be raised nearly one hundred per cent., which is especially valuable in climbing hills or in going over rough roads or in many other emergencies, and the outer pawls are pivoted and constructed especially so that they can thus be reversed in a moment for this purpose.

Any usual style or form of brake may be used on my improved tricycle to stop it when moving forward, while it can be stopped in a moment against backward movement, even when ascending a steep hill, by merely holding the hand-levers stationary, as the outer pawls engaging with the rearwardly-inclined teeth of the ratchet-wheels will effectually prevent the main drive-shaft from turning backward, and thus prevent the machine from moving backward, even when ascending a very steep slope.

If desired, the outer ratchet wheels, N, may be formed with teeth O^2, inclined in both directions, as shown in Fig. 5 of the drawings, instead of the rearwardly-inclined teeth O, and when the teeth of these ratchet-wheels are so constructed the pawl above them is constructed double, as shown at U^2, with points or downward ends extending both forward and backward, but of such a length that one end or point of one of the said pawls has to be raised, and the pawl thus turned on its central pivot before the other point or end can engage with the teeth O^2. The forward part of each pawl is connected pivotally by a connecting-wire or small rod, V^2, with a small spring-actuated handle, W^2, which is pivoted to the side of the upper end of that hand-lever, the tension of the spring operating to normally hold the front point of the pawl down in engagement with the rearwardly-inclined operative faces of the teeth O^2, and it will be seen that by thus raising this forward end of the said pawl by raising the handle W^2 the rear end of the pawl can be thrown into engagement with the forwardly-inclined sides of the double teeth O^2, the inner pawls, V', being at the same time swung or turned forward on their pivots, so as to disengage them from the outer teeth of the flanged wheels Q, and by operating the hand-levers, which only operate now on their backward strokes, the motion of the main drive-shaft is reversed, causing it to revolve backward, and thus propelling the machine backward, which may be necessary at times, both when the propelling mechanism is applied to a tricycle and when it is used for other purposes and on other machines. Any desired form of device may be employed for shifting the clutches, as the form shown in the drawings is in itself old, and forms no part, *per se*, of my invention. The propelling mechanism may be operated by propelling properly-arranged foot levers, as will be readily understood.

From the foregoing description, taken in connection with the accompanying drawings, the construction, operation, and advantages of my improved propelling mechanism and of my improved tricycle provided with the same will be readily understood. It will be seen that the propelling mechanism, while exceedingly effective in its operation, as fully set forth in the body of the specification, is also very simple and strong in its construction, being composed of but comparatively few parts, which are solid and strong in their construction. The propelling mechanism, as described, can be applied to a vast number of different purposes—for propelling machines and vehicles, rotating shafts, drums, &c., and for a great variety of other purposes which it is not necessary to here specify. The main drive-shaft can be revolved continuously either by alternate or simultaneous movements of the hand-levers, and at the rate of speed desired, and can also be rotated backward by adopting the construction shown in Fig. 5 and described in the specification. The said shaft can be rotated backward when desired on the backward strokes of the hand-levers, or by forming the outer series of the teeth of the flanged wheels double and the inner pawls, V, double, corresponding, respectively, with the teeth and pawl shown in Fig. 5. The main drive shaft can be rotated continuously backward when desired, as will be readily understood. When the tricycle is locked or stopped by holding the hand-levers stationary, as described, the lock thus formed is broken and the machine released at the moment when the propulsion is resumed.

A person minus one arm can operate or propel the tricycle to good advantage, or a person minus one leg can guide the tricycle easily.

Any desired form of friction-pawls might be employed without departing from the spirit of my invention, in which case the peripheries

of the ratchet and flanged wheels would of course be formed smooth for the said friction-pawls.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. The combination, in a propelling mechanism, of the main drive-shaft having the ratchet-wheels formed with the rearwardly-inclined teeth and the cog-wheels rigidly mounted upon it, and also having loosely mounted upon it the flanged wheels formed with the inner series of teeth and the outer series of forwardly-inclined teeth, the pivoted hand-levers having the outer and inner pawls, and the auxiliary drive-shaft having the cog-wheels and pinions rigidly mounted upon it, all constructed and arranged substantially as set forth.

2. The combination, with the tricycle-frame and the revolving rear shaft or axle carrying the main wheels, of the main drive-shaft having the ratchet-wheels formed with the rearwardly-inclined teeth and the cog-wheels rigidly mounted upon it, and also having loosely mounted upon it the flanged wheels formed with the inner series of teeth and the outer series of forwardly-inclined teeth, the pivoted hand-lever having the outer and inner pawls, the auxiliary drive-shaft having the cog-wheels and pinions rigidly mounted upon it, and a suitable drive-belt connecting the main drive-shaft with the wheel-axle, substantially as set forth.

3. The combination of the main drive-shaft having the ratchet-wheels formed with the rearwardly-inclined teeth and the cog-wheels rigidly mounted upon it, and having also loosely mounted upon it the flanged wheels formed with the inner series of teeth and the outer series of forwardly-inclined teeth, the hand-levers having the outer and inner pawls and adapted to be operated either alternately or simultaneously, the auxiliary drive-shaft having the cog-wheels and the pinions rigidly mounted upon it, the sprocket-wheel having the cog-wheel formed with the clutch-hub secured to it and both loosely mounted upon the central part of the main drive-shaft, the cog-wheel formed with the clutch-hub and loosely mounted upon the auxiliary drive-shaft, the two clutch-rings sliding on the feathers, and the adjusting-lever for the said rings, all substantially as and for the purpose herein set forth.

4. The combination, with the tricycle-frame and the revolving rear axle carrying the main wheels and having the sprocket-wheel rigidly mounted upon its center, of the main drive-shaft having the ratchet-wheels formed with the rearwardly-inclined teeth and the cog-wheels rigidly mounted upon it, and having also loosely mounted upon it the flanged wheels formed with the inner series of teeth and the outer series of forwardly-inclined teeth, the hand-levers having the outer and inner pawls and adapted to be operated either alternately or simultaneously, the auxiliary drive-shaft having the cog-wheels and the pinions rigidly mounted upon it, the sprocket-wheel having the cog-wheel formed with the clutch-hub secured to it and both loosely mounted upon the main drive-shaft, the cog-wheel formed with the clutch-hub and loosely mounted upon the auxiliary drive-shaft, the two clutch-rings sliding on the feathers, the adjusting-lever for the said rings, and the drive-chain, all substantially as and for the purpose set forth.

5. The combination of the main drive-shaft having the ratchet-wheels formed with the rearwardly-inclined teeth and the cog-wheels rigidly mounted upon it, and having also loosely mounted upon it the flanged wheels formed with the inner series of teeth and the outer series of forwardly-inclined teeth, the hand-levers having the outer and inner pawls and adapted to be operated either alternately or simultaneously, the auxiliary drive-shaft having the end cog-wheels and the pinions rigidly mounted upon it, the sprocket-wheel having secured to each side of it a cog-wheel, one of which is formed with a clutch-hub, and the three loosely mounted upon the main drive-shaft, the cog-wheels formed with the clutch-hubs and loosely mounted upon the auxiliary drive-shaft, the three clutch-rings loosely sliding on the feathers, and the two adjusting-levers for the said rings, substantially as and for the purpose set forth.

In testimony that I claim the foregoing as my own I have hereunto affixed my signature in presence of two witnesses.

ROBERT B. LAMBERT.

Witnesses:
AUGUST PETERSON,
ARTHUR L. MORSELL.