

No. 700,209.

Patented May 20, 1902.

H. J. LAWSON.
MOTOR DRIVING APPARATUS FOR CYCLES.

(Application filed Jan. 31, 1900.)

(No Model.)

4 Sheets—Sheet 1.

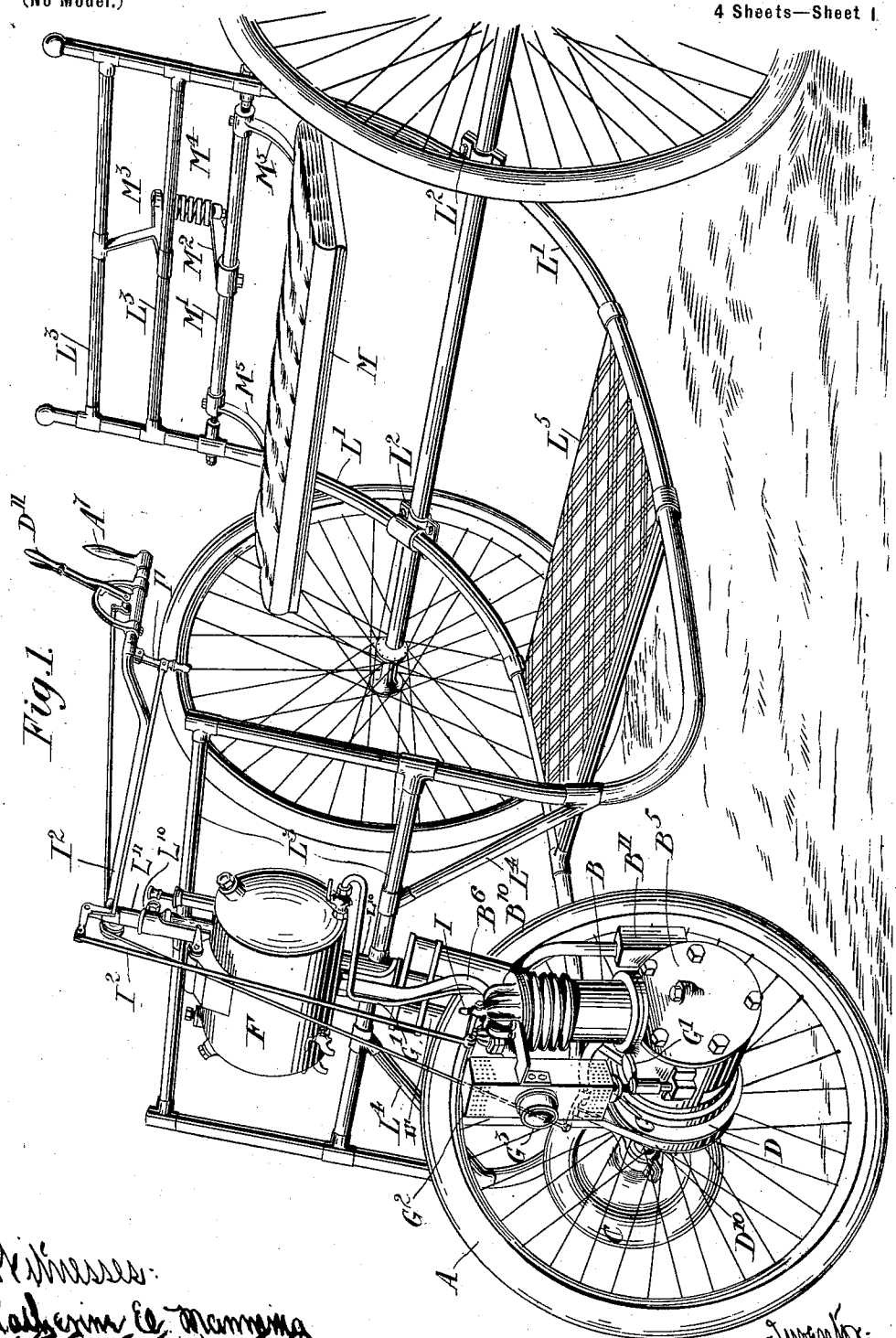


Fig. 1.

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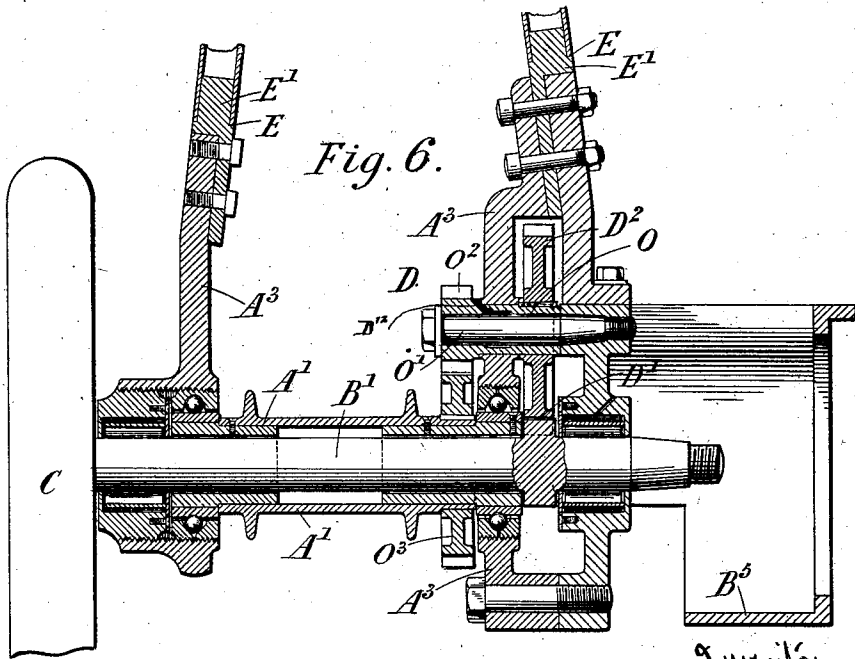
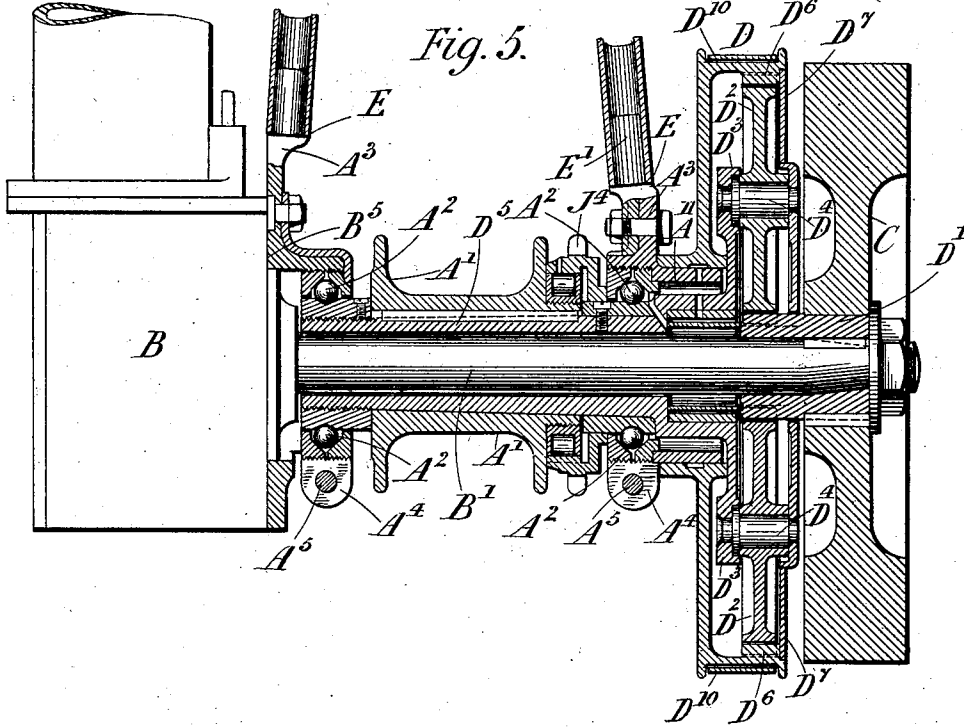
Inventor:
 Henry J. Lawson
 By *[Signature]*

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4 Sheets—Sheet 4.



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Inventor:
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UNITED STATES PATENT OFFICE.

HENRY JOHN LAWSON, OF LONDON, ENGLAND, ASSIGNOR TO CHARLES R. FLINT, TRUSTEE, OF NEW YORK, N. Y.

MOTOR DRIVING APPARATUS FOR CYCLES.

SPECIFICATION forming part of Letters Patent No. 700,209, dated May 20, 1902.

Application filed January 31, 1900. Serial No. 3,421. (No model.)

To all whom it may concern:

Be it known that I, HENRY JOHN LAWSON, a subject of the King of England, residing at London, England, have invented certain new and useful Improvements in or Relating to Motor Driving Apparatus for Cycles and Like Vehicles, of which the following is a specification.

The object of the present invention is to provide in connection with motor-wheels of the type disclosed in my prior Letters Patent, No. 633,014, granted September 12, 1899, certain improvements in the driving-gear of such motor-wheels.

In the accompanying drawings, which show the application of the above improvements, as well as details of construction thereof, Figure 1 is a perspective view of a cheap and light construction of vehicle forming the subject of a division of this application and fitted with the motor-wheel forming part of the subject-matter of the present application. Fig. 2 is a side elevation showing the application of the present invention to a dog-cart. Fig. 3 is a perspective view showing the application of the present invention to a phaeton. Fig. 4 is a central vertical section of my present novel construction of driving-gear adapted to a motor-wheel arranged to carry two motors, and Figs. 5 and 6 are central vertical sections of two modified forms of my new motor-wheel driving-gear.

Like letters indicate like parts throughout the drawings.

Fig. 1 illustrates a construction of vehicle especially adapted to meet the requirements of a three-wheeled vehicle, in that the frame may be made broad to prevent overturning, while the vehicle is at the same time extremely light and rigid. This is made the subject of a divisional application filed September 19, 1901, Serial No. 75,543, and will be but briefly described here. The frame of the vehicle comprises two main longitudinal U-shaped members L' L' , each secured rigidly to the rear axle L^2 and braced by transverse members L^3 at their upper ends. The fore part of the frame is provided with a steering-socket L^{10} , within which is mounted the steering-fork L^{11} for the wheel A, having at its upper end a lever A^7 , by which it may be steered.

The motor and its parts are arranged in a manner to be described below.

The lower front transverse member is braced to the longitudinal members L' by struts L^4 to give additional strength to that part of the frame, and at a convenient point on the upper end of the members L' , at the rear of the vehicle, is a seat M, carried by arms M^5 , projecting forwardly from a transverse rod M' , pivoted between the members L' . A lever M^2 is secured to the rod M' and projects rearwardly approximately at right angles from the same opposite a bracket M^3 above it, and which is rigidly secured to transverse members L^3 . Between the bracket M^3 and lever M^2 is a spring M^4 , by which the seat M is maintained in an approximately horizontal position. This spring is also necessary to take up vibration, (as the vehicle has no axle-springs,) thus preventing the same from being communicated to the rider. A foot-board L^5 , which also serves as a transverse strut to give additional rigidity to the lower part of the frame, is conveniently secured to the members L' beneath and preferably slightly in advance of the seat M.

The levers for operating the various parts of the motor may conveniently be arranged upon the steering-rod A^7 , any number of levers being provided, according to different requirements. The lever D^{11} for operating the band-brake D^{10} is shown in this case as provided with a rack and detent; but, if preferred, it may be arranged in any other convenient manner.

For convenience the casing G^2 of the ignition tube and burner may be provided with one or more apertures G^3 , closed with talc or glass, either plain or colored, to serve as a road-light or danger-signal.

Fig. 2 shows a convenient arrangement by which a motor-wheel may be applied to a dog-cart. The motor-wheel is carried in a steering-fork L^{11} , free to revolve in the steering-head L^{10} , which carries attaching-bars L^6 L^7 , of which the upper bars connect at L^{12} with the two longitudinal members on either side of the vehicle, being made to branch out from the steering-head in a manner to be passed on either side of the body of the vehicle and rigidly secured at L^{12} , as stated. The mem-

ber L^7 is a central member secured at its fore end to the lower part of the steering-head and passes beneath the body of the vehicle, being secured rigidly to the same. Struts L^8 (one
5 only of which is shown in the drawings) may be arranged between the members L^6 L^7 to strengthen that part of the frame which lies between the steering-socket and the vehicle.

The front fork is steered by a worm and
10 worm-wheel gearing operated by a hand-wheel N on a downwardly-extending shaft N^1 , having worm-gear N^2 , with forwardly-extending shaft N^3 , that has suitable gearing at N^4 with the fork L^{11} ; but the vehicle may be
15 steered by a horizontal lever, as in Fig. 1, if preferred.

Figure 3 shows a motor, a motor-wheel applied to a phaeton, the body of which may be constructed in any well-known manner, the
20 motor-connecting frame being replaced by two longitudinal members L^9 , braced together in any convenient manner and secured at their front ends to the steering-socket, within which the fork of the motor-wheel is mounted,
25 and at their rear ends carrying cross-bars L^{13} , connected to the frame of the vehicle. A light splash-board L^{14} may be arranged upon the members L^9 , if desired.

Fig. 4 shows an arrangement of gear for
30 use in a motor-wheel carrying two motors, (one on either side,) the fly-wheel of each in this case being dispensed with and the crank-disk made exceptionally heavy in order that it may serve as a substitute. Each motor is
35 provided with its own shaft B^1 , mounted at one end in a roller-bearing B^6 , formed in the crank-case B^3 , and at the other end in a roller-bearing B^7 , arranged within the hub A^1 of the driving-wheel A . The gearing is of the kind
40 described in my earlier patent, No. 633,014, referred to, a complete set of gear being provided for each motor-shaft. Only one wheel D^4 is shown in each set of gear, but two or more may be provided, and hub A^1 has on each side
45 an extension A^8 , running in ball-bearings A^2 in the lugs A^3 . The cones or cups of the bearings may be retained in the position in which they are set by any well-known devices, such as the stops A^9 A^{10} . It will be seen that the
50 hub A^1 is thus supported in the bearings A^2 independent of the shafts B^2 , and the shafts are each supported at both ends, one in the crank-chamber of the motor, the other in the hub A^1 . This form of driving-gear may be
55 modified by employing a single motor-shaft B^1 for both motors, such shafts having a pinion D^1 at each end for engagement with the separate driving-gear of each motor, and these gears may be arranged to give different
60 speeds. When arranged in this manner, it is obvious that the two gears cannot be used together, although both motors may be used to drive the shaft simultaneously through one or other of the gears.

Fig. 5 shows another construction of motor-wheel driving-gear. The reducing-gear D in this arrangement is mounted outside the fork

and preferably between the fly-wheel C and the blade of the fork. The wheel D^6 of the speed-gear is not secured to the fork, but is
70 carried by an extension A^{11} of the lug A^3 , upon which it is free to revolve. The wheels D^2 are carried, as before, by an arm D^3 , having an extension or sleeve D^5 , upon which is
75 mounted the hub A^1 , and between the spoke-flange of the hub and the blade of the fork is arranged a free wheel-clutch J^4 of any well-known construction. The motor-shaft
80 B^1 is carried at one end by a roller-bearing in the crank-case B^5 and at the other end by a roller-bearing arranged within the sleeve D^5 . In this construction of gear the pinion D^1 is keyed or otherwise secured to the fly-wheel C , the whole being then secured in any
85 convenient manner to the motor B^1 . Owing to this arrangement it is only necessary to detach the fly-wheel C from the motor-shaft in order that the whole motor may be removed from the rest of the mechanism, the shaft B being drawn out of the hub A^1 of the
90 road-wheel, while the driving-gear will still remain in place. The road-wheel will also retain its position, being carried in its bearings A^2 by the lugs A^3 . The lug A^3 , which carries the bearings A^2 on the left-hand side
95 of the figure, is shown as connected direct to the blade of the fork instead of being first attached to a second lug E^1 , as shown on the right hand of the hub. Where convenient, both lugs may be arranged in this manner in
100 any of the gears described, though it is generally desirable to have one side detachable from the fork-blade, as shown in this case, in order that the various parts may be placed
105 in position without unduly straining the fork-blades apart. The advantages of this arrangement over that described in my previous patent is that the wheel D^6 is free to revolve upon the extension A^{11} of the lug A^3 , except
110 when held by its band-brake D^{10} , so that the vehicle may be stopped by releasing the band-brake and thus allow the motor and gear to run idle. To start the motor, the whole vehicle is propelled forward by means of the clutch mechanism J^4 . Another advantage of this
115 construction is the reduction of friction between the high-speed motor-shaft B^1 and the sleeve D^5 , as the only contact between these two is a roller-bearing at one end, the greater part of the shaft being free from contact with
120 any part of the mechanism.

Fig. 6 shows another modified construction of speed-gear in which the wheel D^6 is dispensed with and one only of the wheels D^2 used; which is carried fast upon a sleeve O ,
125 free to revolve upon a pin O^1 . The pin O^1 is for convenience secured in the crank-case B^5 of the motor and projects through the lug A^3 , by which the motor and its parts are secured to the blades of the wheel-fork. The sleeve
130 O also passes through the lug A^3 and is provided on that side opposite that upon which the wheel D^2 is situated with a pinion O^2 , preferably made in one with the sleeve. Keyed

or otherwise secured on the hub A' is a wheel O³, which engages with the wheel O². This arrangement enables a cheap and simple construction of speed-gear to be used with the motor-wheel, and a clutch may be added, if desired, to throw one of the pinions out of gear, so that the motor may run idle when the vehicle is stopped. Also any well-known starting device may be applied to the mechanism.

It will be understood that the various connections between the operating-handles and valve or other parts operated by such handles in any of the devices described may be variously arranged to suit the requirements of the different riders or different forms of machine to which it may be desired to apply the motor-wheel.

In order that the bearings of the wheels D² in the speed-gears may be readily oiled without dismantling any part of the mechanism, a suitable oil-passage may be made through the casing with which they are surrounded, communicating with a longitudinal groove in the spindle D⁴, so that oil may be admitted to the center of the wheel-boss.

With reference to the gear Fig. 5 it is obvious that instead of holding the exterior of the circular rack with the hand-brake or other releaseable or graduating means the intermediate wheels may obviously be held or released in a similar manner and the circular rack revolved, or the pinion might be held and released and the two other members of the clutch made to revolve, one of the revolving members in each case being connected to the motor-shaft and the other to the wheel-hub; but by preference I hold the circular rack as shown.

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

1. In a motor driving apparatus the combination with a driving-wheel, of a hollow axle or hub therefor, fixed exterior bearings carrying the hub, means for securing said bearings to a rigid frame, a motor mounted on one side of the driving-wheel, a driving-shaft projecting from the motor into the hub of the driving-wheel, but not supporting the vehicle, a bearing within said hub for one end of the motor-shaft, a fixed bearing for the other end of the shaft, means for securing the fixed bearing to a rigid frame, and speed-gear interposed between the motor-shaft and hub of the driving-wheel.

2. In a motor driving apparatus, the combination with a driving-wheel, of a hollow axle or hub therefor, fixed exterior bearings carrying the hub, means for securing said bearings to a rigid frame whereby the vehicle is supported directly on the hub, a motor mounted on one side of the driving-wheel, a driving-shaft free from the weight of the vehicle projecting from the motor through the hub of the driving-wheel and having bearings therein, a fly-wheel mounted on that end of the shaft remote from the motor, fixed bearings

at each end of the shaft, means for securing these bearings to a rigid frame, and speed-gear interposed between the shaft and the hub of the driving-wheel at a point intermediate of the bearings for the hub, substantially as set forth.

3. In a motor driving apparatus the combination with a driving-wheel of a hollow axle or hub therefor, fixed bearings carrying the hub, means for securing said bearings to a rigid frame, a motor mounted on each side of the driving-wheel, a driving-shaft projecting from each motor into the hub of the driving-wheel, bearings within said hub for one end of each motor-shaft, fixed bearings for the other end of each shaft, means for securing these last bearings to a rigid frame, and speed-gear interposed between each shaft and the hub of the driving-wheel at points intermediate of the bearings for the hub, substantially as set forth.

4. In a motor driving apparatus, the combination with a driving-wheel of a hollow axle or hub therefor, a motor mounted on each side of the driving-wheel, a driving-shaft projecting from each motor into the hub of the said driving-wheel, bearings within the hub for one end of each motor-shaft, fixed bearings for the other end of each shaft, means for securing these bearings to a rigid frame, a pinion mounted fast on each driving-shaft, projections on the ends of the hub proper of the driving-wheel, extensions to the hub, projections on these extensions, means for connecting the extensions and hub, spur-wheels mounted between the hub and extensions carried by the projections on each and gearing with the pinions on the driving-shaft, fixed bearings for the extensions, means for securing these bearings to a rigid frame, internally-toothed wheels free to revolve on portions of the rigid frame and engaging the spur-wheels of the motors, and brake-bands whereby the internally-toothed wheels may be controlled, substantially as set forth.

5. In a motor driving apparatus the combination with a driving-wheel of a hollow axle or hub therefor, a motor mounted on one side of the driving-wheel, a driving-shaft projecting from the motor into the hub of the said driving-wheel, a bearing within the hub for one end of the motor-shaft, a fixed bearing for the other end of the shaft, means for securing said fixed bearing to a rigid frame, a pinion fast on the motor-shaft, a projection on one end of the hub proper, an extension to the hub, a projection on this extension, means for connecting the extension and hub, a spur-wheel mounted between the hub and extension carried by the projections on each and gearing with the pinions on the driving-shaft, a fixed bearing for this extension, a fixed bearing for that end of the hub remote from this extension, means for securing both bearings to a rigid frame, an internally-toothed wheel free to turn on a portion of the rigid frame outside the fork and engaging

the spur-wheel of the motor-shaft and a brake-band whereby the internally-toothed wheel may be controlled, substantially as set forth.

6. In a motor driving apparatus the combination with a driving-wheel of a hollow axle or hub therefor, a motor mounted on one side of the driving-wheel, a driving-shaft projecting from the motor through the hub of the road-wheel, bearings for the same, a fly-wheel mounted on that end of the shaft remote from the motor, a pinion fast on the motor-shaft outside the hub a projection on one end of the hub proper, an extension to the hub, a projection on this extension, means for connecting the extension and hub a spur-wheel mounted between the hub and extension carried by the projections on each and gearing with the pinions on the driving-shaft, a fixed bearing for this extension a fixed bearing for that end of the hub remote from this extension, means for securing these bearings to a rigid frame, an internally-toothed wheel free to turn on a portion of the rigid frame and engaging the spur-wheel of the motor-shaft and a brake-band whereby the internally-toothed wheel may be controlled, substantially as described.

7. In a motor driving apparatus the combination with a driving-wheel of a hollow axle or hub therefor, fixed bearings for the hub, means for securing said bearings to a rigid frame, a motor mounted on one side of the driving-wheel, a driving-shaft projecting from the motor through the hub of the driving-wheel, and removable longitudinally therefrom, an extension on one side of the

hub of the driving-wheel which projects through the hub-bearing on that side, a bearing within the hub for one end of the driving-shaft, a fixed bearing at the other end of the driving-shaft, means for securing this last bearing to a rigid frame, a pinion mounted detachably on that end of the driving-shaft remote from the motor, and speed-gear interposed between the said pinion and the hub extension, substantially as set forth.

8. In a motor driving apparatus, the combination with a driving-wheel of a hollow axle or hub therefor, fixed bearings for the hub, means for securing said bearings to a rigid frame, a motor mounted on one side of the driving-wheel, a driving-shaft projecting from the motor through the hub of the driving-wheel, an extension on one side of the hub of the driving-wheel which projects through the bearing on that side, a bearing within the hub for one end of the driving-shaft, a fixed bearing at the other end of the driving-shaft, means for securing this last bearing to a rigid frame, a fly-wheel and pinion mounted detachably on that end of the driving-shaft remote from the motor, so that the motor thereby becomes detachable, and speed-gear interposed between the said pinion and the hub extension, substantially as set forth.

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

HENRY JOHN LAWSON.

Witnesses:

EDWIN S. CLARKSON,
HERVEY S. KNIGHT.