No. 654,478. Patented July 24, 1900.

# J. H. MUNSON.

## MOTOR CYCLE.

(Application filed May 16, 1898.)

(No Model.) 6 Sheets—Sheet 1.

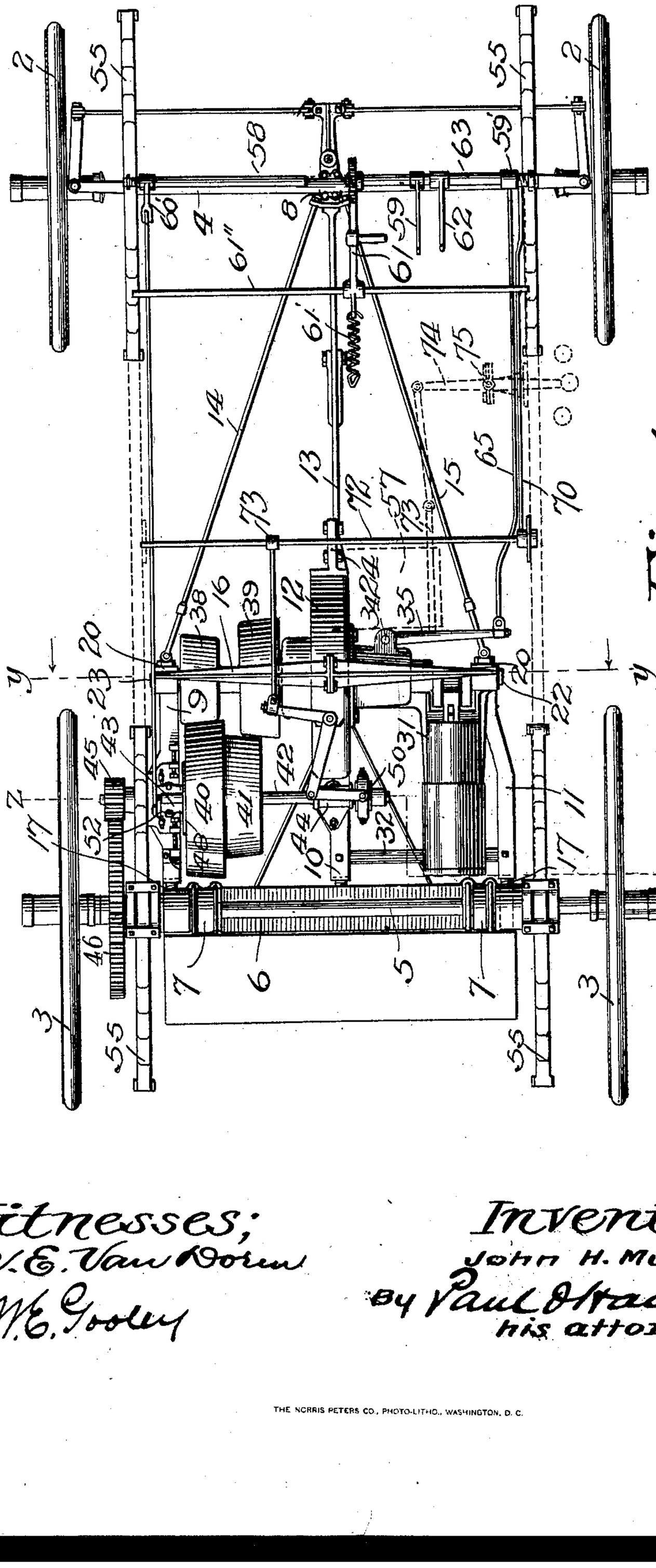


Fig. 1.

Witnesses;
C. E. Van Dorn
W. E. Gooley

Inventor;
John H. Munson.
By Paul & Strawley
his attorneys.

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## MOTOR CYCLE.

(Application filed May 16, 1898.)

(No Model.) 6 Sheets—Sheet 2.

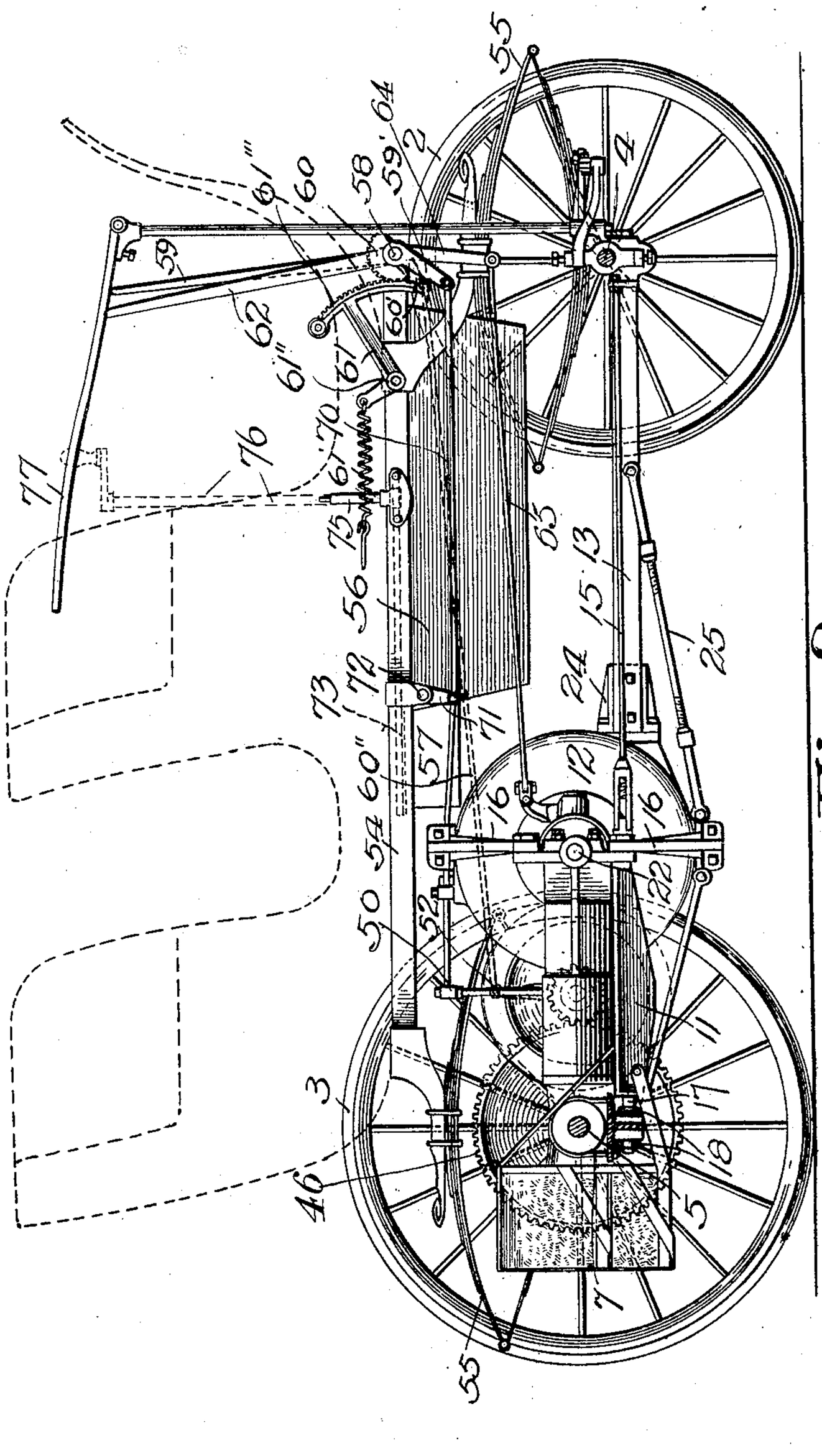


Fig. 2.

Witnesses;
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(No Model.) 6 Sheets—Sheet 3.

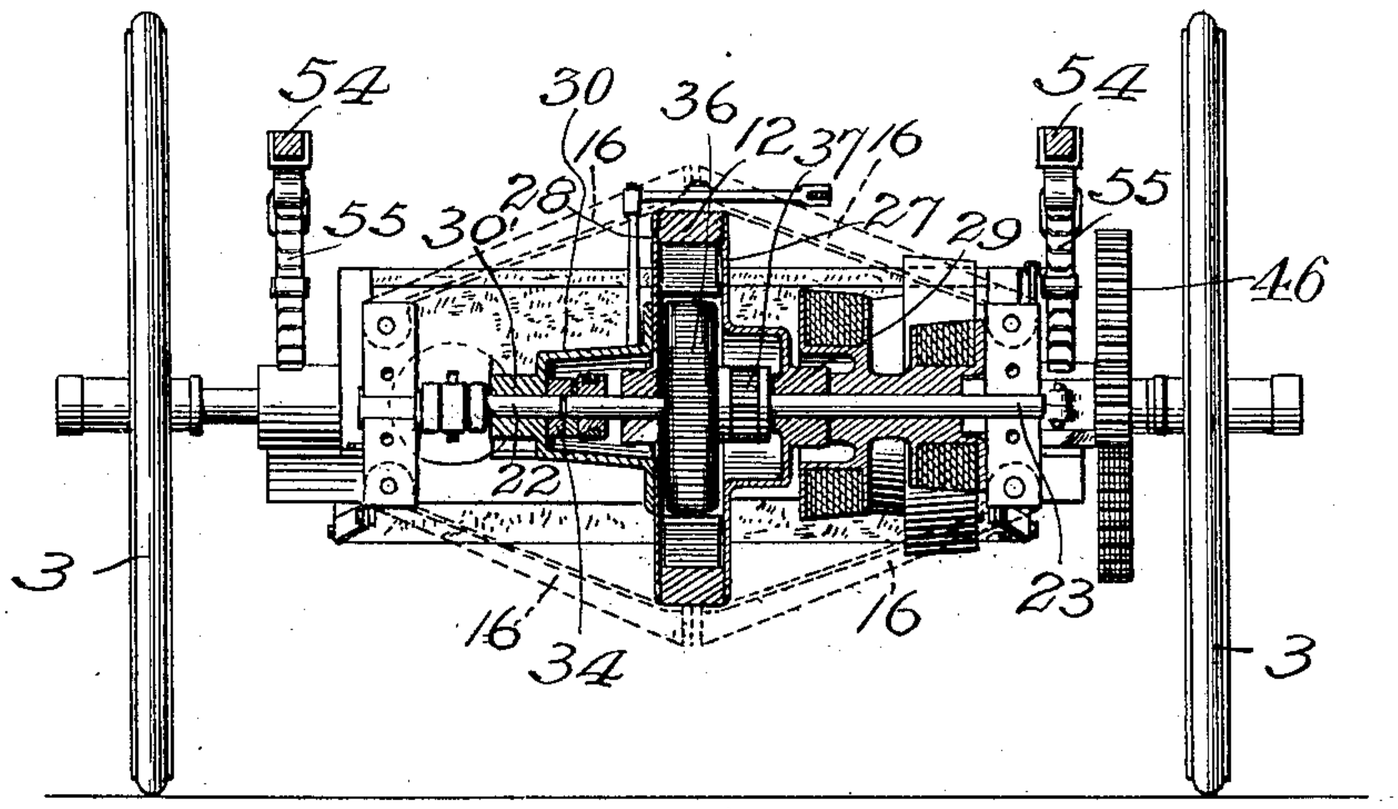


Fig. 3.

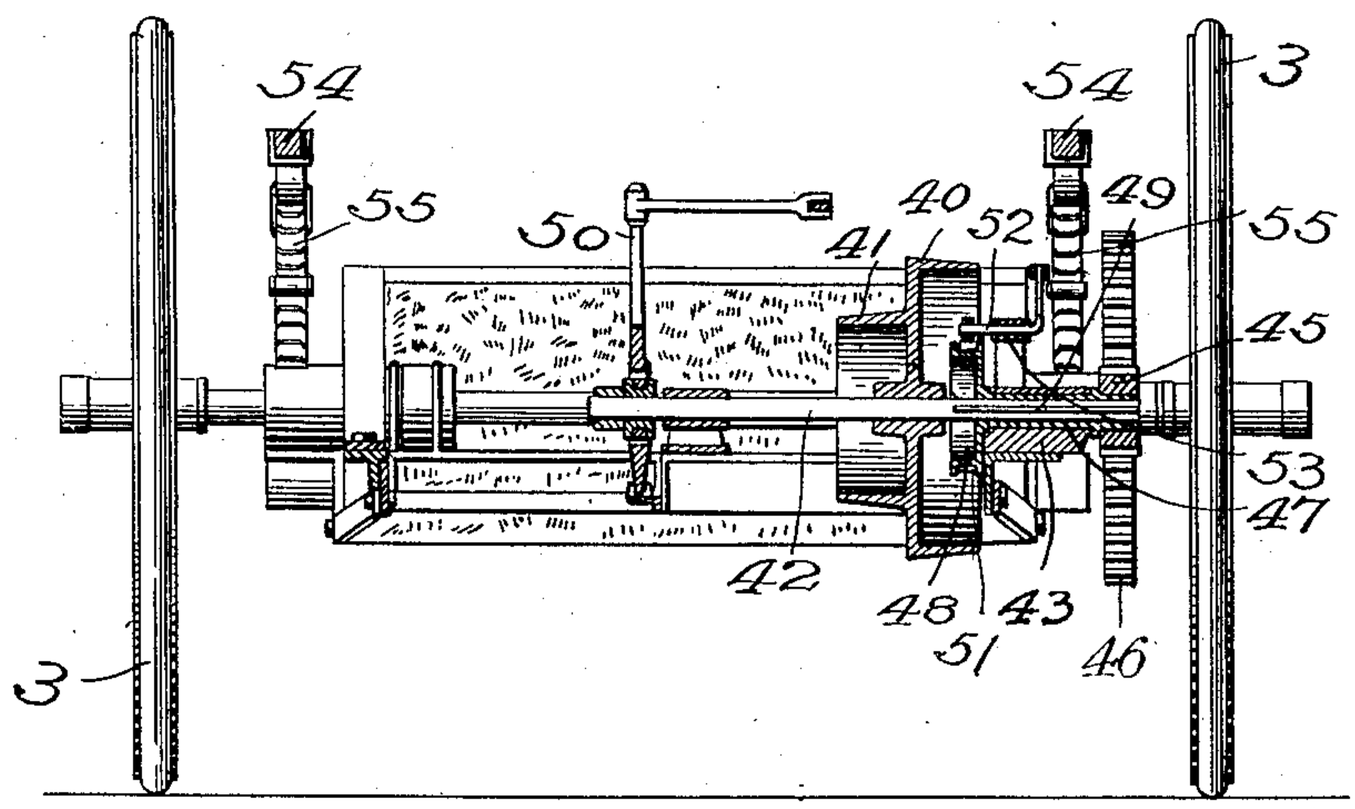


Fig. 4.

Witnesses;
C. E. Van Dorn
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## MOTOR CYCLE.

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(No Model.) 6 Sheets—Sheet 4.

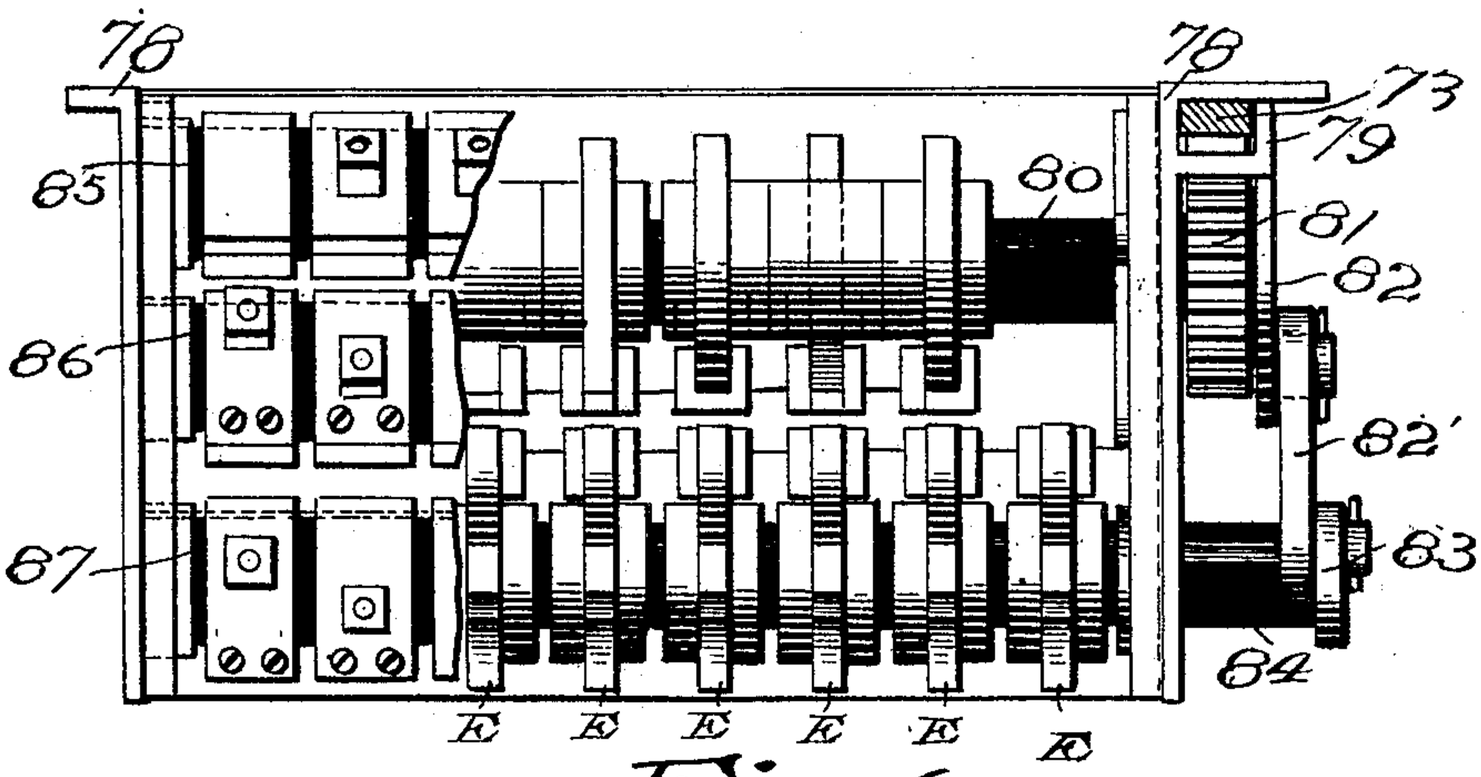


Fig. 6.

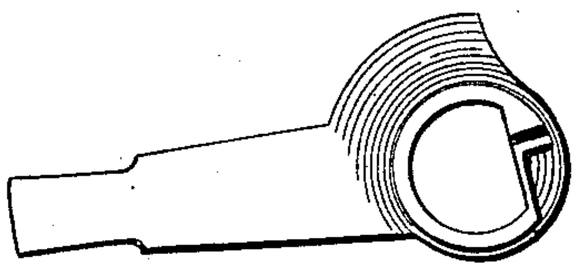

Fig. 8.

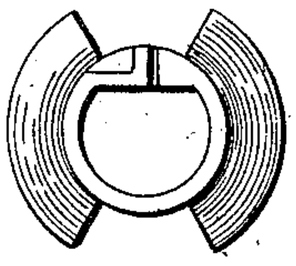

Fig. 10.

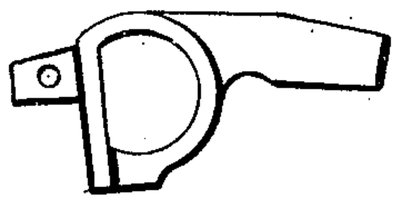

Fig. 9.

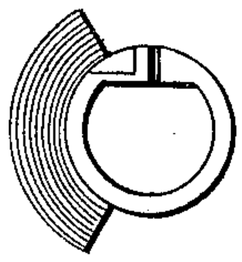

Fig. 11.

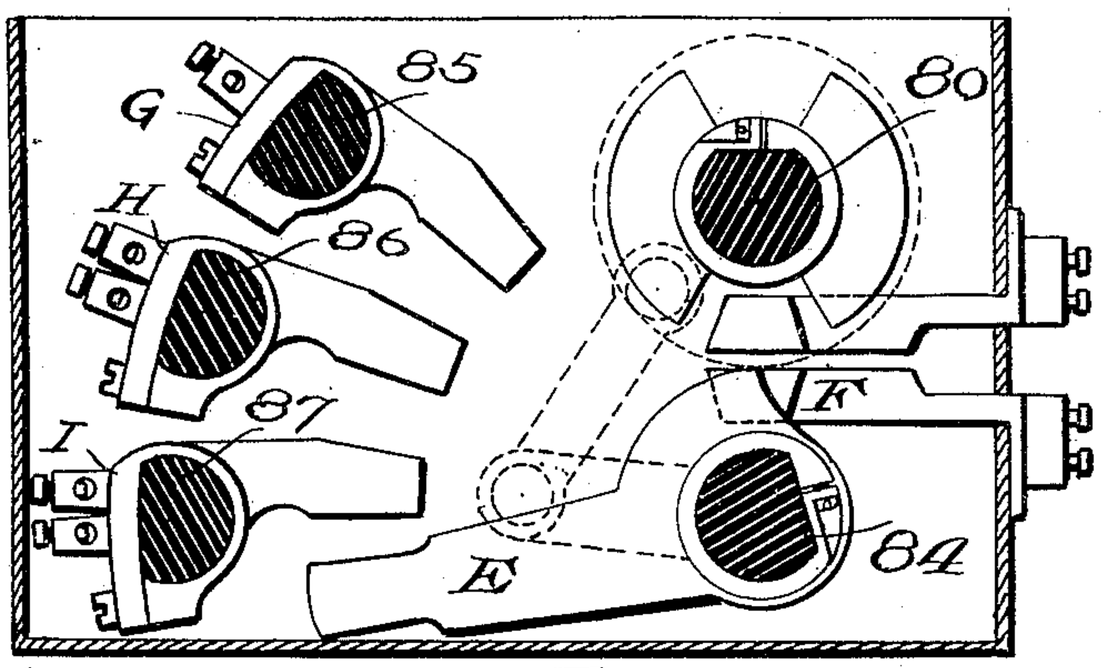


Fig. 5.

Witnesses;
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J. H. MUNSON.

MOTOR CYCLE.

(Application filed May 16, 1898.)

(No Model.) 6 Sheets—Sheet 5.

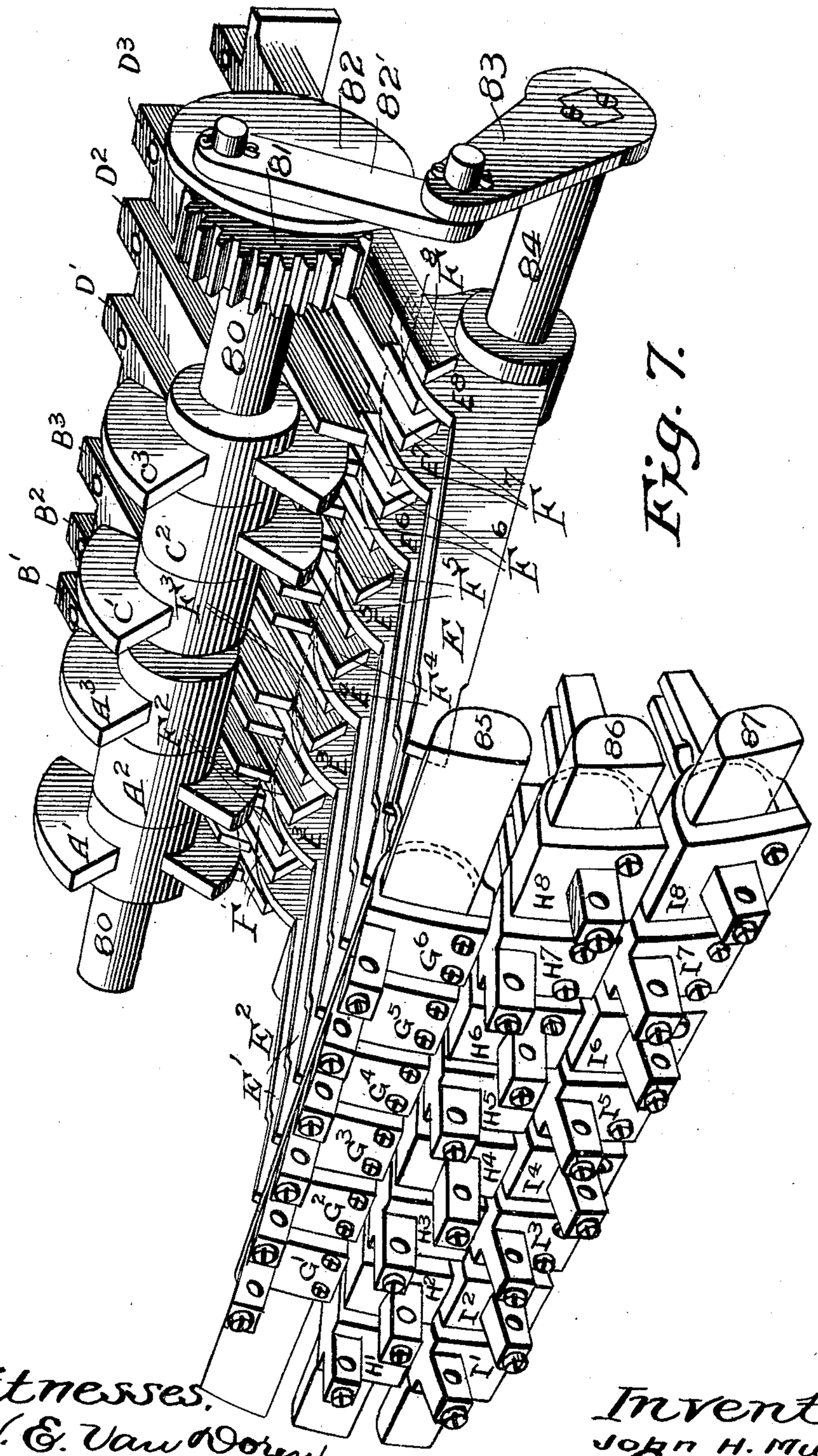


Fig. 7.

Witnesses.
C. E. Van Doren
W. E. Gooley.

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No. 654,478. Patented July 24, 1900.

# J. H. MUNSON.

## MOTOR CYCLE.

(Application filed May 16, 1898.)

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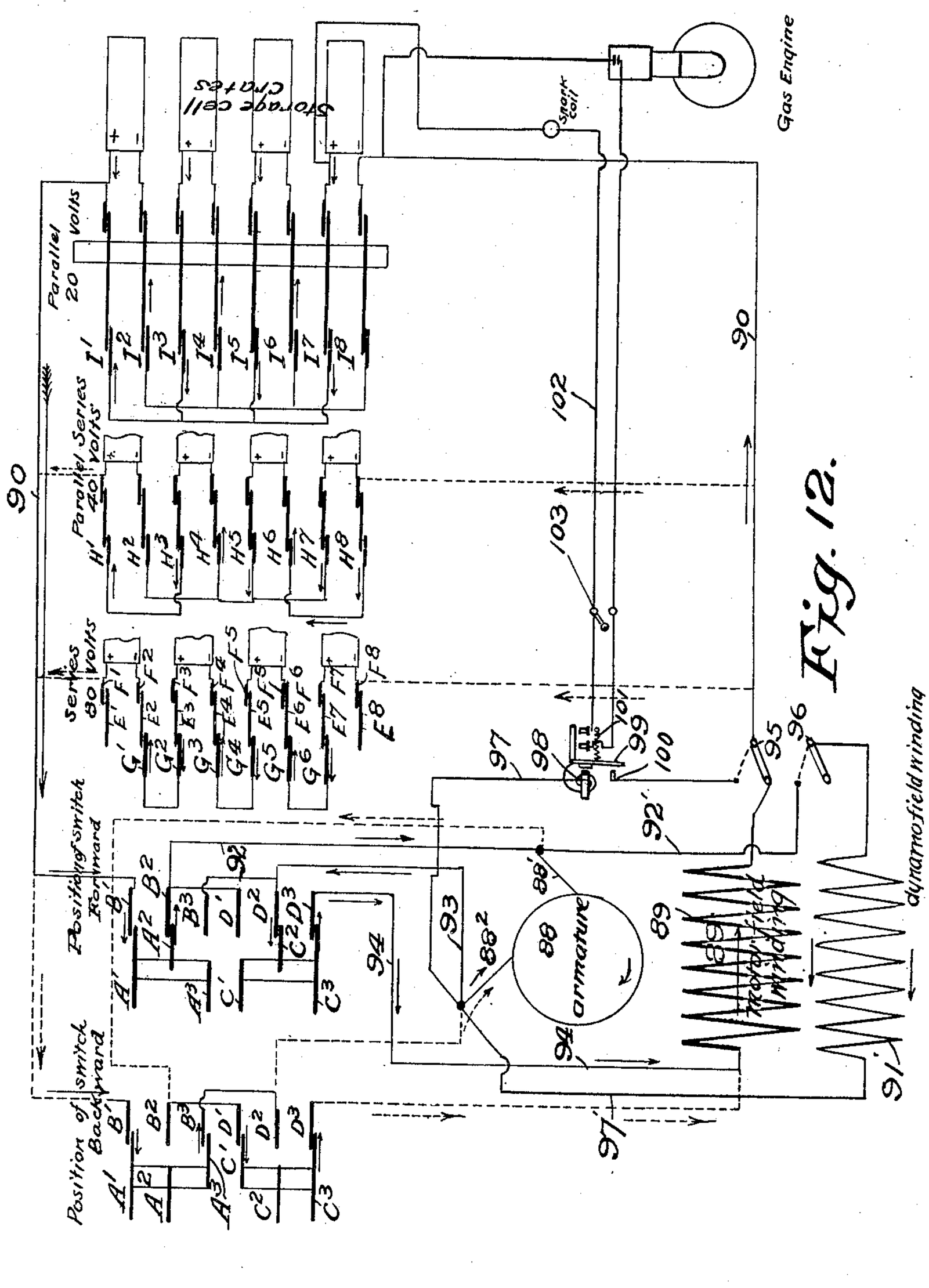


Fig. 12.

Witnesses;
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W. G. Gourley

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By Paul Otis Crawley
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# UNITED STATES PATENT OFFICE.

JOHN HENRY MUNSON, OF CHICAGO, ILLINOIS.

## MOTOR-CYCLE.

SPECIFICATION forming part of Letters Patent No. 654,478, dated July 24, 1900.

Application filed May 16, 1898. Serial No. 680,793. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN HENRY MUNSON, of the city of Chicago, county of Cook, State of Illinois, have invented certain new and useful Improvements in Motor-Cycles, of which the following is a specification.

This invention relates to motor-vehicles; and one of the objects of the invention is to provide a self-contained electric-motor vehicle, which, unlike ordinary electric-motor vehicles, will not be dependent upon storage or power stations, but instead may be used in making long journeys through districts not provided with power-stations, and therefore inaccessible to ordinary electric vehicles with which the element of time and distance between stations is vital.

Another object of the invention is to provide a motor-vehicle of lighter weight and lower cost than present electric vehicles of the same carrying and speed capacity.

A further object of the invention is to provide a combination electric and vapor motor-vehicle the explosion-engine of which will be capable of alone propelling the vehicle at a high speed and will be capable of use with the electric motor to propel the vehicle on difficult roads or hills or for the purpose of both propelling the vehicle and the electric machine to replenish the storage battery while the vehicle is in motion.

A further object of the invention is to provide a combined electric-motor and gas-engine vehicle having means permitting the use of the engine to store the battery while the vehicle is standing still.

Another and particular object of the invention is to so connect and combine the electric motor and the engine upon the vehicle that the usual governors, controlling-levers, and rods and other engineering complications are avoided and the control of the engine is made absolute and positive.

Another object of the invention is to provide a motor-cycle equipped with an explosion-engine and motor in such a manner that the motor may be employed to start the engine, thereby avoiding the usual manual labor connected with the starting of the vehicle and securing the further advantage of the assistance of the engine to start the vehicle, and thus avoid a heavy draft upon the batteries that supply current to the motor.

Another object of the invention is to improve the distribution of the weight of the batteries and the driving machinery upon the wheels of the vehicle in order that the required traction may be obtained upon the driving-wheels and at the same time have sufficient weight upon the forward wheels to make the vehicle easy and safe to steer.

Another object of the invention is to provide a motor-cycle in which a low center of gravity may be obtained, and thus avoid the usual topheaviness of such machines; and a further and particular object of the invention is to enable the use of light bodies or boxes upon motor-cycles, relieving the same of the weight of the battery or engine usually stored therein and permitting the body to be of a comparatively-cheap construction and of any desired design, not being restricted to the usual ugly boxes that are made a part of the ordinary body.

Other objects of the invention are to provide improved means for reversing and controlling the electric motor by one lever and to improve the form and application of the brake.

The invention consists generally in a motor cycle or vehicle provided with an explosion-engine or like machine and an electric-motor dynamo of substantially-equal power and normal speeds, such motor-dynamo being adapted for use as a motor or as a dynamo, and a storage battery to supply current to said motor-dynamo or to receive current therefrom, said engine adapted to be used separately or together to propel the vehicle.

The invention further consists in the particular construction and arrangement of the explosion-engine and the motor-dynamo whereby the armature of said motor-dynamo serves as both the fly-wheel and the governor of said engine; and the invention further consists in particular means for transmitting the power of either the engine or the motor to the driving-wheels of the motor-vehicle and governing the speed of the motor.

The invention further consists in particular constructions and arrangements of the frame and supporting parts of the vehicle and in novel means for controlling and reversing the

motor-dynamo; and, further, the invention consists in various details of construction and in combinations of parts, all as hereinafter described, and particularly pointed out in the claims.

The invention will be more readily understood by reference to the accompanying drawings, forming part of this specification, and in which—

Figure 1 is a plan view of a motor-cycle with the side bars and the battery compartment or box removed. Fig. 2 is a side view with the wheels upon the forward side removed. Fig. 3 is a sectional view on line *y y* of Fig. 1. Fig. 4 is a sectional view on line *z z* of Fig. 1. Fig. 5 is a side view of the controller and reversing switch box. Fig. 6 is an end view thereof with a portion broken away to show the interior. Fig. 7 is an enlarged perspective view of the controller and reversing switches removed from the containing box or frame. Fig. 8 is a detail view of one of the switch-arms. Fig. 9 is a similar view of one of the contacts. Figs. 10 and 11 are similar views of the switch-segments. Fig. 12 is a diagram of the circuits.

As shown in the drawings, 2 2 represent the forward wheels of the vehicle, and 3 3 the rear wheels thereof. The short axles of the forward wheels are carried in yokes that swing upon the ends of the forward axle 4. The rear wheels are arranged upon the rear axle 5, which is preferably made in two parts that are connected by differential gears (not shown) to permit the turning of corners with the vehicle. The main truss 6 is swung from the axle 5 by bearings 7, that preferably contain rollers to reduce friction. The forward axle is provided with a rigid block 8 and is connected with the rear axle by a strong frame comprising the trusses 9, 10, and 11, the field portion 12 of the motor-dynamo, and the reach-bar 13, which parts are securely tied and braced by rods 14 and 15 and the transverse trusses 16. The steel truss-castings 9, 10, and 11 are each provided with threaded studs 17 upon their rear ends, which studs pass through the depending flange of the main truss 6 and are secured by adjustable locking-nuts 18 upon opposite sides thereof. The middle truss 10 has its forward end bolted to the field portion 12 of the motor-dynamo, and the forward ends of the trusses 9 and 11 are provided with threaded studs which pass through the bearing blocks or brackets 20, that are fastened solidly therein. These bearings or brackets (see Figs. 1, 2, and 3) are provided with boxes for the outer ends of the engine crank-shaft 22 and the shaft 23 of the motor-dynamo, respectively. The tie-rods 14 15, which are adjustable, extend from the lower ends of the brackets 20 to the block 8 on the forward axle, and the reach 13, which is rigidly secured in said block 8, has its rear end solidly bolted in the socket-bracket 24, that projects from the forward side of the field portion 12 of the motor and preferably below the center thereof. The adjustable rods 9 and 11, extending from the rear truss 6 to lugs upon the under side of the field 12, and the adjustable rod 25, also attached to the under side of the field portion 12 and to the reach 13, prevent the sagging of the frame. The forward ends of the trusses 9 and 11 are rigidly connected together and to the field portion 12 by the transverse trusses 16, made in four parts and attached rigidly to the upper and lower sides of the field portion 12 of the motor and to the brackets 20 upon the trusses 9 and 11. These trusses 16 hold the shaft-bearing in line, forming a rigid diamond that is braced by the part 12 of the motor. The ends of the field portion of the motor are closed by plates or disks 27 28, in each of which is a bearing 29 for the armature-shaft, while the plate 28 carries the box or case 30, having the bearing 30′ for the inner end of the engine crank-shaft. The engine-frame 31 is secured upon a bar 32, extending between the trusses 10 and 11, and said frame is preferably integral with the bearing 30 and the bracket 20 at the end of the truss 11. The crank-shaft and the armature-shaft are connected by a clutch 34, covered by the casing 30, that is integral with the bearing 30′. Said clutch 34 is operated by a bell-crank 35, pivoted on the side of the casing 30 and extending into the same. The armature 36 of the motor is of larger diameter than commonly and is purposely made heavier than usual to serve as the fly-wheel of the explosion-engine. 37 represents the single commutator of the armature, and the same is inclosed within the field portion of the machine, which field has two windings of different sizes of wire.

The driving machinery is connected with the rear wheels of the vehicle by means of friction-pulleys. Two pairs of pulleys 38 39 and 40 41 are used, the same being arranged, respectively, upon the armature-shaft 23 and the shaft 42. Bearings or blocks 43 and 44 are provided for the shaft 42 on the trusses 9 and 10, and these bearings are adjustable upon said trusses in order that the pairs of friction-pulleys may be relatively adjusted for the purpose of taking up wear. The pinion 45 meshes with the large gear-wheel 46 upon the rear axle and is connected with the two rear wheels, either rigidly or by the usual differential gears. (Not shown.) The pinion 45 is secured upon a short shaft 47, arranged in the bearing 43 and carrying the brake-wheel 48 upon its inner end. The shaft 47 is held against longitudinal movement in its bearings, and the shaft 42 extends through the shaft 47 and is longitudinally movable therein, being connected with the same by a key or spline 49. (See Fig. 4.) The friction-pulleys 40 41 are securely keyed and fastened upon the shaft 42, and the friction-pulleys 38 39 are similarly secured upon the armature-shaft 23 and with the same are held against longitudinal movement. The friction-pul-

leys 38 39 are of different sizes and are oppositely-inclined cones. The friction-pulleys 40 41 are similarly beveled and are placed end to end on the shaft 42. The pulleys 38 39 are separated to allow the movement of the pair of pulleys 40 41 from one to the other. The pulleys 40 41 are operated by the shifting-lever 50, pivoted on the truss 10 and engaging a collar on the inner end of the shaft 42. Thus while the shaft 42 and the friction-pulleys thereon are adapted to move the pinion 45 and the brake-wheel 48 are longitudinally stationary. The brake-wheel 48 is engaged by a friction-strap 51, (see Fig. 4,) which is operated by a bell-crank 52, supported in a bracket 53 on the bearing 43.

The storage battery and the various rods and levers for operating the engine-clutch, the friction-pulleys, and the brake are arranged upon the light frame upon which the carriage-body is placed. This frame comprises the side bars 54, which are carried upon the springs 55 and secured upon the forward axle and the main truck or frame part 6 of the rear axle. The side bars are connected in any suitable manner and carry the box or casing 56 for the storage batteries, said box or casing being hung from said side bars with its top substantially flush with the tops of said bars, so as not to interfere with any style of carriage or wagon body that may be placed upon the side bars. This box or casing occupies the space forward of the driving machinery and is nearer the forward axle than the rear one to more evenly distribute the weight on the wheels. The switch-box 57 is also below the tops of the side bars 54 and preferably back of the battery.

58 represents a shaft extending between the forward ends of the bars 54, on which the several levers for controlling the vehicle are arranged.

59 is the friction-pulley-shifting lever. This lever is arranged on a sleeve on the shaft 58 and operates the arm 59′, that is connected by a rod 70 to an arm 71 upon the rocking shaft 72, extending between the opposite side bars 54 and having another arm 73, that is connected to the bell-crank 74, pivoted upon the field portion of the motor and connected to the upper end of the shifter-lever 50 by a suitable link, whereby said lever may be operated to move the shaft 42 longitudinally and engage either of the friction-pulleys thereon with the opposite friction-pulley upon the armature-shaft.

62 is the clutch-lever, preferably arranged upon a sleeve 63 on the shaft 58 and having an arm 64, that is connected with the lever 35 by a rod 65, by means of which the clutch between the engine and armature-shaft may be operated. I prefer that the brake should be operated by the pressure of the foot of the driver, and therefore provide the lever 61, having a footpiece and normally lifted by a spring 61′. This lever may be arranged upon a cross-shaft 61″, and it carries a gear-segment 61‴, that meshes with the pinion-segment 60, that is secured upon a sleeve, having an arm 60′ and arranged on the shaft 58. The arm 60′ is connected with the brake-strap bell-crank 52 by a rod 60″, and when the lever 61 is depressed the brake-strap will be firmly bound upon the brake-wheel 48, thereby applying the resistance directly to the driving-wheels, as well as to the driving machinery. The controlling and reversing switches that are arranged in the box 57 are operated by a rack 73. (See dotted lines, Fig. 2, and detail figures.) This rack is operated from an arm 74, extending horizontally from a short upright stud 75, that is arranged in a bracket on the side bar. The stud-shaft 75 is provided with a square upper end to receive the lower end of an operating-shaft 76, having a crank at its upper end and preferably fastened on the carriage-body. One of these shafts 76 is preferably supplied with each carriage-body that is intended for use upon the truck, said carriage-bodies being interchangeable.

The steering device may be of any suitable design, with a handle or tiller 77 extending back within reach of the driver.

A most important part of my invention is the combined controlling and reversing switch. (Shown in Figs. 5, 6, and 7.) The single lever or arm that is attached to the stud-shaft 75 suffices for the operation of both the reversing-switch and the controller, the moving parts of which are linked together. The switch devices are arranged in a tight box the sides of which are preferably of insulating material, while the ends 78 may be of metal to provide bearings for the shafts 80 and 84 and for the bars upon which the contact-blocks are arranged. One end of the box is provided with guides 79 for the rack 73, which meshes with the gear-wheel 81, arranged on the shaft 80. The shaft 80 also bears the crank-disk 82, from which a link 82′ extends to the arm 83, that is provided upon the end of the shaft 84. The shafts 80 and 84 are provided with insulating-coverings to electrically separate the parts arranged thereon. The bars 85, 86, and 87 are preferably wood or fiber and carry the contact-blocks G, H, and I, that have jaws to receive the ends of the movable switch-arms E, that are arranged on the rocking shaft 84 and are insulated from one another by the covering thereof. The switch arms or poles E are provided with segments to enter between the jaws of the contacts F and are always in contact therewith. The groups of contact segments or sectors are arranged upon the shaft 80. These are adapted to engage the contacts B and D. The first group, which is electrically connected, includes the double segment $A^1$ and the oppositely-arranged single segments $A^2$ and $A^3$. The second group comprises similar parts, preferably arranged in reverse order. The arrangement is such that two segments in each group A and C will be in contact with respec-

tive blocks B and D when the switch-arms E are in contact with either row of blocks G, H, or I and will be out of contact when said arms E are lifted above or thrown below the rows of contact-blocks G, H, and I, this being necessary in order that the circuit may be open at the time that the direction of the current is reversed. The poles A and C, with the contact fingers or blocks B and D, constitute the reversing-switch, while the arms E, with their permanent connections F and the contacts G, H, and I, comprise the controller, whereby the arrangement of the batteries in circuit may be altered successively from parallel to series parallel and from series parallel to series. Any number of cells or groups of cells may be employed, according to the number of arms E and contacts therefor. The controller shown in the drawings is designed for use with four cells or groups of cells, which have their terminals connected in order with the contacts $F'$, $F^2$, $F^3$, $F^4$, $F^5$, $F^6$, $F^7$, and $F^8$. These points thus represent the terminals of the batteries, and in turn the movable switch-arms $E'$ $E^2$ $E^3$ $E^4$ $E^5$ $E^6$ $E^7$ $E^8$ represent the same. There are permanent connections between the contact-blocks in each row G, H, and I. The eight blocks or contacts of the first row $I'$ $I^2$ $I^3$ $I^4$ $I^5$ $I^6$ $I^7$ $I^8$ are connected in parallel arrangement, so that when the arms $E'$ to $E^8$ are moved into contact therewith the batteries will be thrown into parallel. The next row or series of contacts $H'$ to $H^8$ are connected in two multiple groups and the groups are arranged in series, and when the switch-arms E are moved into contact therewith the batteries will be in parallel-series arrangement. To throw the batteries into series, six contacts $G'$ to $G^6$ are required, and succeeding pairs of these are connected to bridge or couple the adjacent terminals of the different batteries. The terminals of the circuit 90, (see Fig. 12,) including the field-windings of the motor-dynamo, are connected with the positive and negative poles of the first and last storage batteries or groups of cells. The voltage upon said circuit is varied by shifting the arms $E'$ to $E^8$ from one to the other of the rows or series of contacts I, H, and G, the voltage being doubled when the arms are shifted from the contacts I to H and again doubled when contact is made with the contacts G. One branch of the battery-circuit is connected to the contact $B'$ of the reversing-switch. When said switch is in the forward position, the current will flow through the poles $A'$ $A^2$ to the contact $B^2$ and thence to the line 92, which is connected to the brush $88'$ of the armature 88 of the motor-dynamo. The current passing through the motor-dynamo is taken therefrom by the brush $88''$ and the line 93 connected therewith to the contact $D^2$ of the reversing-switch, and from thence through the poles $C^2$ $C^3$ to the contact $D^3$, and from thence the current is conveyed through the line 94 to the field-windings 89, the opposite terminal of which is connected by the switch 95 to the other side of the main circuit 90. In case it is desired to use the motor-dynamo as a dynamo the reversing-switch is not disturbed; but the switch 95 and a switch 96 are both thrown to connect the same respectively with lines 97 and $92'$ to cut out the motor field-windings and include the dynamo field-winding $91'$ in parallel circuit with the armature. When these switches are changed, the current will flow through the line 92 to the armature 88 and from thence to the line 97. At the same time the current will divide at the brush $88'$ and passing through the line $92'$ and the switch 96 will enter the field-windings 91 and will return from thence through the line $97'$ to join the current from the armature and pass through the line 97 and the switch 95 to the return side of the circuit 90. Meantime the circuit of the motor field-winding 89 will be found to be open when the same is traced through the lines 93 and 94 to the switch-point of the switch 95, which at this time will be connected with the line 97. I prefer to arrange the switches 95 and 96 near the driver's seat upon the carriage-body in order that the same may be thrown to convert the motor-dynamo into a dynamo to replenish the batteries when the vehicle is running upon level roads. In like manner the switch is used to convert the dynamo into a motor, and a switch may also be used to abruptly break the circuit of the motor-dynamo without regard to the reversing-switch or the controller, though the use of the latter is to be preferred. When the storage battery has been fully charged by the operation of the dynamo, the resistance of the dynamo due to counter electromotive force will overcome the force of the engine and the same will be stopped. To avoid the automatic stoppage of the motor in this manner when the vehicle is running and to avoid a waste of the power of the engine when the same has been left to run while the vehicle is stationary and also to avoid the effects of a possible leakage through the windings of the electric machine after the engine has been stopped and while the circuits are closed through the controller and reversing-switch, I prefer to provide an automatic cut-out in the dynamo-circuit to open said circuit automatically at the moment that the electromotive force of the storage battery and the dynamo becomes equal. This device is a simple electromagnetic switch comprising an electromagnet 98, preferably arranged in the line 97 belonging to the dynamo-circuit and which line is completed through the armature-lever 99 and the contact 100. The lever is normally drawn away by a spring 101, and when the dynamo-circuits are completed and the lever 99 is moved by hand against the contact 100 to complete the line 97 the power of the magnet 98 will be sufficient to hold the lever 99 in place against the tension of the spring 100. When, however, the batteries

have become fully charged, there will be a moment when current will cease to flow through the line 97 and the circuit 90 or will be reversed therein, and at this moment the magnet 98, losing its power, will release the lever 99, and thus automatically open the dynamo-circuit, rendering the dynamo ineffective and preventing a leakage of the current from the batteries.

The explosion-engine is provided with an electric igniter, which with the usual spark-coil and one or more cells of the storage battery is included in the circuit 102, that is closed during the time that the lever 99 is in engagement with the contact 100 and is broken when said lever 99 is released.

103 represents a switch which is preferably conveniently located upon the vehicle-body and by which the igniter-circuit may be arbitrarily closed without regard to the automatic cut-out. This switch is opened when the automatic cut-out is closed.

It will be noted that the contacts $B^2$ and $D'$ are both connected with the line 92 and that the contacts $B^3$ and $D^2$ are both connected with the line 93. Therefore when the poles of the reversing-switch are shifted the direction of the flow of the current through the armature of the electric machine will be reversed, with a consequent change in the direction of the rotation of the armature. The movement of the operating-rack in one direction closes the reversing-switch and moves the arms E into contact with the parallel-arranged blocks I′ to $I^8$, the normal position of the arms E being below the same. A continued movement of the rack in the same direction will raise the arms E′ to $E^8$ into contact with the other rows of blocks or contacts G. An opposite movement of the rack will depress the arms E and throw them out of contact, and this movement, if continued, will reverse the contacts A and C and again raise the arms E to the desired parallel, series parallel, or series row of contacts I, H, or G, all as well illustrated in Fig. 12. The reversal of the motor and the control of the speed thereof are thus made easy.

The water and gasolene tanks for the engine are suitably supported back of the rear axle. (See Figs. 1 to 4.) The electrical connections are not shown in the principal figures of the drawings, as the same are more clearly illustrated in Fig. 12.

The operation of the motor-cycle is as follows: The explosion-engine and the motor-dynamo are of about equal power, the engine being capable of alone propelling the vehicle over ordinary roads and furnishing a surplus power, which is taken up in driving the motor-dynamo to maintain the voltage of the storage battery. Although it is possible to run the engine for the sole purpose of storing the batteries when they are first placed on the vehicle, said batteries are preferably charged before they are placed in the compartment or box. Thereafter when it is desired to use the vehicle the charging-switches 95 and 96 are placed to throw the motor-field into series with the armature, so that the machine will operate as a motor when the controller is operated to close the battery-circuit. The motor being started, the engine-clutch is then moved to connect the engine crank-shaft and the armature-shaft to operate the engine-piston and draw in the first few charges of gas until the engine begins to work automatically. Meantime one or the other of the friction-pulleys having been shifted into engagement with the opposite one on the armature-shaft, the vehicle will be set into motion. The motor alone is capable of starting the vehicle; but when a difficult start is to be made it is preferable to allow the engine and the motor to gather the normal speed before the friction-pulleys are thrown in to start the vehicle. If a fairly-good road is encountered, the controller switch-lever may be thrown to the middle position to open the battery-circuit, the engine alone being used. On an ordinary road the switches 95 and 96 may then be thrown to connect the dynamo-windings in circuit and the controller will be moved to arrange the batteries in parallel in said circuit, so that as the vehicle moves along the road the surplus power of the engine will be converted into electricity and stored in the batteries. When passing over rough roads or when climbing hills, the circuit-changing switches 95 and 96 will be reinstated to connect the motor-windings in circuit. The electric machine thereafter works as a motor to assist the engine, and the speed of both the engine and the motor is controlled by the electric controller, which in regulating the speed of the motor-armature also regulates or governs the speed of the explosion-engine, of which said armature is the fly-wheel. When it is desired to force the vehicle at a higher speed than can be attained with the explosion-engine running at the maximum number of revolutions, the engine-clutch will be disconnected and the motor alone relied upon, the controller being shifted to supply electricity from the batteries at a higher voltage, whereby the speed of the motor will be increased and the current taken from the battery being commensurate with the work to be performed at the higher speed induced by the increased pressure or voltage. When the engine is disconnected from the armature-shaft, the same will instantly stop owing to the same being deprived of its fly-wheel. In addition to the control of the speed through the medium of the motor two arbitrary changes of speed are possible through the use of the friction-pulleys.

Any wear between the driving-gears 45 and 46 is taken up by adjusting the nuts on the rear ends of the longitudinally-extending trusses 9, 10, and 11, and wear between the friction-pulleys is compensated by adjustment of the bearings of the shaft 42 upon the trusses 9 and 10. The entire frame is so constructed

that tension may be obtained in its several parts to keep the same rigid. The explosion-engine, the engine-clutch, and the motor-dynamo are all tightly incased or inclosed to prevent the entrance of dust or moisture. The friction-wheels and the driving-gears do not require protection. The controlling-levers and the foot-brake being all mounted upon the frame of the truck or running-gear are independent of the carriage body or box and are not disturbed when a change of bodies is made. In like manner the storage batteries, the controlling-switch, and the engine-tanks are all independent of the carriage-body, and it is not necessary to employ a carriage-body of any particular design. The location of the driving machinery and the water-tank upon the rear axle places the weight where it is required to give a maximum traction to the driving-wheels. In case of an accident to the machinery when climbing or descending a hill the driver has complete control of the vehicle, owing to the direct application of the brake to the rear wheels.

As various modifications of my invention will be evident to persons skilled in the art, I do not confine the same to the specific constructions herein shown and described.

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

1. The combination, with the truck or running-gear, of the explosion-engine, the storage battery, the electric motor coupled with said engine, means for varying the speed of said motor and through the same governing the speed of said engine, the variable friction driving means, and a brake mechanism interposed between the same and the driving wheel or wheels of the vehicle, substantially as described.

2. The combination, with the truck, of the motor mechanism, the shifting shaft, the oppositely-coned pairs of friction-pulleys arranged thereon and in connection with said motor, a longitudinally-fixed driving-gear, means for shifting said shaft and the pulleys thereon, and a friction-brake in connection with said fixed gear, substantially as described.

3. The combination, with the forward and rear axles, of the trusses or bars 9, 10 and 11 extending from the rear axle, the motor and the engine, the frame thereof connecting the forward ends of said trusses, and a reach connecting said frame with the forward axle, substantially as described.

4. The combination, with the rear axle, of the truss 6 thereon, the trusses extending forward from said truss 6, the driving machinery, the frame thereof connecting the forward ends of said trusses, the wheel-support for the forward part of said frame, and the supporting tie-rods, substantially as described.

5. The combination, with the rear axle, of the truss 6, the field portion of the motor, the forwardly-extending trusses, and the transversely-extending trusses attached thereto and to the upper and lower parts of said field portion of the motor, substantially as described.

6. The combination, with the rear axle, of the forwardly-extending trusses 9, 10 and 11, the motor-shaft having bearings at the forward ends of said trusses, the motor, to the frame whereof said truss 10 is attached, the forward axle and the reach connecting the same to the forward part of said frame of the motor, substantially as described.

7. The combination, with the rear axle and the forward axle, of the trusses or bars extending from said rear axle, the motor arranged between said trusses, the transverse trusses rigidly connecting the motor and first-mentioned trusses, the reach extending from the frame of said motor to the forward axle, and the supporting and tie rods extending from the forward axle, substantially as described.

8. The combination, with the truck or running-gear, of the driving machinery, the body or box upon said truck, and independent of said driving machinery, and the controlling-levers, &c., independent of said body or box, substantially as described.

9. The combination, in a motor-vehicle, of the forward and rear axles of the truck, the truss 6 depending from suitable bearings upon the rear axle, the longitudinal trusses 9 and 11 having their rear ends adjustable in the depending web of said truss 6, the transverse trusses connecting the forward ends of said trusses 9 and 11, the motor having its frame secured between said transverse trusses and a reach and tie-rod extending to said forward axle, substantially as described.

10. The combination, in a motor-vehicle, of the truck, with the metallically-inclosed electric-motor dynamo arranged thereon and having a driving connection with said truck, the explosion-engine also arranged on said truck and inclosed, a suitable clutch 15 between said engine and motor-dynamo, and a casing inclosing said clutch, secured to said motor-dynamo and integral with said engine-frame, substantially as described.

11. The combination, in a motor-vehicle, with the forward and rear axles and the wheels thereon, of the reach between said axles comprising the forwardly-extending truss or trusses, the frame of the electric motor secured to said truss at the forward end thereof and the reach-bar having its rear end firmly secured to the forward side of said frame, and suitable ties or braces, substantially as described.

12. The combination, in a motor-vehicle, of the truck, with the driving-motor thereon, an intermediate driving-shaft driven by said motor and longitudinally movable for disengagement therefrom, the fixed shaft attached to said intermediate shaft to rotate therewith, the driving-pinion on said fixed shaft, the brake-wheel also on said shaft, the bearings

of said fixed shaft, the bracket thereon, the brake-strap upon said wheel and the strap operating the crank arranged in said bracket, substantially as described.

13. The combination, in a motor-cycle, of the truck or running-gear, with the explosion-engine mounted thereon, a storage battery, and an electric motor geared to said truck permanently interposed between the running-gear and said engine and having its armature connected with said engine to serve at once as the fly-wheel thereof and as the armature of said motor, whereby the speed of the engine may be governed, substantially as described.

14. The combination, with the truck or running-gear, of the explosion-engine, the storage battery, the electric motor coupled with said engine, means for varying the speed of said motor and through the same governing the speed of said engine, and the variable friction-pulleys interposed between the shaft of said motor, and the wheel or wheels of the truck, substantially as described.

15. The combination, with the truck or running-gear, of the explosion-engine thereon, the dynamo-motor adapted to be connected to said engine and connected with said truck to drive the same, the storage battery upon said truck, the controller, the body or box upon said truck, and independent of said battery, motor or engine, and the levers, &c., arranged upon said truck independent of said body or box for controlling said battery, engine and motor-dynamo, substantially as described.

16. The combination, with the shafts 80 and 84, the single operating part to actuate the same simultaneously, the reversing-switch poles upon said shaft 80, stationary contacts to be engaged thereby, the controlling-switch poles or arms provided upon said shaft 84, and provided with heels or segments, fixed contacts wherewith the segments have rubbing contact, and the rows or tiers of circuit-changing contacts fixed to be engaged by said controller-switch poles or arms, substantially as described.

17. The combination, in a motor-vehicle, of the truck with the frame having spring-supports thereon, the driving-motor mounted on said truck near the rear axle thereof and geared thereto, and the storage battery suspended from said frame at a point back of, but near, the forward axle of said truck, substantially as described.

18. The combination, in a motor-vehicle, of the truck carrying the driving machinery with the spring-frame arranged upon said truck, the storage battery suspended from said frame, the body upon said frame, and independent of said battery, the cross rod or shaft 58 at the forward end of said frame and the operating and controlling levers upon said cross-rods, substantially as described.

19. The combination, in a motor-vehicle, with the truck, of the engine and the motor-dynamo thereon adapted to be connected and adapted separately or together to drive said truck, said motor-dynamo having independent field-windings respectively in series and multiple arrangement with its armature, a suitable switch for connecting either of said windings in circuit with said armature, a storage battery and means interposed between said battery and said motor-dynamo for electrically governing or controlling the same, substantially as described.

20. The combination, in a motor-vehicle, with the truck, of the engine and the motor-dynamo thereon adapted to be connected and adapted, separately or together, to drive said truck, said motor-dynamo having independent field-windings respectively in series and multiple arrangement with its armature, a suitable switch for connecting either of said windings in circuit with said armature, a storage battery, means interposed between said battery and said motor-dynamo for electrically governing or controlling the same and an automatic circuit-breaker included in the battery-circuit and operable upon the cessation of current in said circuit, substantially as described and for the purpose set forth.

21. The combination, in a motor-vehicle, with a truck, of the engine and the motor-dynamo thereon adapted to be connected and adapted, separately or together, to drive said truck, said motor-dynamo having independent field-windings respectively in series and multiple arrangement with its armature, a suitable switch for connecting either of said windings in circuit with said armature, a storage battery, means interposed between said battery and said motor-dynamo for electrically governing or controlling the same and a circuit-breaker having its magnet in the battery-circuit, the engine-igniter and the circuit thereof including a source of electricity and automatically opened by said breaker upon the cessation of current in said battery-circuit as and for the purpose specified.

22. The combination, in a motor-vehicle, of the truck, with the engine and the motor-dynamo on said truck, adapted to be used alone or together to drive said truck, and said engine adapted to drive said motor-dynamo, said motor-dynamo having independent motor and field windings, a storage battery, means interposed between said storage battery and said motor-dynamo for electrically governing or controlling the same, the igniter of said engine, the local circuit thereof, and automatic means for opening the circuits of said battery and said igniter upon the cessation of current in said battery-circuit, substantially as and for the purpose specified.

In testimony whereof I have hereunto set my hand, this 3d day of May, 1898, at Minneapolis, Minnesota.

JOHN HENRY MUNSON.

In presence of—
C. G. HAWLEY,
M. E. GOOLEY.