(No Model.) 4 Sheets—Sheet 1.

G. WILLETT.

ELECTRIC CAR MOTOR.

No. 461,228. Patented Oct. 13, 1891.

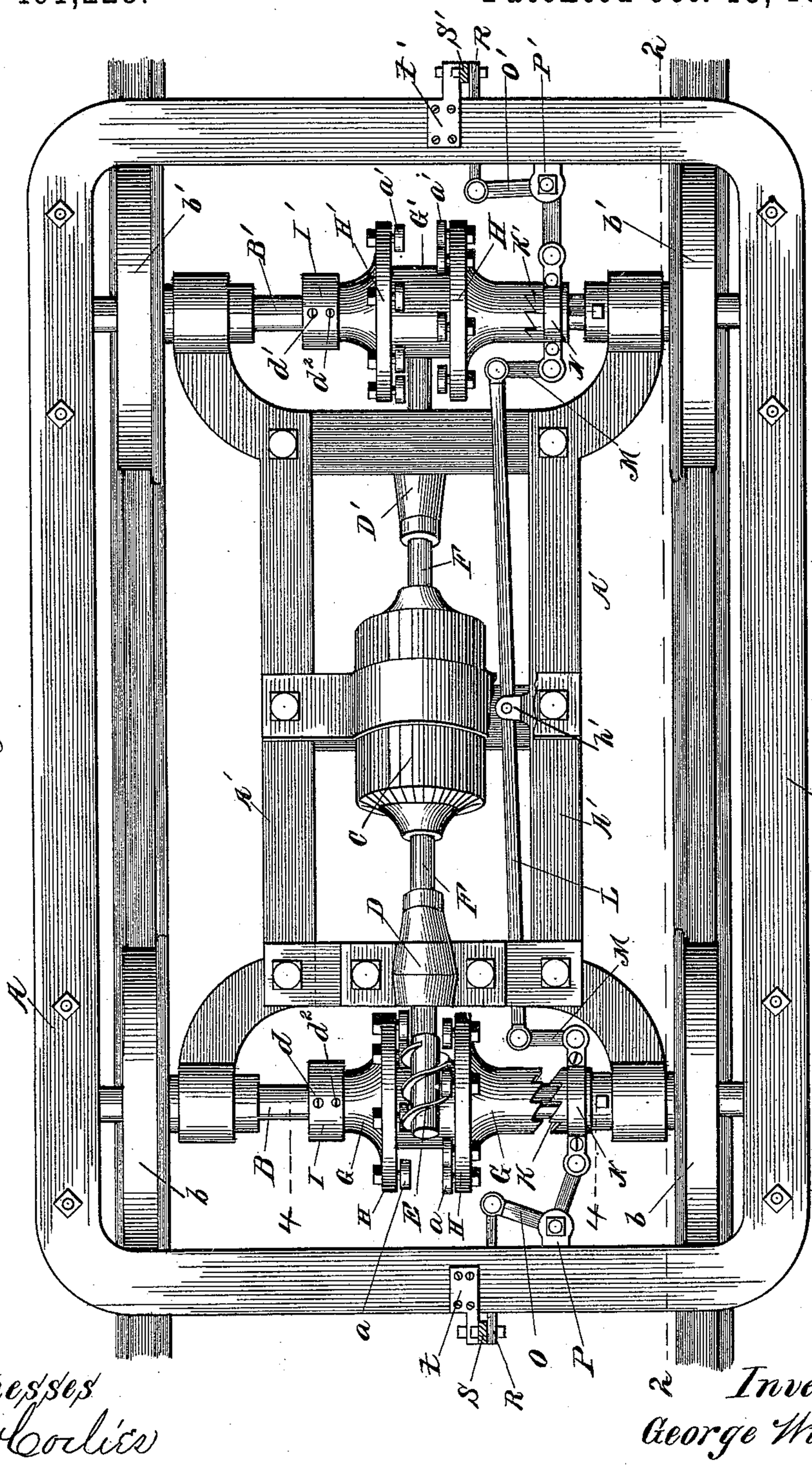

Fig 1.

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(No Model.) 4 Sheets—Sheet 2.

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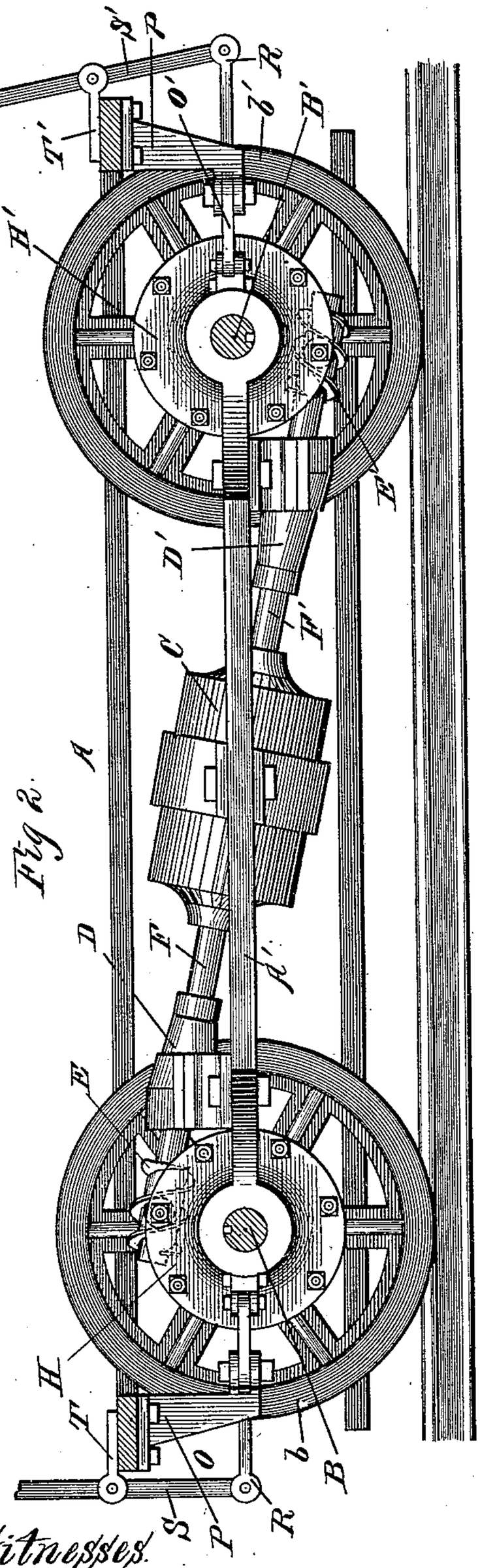

Fig 2.

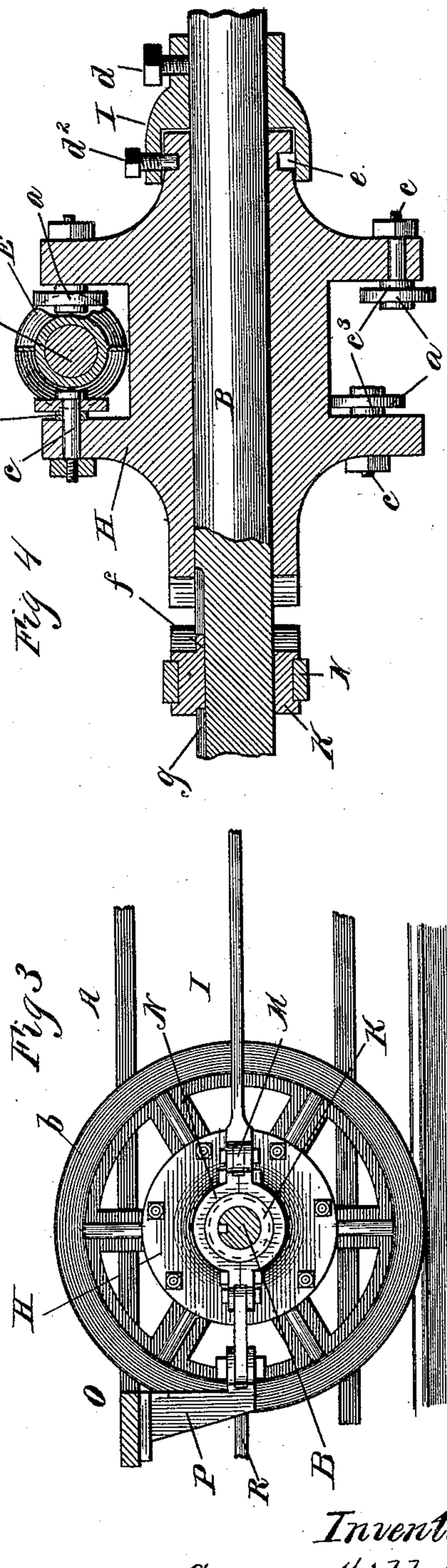

Fig 4

Fig 3

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(No Model.) 4 Sheets—Sheet 3.

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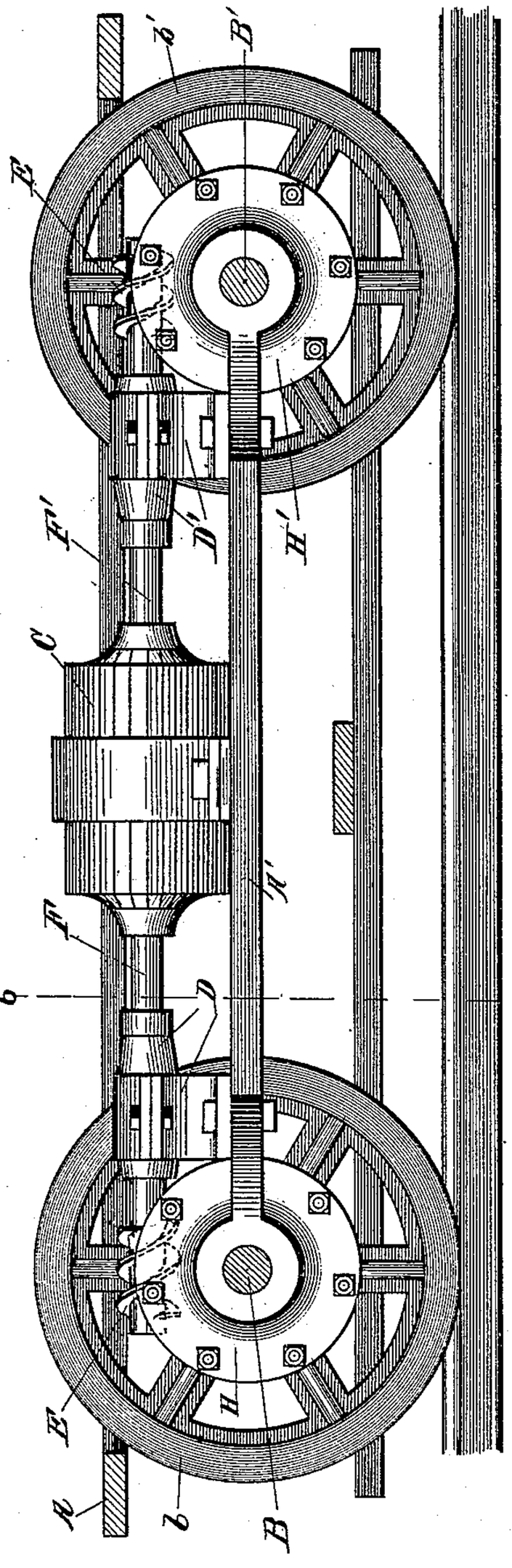

Fig 5

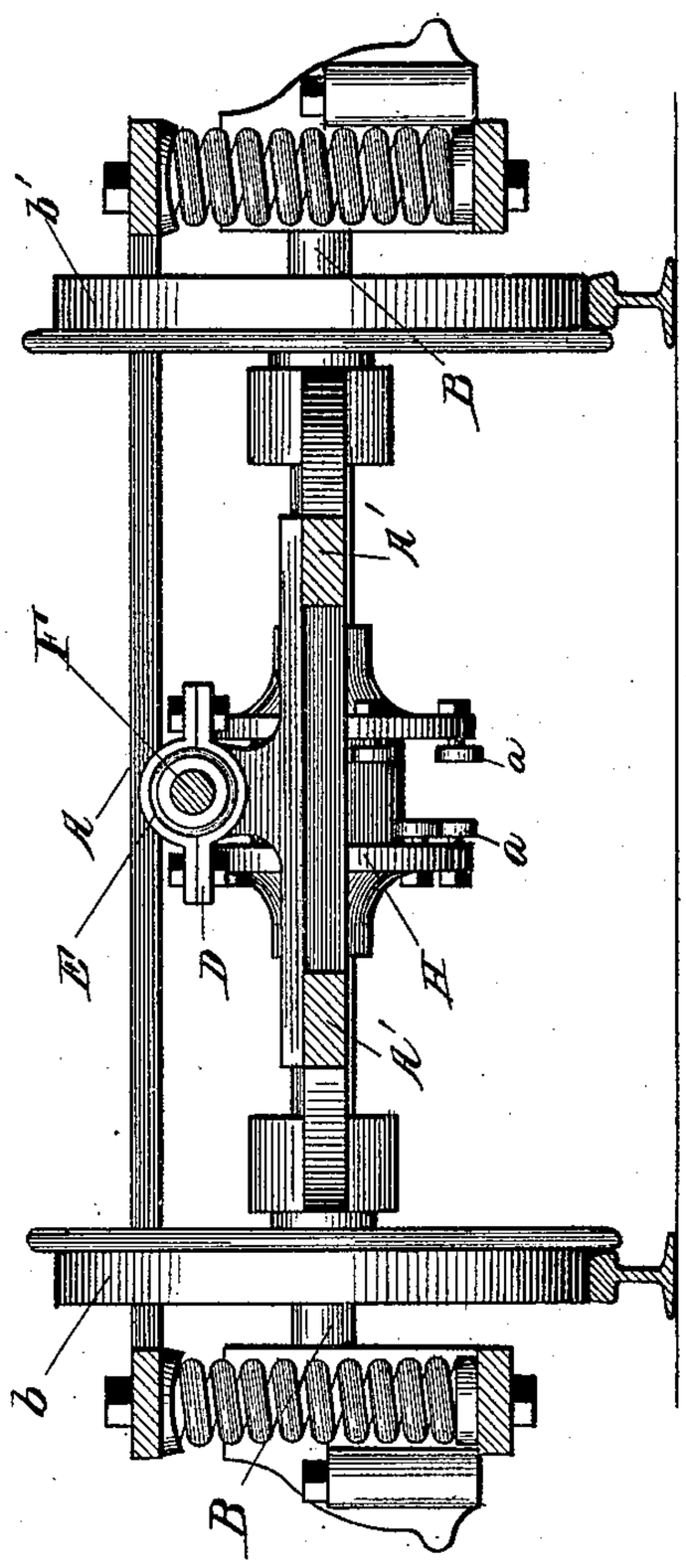

Fig 6

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ELECTRIC CAR MOTOR.

No. 461,228. Patented Oct. 13, 1891.

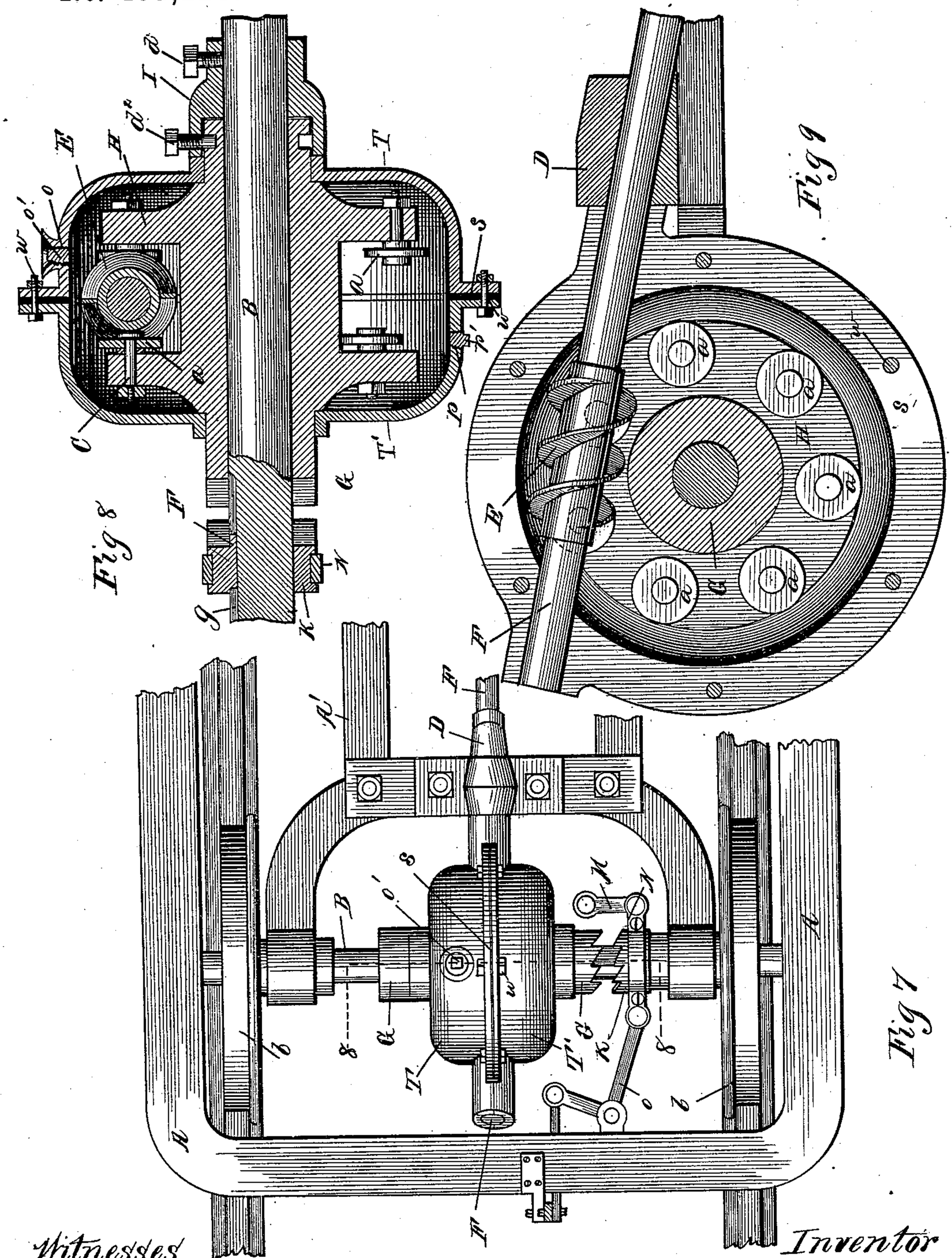

Fig 8.

Fig 9.

Fig 7.

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UNITED STATES PATENT OFFICE.

GEORGE WILLETT, OF ENGLEWOOD, ILLINOIS.

ELECTRIC CAR-MOTOR.

SPECIFICATION forming part of Letters Patent No. 461,228, dated October 13, 1891.

Application filed December 22, 1890. Serial No. 375,447. (No model.)

To all whom it may concern:

Be it known that I, GEORGE WILLETT, a citizen of the United States, residing at Englewood, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Electric Motors, which is fully set forth in the following specification, reference being had to the accompanying drawings, in which—

Figure 1 is a plan view of the car-truck embodying my invention. Fig. 2 is a longitudinal section taken on the line 2 2 of Fig. 1. Fig. 3 is a detail cross-section taken on the line 3 3 at one end of Fig. 1, showing the clutch-shifting device. Fig. 4 is a detail cross-section taken on the line 4 4 of Fig 1. Fig. 5 is a longitudinal section similar to Fig. 2, but showing a modified form in the mounting of the worm-screws. Fig. 6 is a detail cross-section of the same, taken on the line 6 6 of Fig. 5. Fig. 7 is a plan view of the end of the car-truck, showing my oil box or receiver mounted on the hub and motor-shaft. Fig. 8 is a detail cross-section of the same, taken on the line 8 8, looking in the direction of the arrows. Fig. 9 is a longitudinal cross-section of the oil-box, taken on the line 9 9, Fig. 8, the shaft carrying the worm being shown in elevation. All figures are on the same scale, except Fig. 4, which is enlarged.

My invention relates more particularly to the method of application of motors, particularly electric motors, to vehicles or other conveyances which it is desired to communicate power to for the purposes of locomotion; and it consists in various devices and improvements hereinafter stated, whereby power is communicated from the shaft of the motor by means of a worm attached to said shaft and revolving with it in connection with the suitable devices secured to the axle or shaft of a car-truck, and also certain clutch mechanisms for connecting the devices operated by the worm-screw directly to the shaft or axle to be operated on, as hereinafter described.

Heretofore the shaft of the motor, especially electric motors, has been connected to the axle of the vehicle by a system of gears usually intricate and involved, requiring a nice adjustment of parts to operate satisfactorily, and frequently breaking and getting out of order, besides being cumbrous and expensive. By the use of my improvement the old system of connection by gears, with its disadvantages and expenses, is avoided.

A represents a car-truck of any suitable construction, having axles B B′. I have represented my invention as connected with a car-truck used in street-railways and the axles B B′ as the axles of a car-truck; but the motor of the shaft may be attached to the axle of any vehicle or to the main or operating shaft of any conveyance for the purposes of locomotion. The wheels *b b′* are rigidly secured to said axle and revolve with it.

C is a motor of any well-known construction. It need not be described in my present application, as I make no claim upon the motor.

E E′ are worms rigidly secured to the shaft F of the motor C. The bodies of the worms E E′ are in form of a hollow cylinder, preferably made of steel. Around this cylinder is threaded the worm proper. The cylinder or tube upon which the worm is placed is adapted to fit the shaft F of the motor, to which it is rigidly secured. The shaft F is journaled in the bearing D, which bearings are secured to the frame A′. The frame A′ is supported by the axles B B′, to which it is sleeved, as shown in Fig. 1. The purpose of the frame A′ is to support the motor C and the attached worms E E′ with the clutch-shifting devices, as hereinafter described.

G G′ are hubs mounted on the axles B B′. Said hubs may be loosely mounted thereon; or they may be either splined or keyed to the shaft or secured in some suitable manner thereto, as hereinafter described. On each side of the centers of the hubs are disks H H′, two on each hub. These hubs and disks are of metal, preferably cast in one piece, as shown in Fig. 4 of the drawings. On the inner faces of these disks are rolls *a a′*, which revolve and have their bearing on studs *c c′*. These studs pass through holes in the disks H H′ and are screw-threaded at their outer ends, on which are placed nuts c^2, which hold the studs in the disks. The rolls *a a′* are prevented from horizontal movement on the studs

by washers c^3 on the inner side and the head of the stud on the other. The rolls a a' are caused to revolve on the studs by the action of the threads of the worms E E'. These worms have a certain pitch or distance between the threads, and the rolls should be of such a diameter and the studs c c', on which the rolls have their bearing, should be placed in the disks H H' at such a distance from each other as to make the rolls conform to the pitch of the worms E E'. The disks H H', studs c c', and rolls a a' are at such a distance from each other and each roll and the stud bearing it are so arranged, as above described, that the worms will revolve the disks and hubs in the desired direction, the worm E operating the hub G in one direction and the worm E' operating the hub G' in the opposite direction. It is obvious that the hubs G G', by means of the disks, with the rolls attached and arranged as described, are operated by the worms E E' with a minimum amount of friction, there being no friction whatever between the worms E E' and the rolls a a'. The hubs G G', with the disks secured to them, are prevented from moving horizontally on the axles B B' by collars I I', which are secured to the shaft by set-screws d d' and by studs d^2, passing through that part of the collar embracing the hub and into an annular groove e in said hub, the stud d^2 moving loosely in the groove e and allowing the sleeve to revolve freely without the collar; or when the collar is turning with the axle the sleeve may turn in opposite direction.

The shaft of the motor, through the mechanisms hereinbefore described, is brought into operative connection with the shaft or axle of the vehicle to be propelled thereby by the following mechanisms. K K' are toothed clutches secured to the axles B B' by a spline-and-groove connection, the spline f on the axle entering the groove g of the clutch. The clutches K K' are adapted to enter into contact with the hub G G', correspondingly toothed, and are brought into operative contact with said hub by the following mechanisms: To a lug h', secured in the center of one side of the frame A' is pivoted the lever L. On each end of the lever L are pivoted depending arms M M'. The arms M M' are pivoted to collars N N', which loosely encircle the clutches K K', the clutches being grooved to secure these collars. At the other end of the collars N N' are pivoted the bell-crank levers O O'. The bell-crank levers O O' are pivotally secured to brackets P P', which are fastened to the frame A. The bell-crank levers O O' are pivoted at one end to the collars N N' and at the other end to arms R R'. These arms are pivotally connected with the hand-levers S S', as shown in Fig. 2, these hand-levers being pivotally fulcrumed to brackets t t', which are secured to the frame A of the truck.

Whenever one of the clutches is in contact with a hub, as shown in Fig. 1 of the drawings, where the clutch K' is in operative contact with the hub G', the shaft will be revolved and the vehicle propelled in a certain direction, depending on the motion given the axle by the worms, which are right and left. When the operator wishes to reverse the motion of the truck or vehicle, he withdraws the clutch from operative contact with the hub, and the same motion by which he withdraws one of the clutches will bring the other clutch into operative contact with the hub on the other end of the truck, thus reversing the motion of the vehicle or truck.

Fig. 5 shows a modified form in mounting the worm-screws. The worms shown in Fig. 5 are both right and left worms and operate the axles of the trucks in the same direction, provided the shaft of the motor always revolves in the same direction. In the form of mounting the worms, as shown in Figs. 1 and 2, one end of the shaft of the motor is on the under side of the axle and the other on the upper side. In the modified form shown in Fig. 6 both the worms operate on the upper side of the axles or shafts B B' and operate in the same manner. This dispenses entirely with the clutch mechanisms hereinbefore described, and shown in the other figures of the drawings, the hubs being either splined or keyed directly to the shaft. In other respects the operation is the same. Whenever this form (shown in Fig. 5) is used, the car or truck can be propelled in the opposite direction by being made to turn on a loop formed by the truck, or the motion of the shaft of the motor bearing the worm-screws may be reversed by suitable mechanisms, in case of an electric motor, by the use of suitable switching appliances, whereby the direction of the electric current through the electric motor may be changed, thus changing the direction of the revolution of the motor-shaft and the worm-screws on them, and of course reversing the direction of the revolution of the axle, the motion of the shaft of the motor being reversed by the reversing of the movement of the current through the motor.

T T' are boxes, only one of which is shown in the drawings. These boxes are of metal, usually light castings, are spherical in form, and are supported on the hubs G G' and shafts F F' of the motor, which are extended a little beyond the worms and have a bearing in the boxes. They are composed of two hemispherical parts secured to each other by bolts w, passing through flanges projecting from the edges of these hemispherical parts. A gasket s or washer of rubber or hemp is secured between these flanges for the purpose of making these boxes tight. On the top of these boxes are orifices o, through which oil may be supplied to the boxes. These orifices

are closed by a screw-plug *o'*, by which the orifices may be readily opened or closed. At the bottom of the boxes are small openings *p*, fitted to receive a screw-plug *p'*. By means of these openings the oil is let out of the box whenever it is desired. Oil is poured into the boxes through the orifice *o* and falls to the bottom of the box, where it is kept at such a depth that the rolls *a a'* will take up sufficient quantities of oil to lubricate the said rolls, and as they revolve will carry a sufficient quantity of oil to lubricate the blades of the worms E E'. Another object served by these boxes is to prevent the dust and smoke from any sources to cover the rolls, worms, or disks hereinbefore described, and to keep them clean, and at the same time to keep them sufficiently oiled to work without any friction whatever. These boxes are of sizes sufficient to cover and surround the worms E E', disks H H', and rolls *a a'*.

In the drawings I have shown my invention as applied to a car-truck. I do not, however, by this intend to limit myself to the application shown; but my invention may be applied to any axle or shaft for the purpose of producing locomotion in a car or boat or in whatever object it is applied to.

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

1. The shaft of a motor, with a worm rigidly attached thereto, in combination with a hub loosely mounted on a propelling axle or shaft, said hub being provided with disks, on the faces of which are rolls revoluble by said worms and having a bearing on studs, said rolls being at such a distance from each other as to conform to the pitch of the threads of the worm, substantially as specified.

2. The shaft of a motor, with a worm rigidly attached thereto, in combination with a hub loosely mounted on a propelling-shaft, said hub being provided with disks facing each other, and on the faces of which are revoluble rolls having a bearing on studs projecting from the disks, said rolls being revolved by contact with the worms, with suitable mechanisms whereby said hub may be attached to said propelling-shaft, so that said shaft will revolve with said hub when operated by said worm, substantially as shown and described.

3. The shaft of a motor, with a worm rigidly attached thereto, in combination with a hub loosely mounted on a propelling axle or shaft and provided with disks facing each other, with rolls revoluble by said worms, mounted on studs projecting from the inner faces of said disks, said hub being actuated by said worm through said rolls, which are set at such a distance from each other as to conform to the pitch of the threads of said worms, and a clutch mounted on and surrounding said axle, with suitable mechanisms for bringing said clutch and said hub into operative connection, by means of which the shaft or axle can be revolved with the hub, substantially as shown and described.

4. The shaft of a motor, with a worm rigidly secured thereto, in combination with a hub mounted on a propelling axle or shaft, said hub being provided with disks, on the inner faces of which are revolving rollers, said rollers being revolved by said worms and having a bearing on studs projecting from the faces of said disks and being at such a distance from each other as to conform to the pitch of the threads of the worms, substantially as shown and described.

5. In a motor, a worm rigidly attached to the shaft of the motor, in combination with a hub loosely mounted on a propelling-shaft and having two disks with their inner faces opposite each other, with rolls revolving on studs secured in said disks and revolving with said disks, said rolls being at such a distance from each other as to conform to the pitch of the worm-threads, substantially as specified and shown.

6. In a motor, the combination of the worm E, rigidly attached to the shaft F, with hub G, having grooves a^2, disks H, rolls *a*, studs *c*, axle B, and collar I, having pin *d* and set-screw *d'* to prevent longitudinal movement on the axle B, substantially as shown and described.

7. In a motor, the oil box or receiver T, having the orifice *o* and screw-plug *o'*, in combination with the hub G, having disks H, rolls *a*, and worm E, substantially as shown and described.

8. In a motor, the axles of a truck, hubs loosely mounted on said axles, said hubs being provided with disks facing each other, on the faces of which are revoluble rolls, having a bearing on studs projecting from the disks, clutches splined to said axles, with suitable mechanisms for bringing said hubs and clutches into operative connection, in combination with the shaft of a motor, having worms attached to each end thereof, respectively, one of said worms being right-handed and the other being left-handed and one operating below one axle and the other above the other axle, the right-handed worm actuating the truck through the mechanisms aforesaid in one direction and the left-handed worm actuating the truck in the opposite direction, substantially as shown and described.

9. In a motor, the hub G, having disks H H' and rolls *a*, mounted on studs *c*, the clutch K, with suitable mechanisms for bringing said clutch into operative contact with said hub, and the axle B, in combination with the shaft F and worm E, substantially as shown and described.

10. In a motor, the axles B B' of the truck A, the hubs G G', disks H H', revolving rolls *a a'*; mounted on studs *c c'*, said hubs being

loosely mounted on the axles, and the toothed clutches K K′, splined to said axles, with suitable mechanisms for bringing said hubs and clutches into operative connection, in combination with the shaft F of the motor, having worms E E′ attached at each end thereof, respectively, the worm E being right-handed and the worm E′ being left-handed, one of which worms operates below the axle and the other above, the worm E, through the mechanisms aforesaid, actuating the truck A in one direction, and the worm E′, through the mechanisms aforesaid, actuating the truck in an opposite direction, substantially as shown and described.

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