No. 753,925. PATENTED MAR. 8, 1904.

R. SIEGFRIED.

ELECTRIC RAILWAY MOTOR.

APPLICATION FILED MAY 2, 1903.

NO MODEL. 4 SHEETS—SHEET 1.

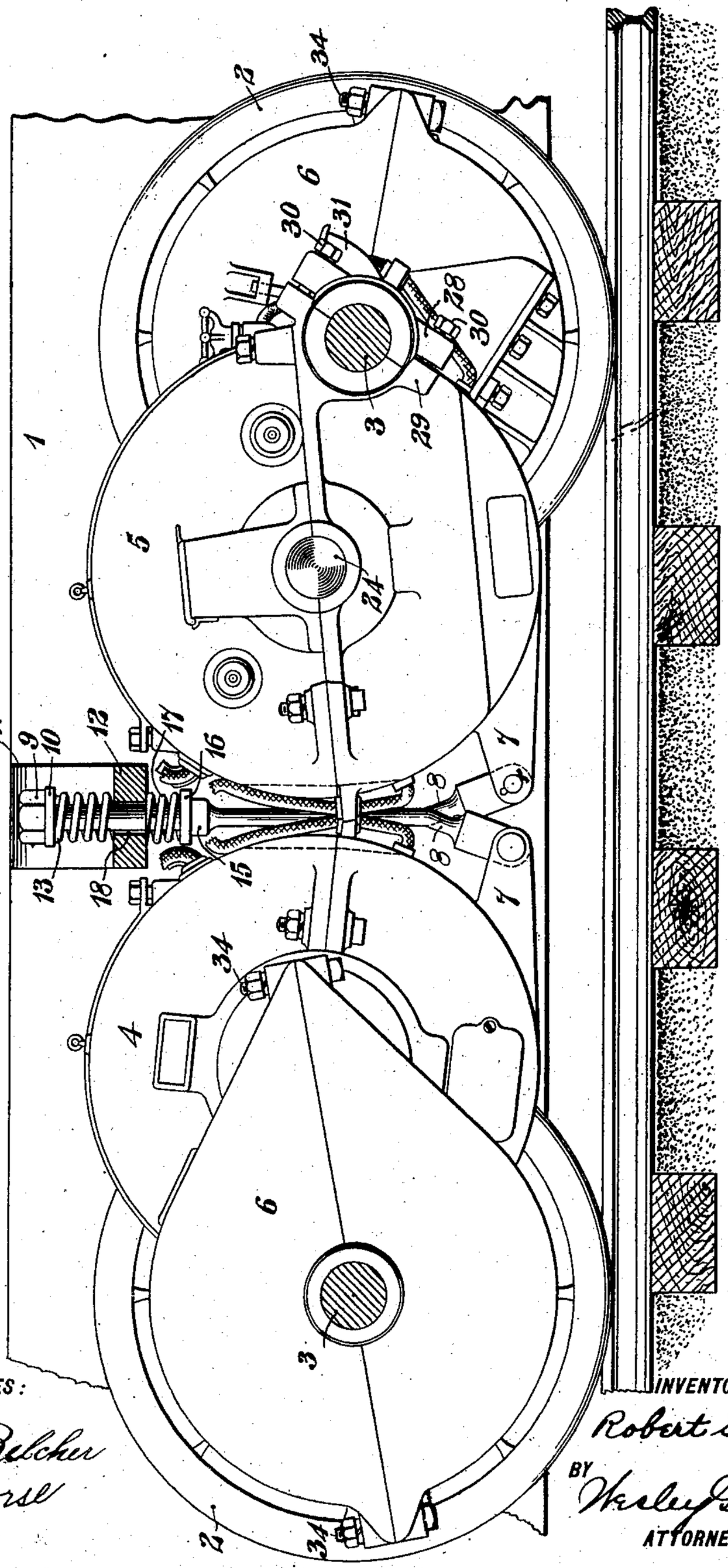


Fig. 1.

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NO MODEL. 4 SHEETS—SHEET 2.

Fig. 2.

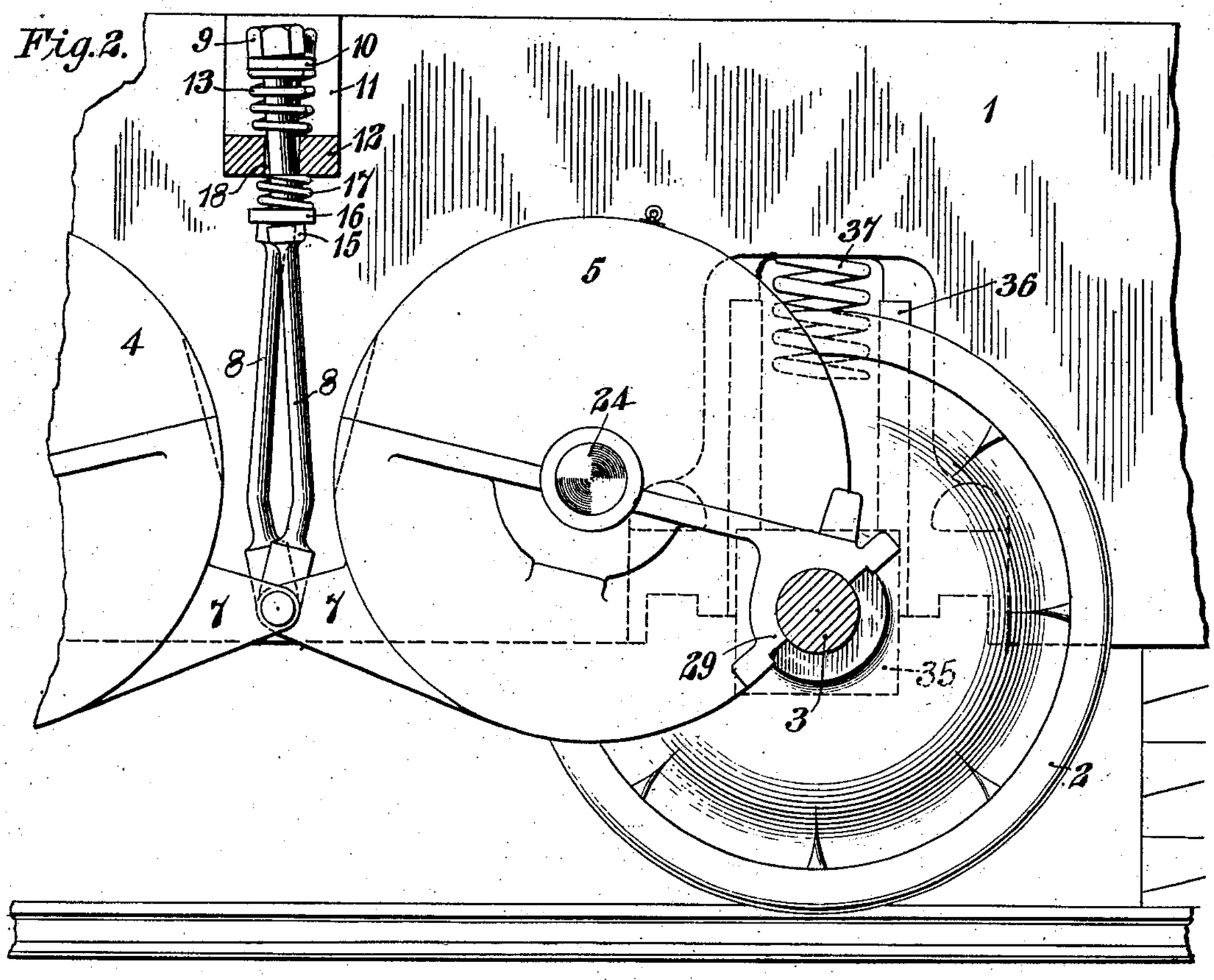
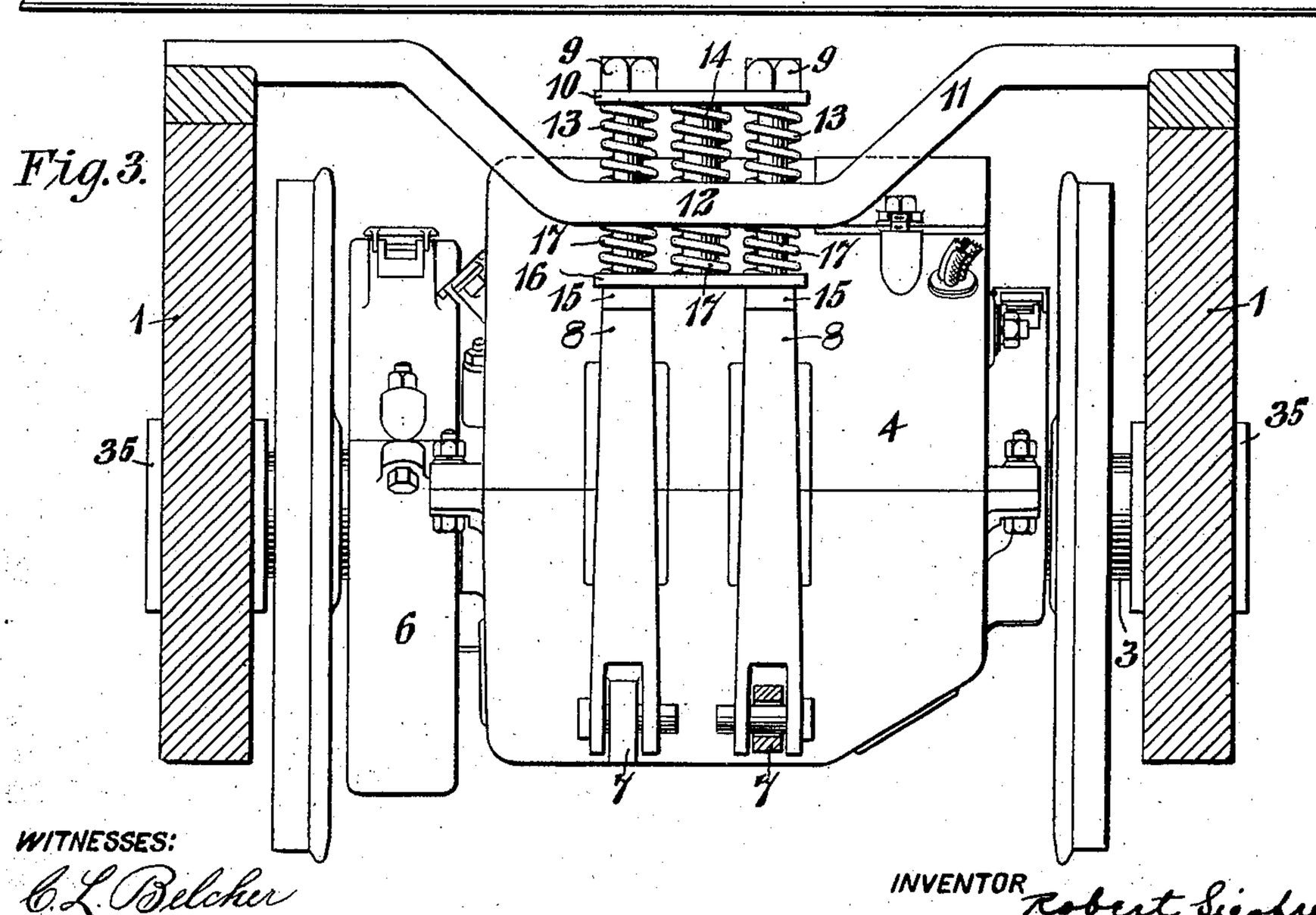



Fig. 3.

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NO MODEL. 4 SHEETS—SHEET 3.

*Fig. 4.*

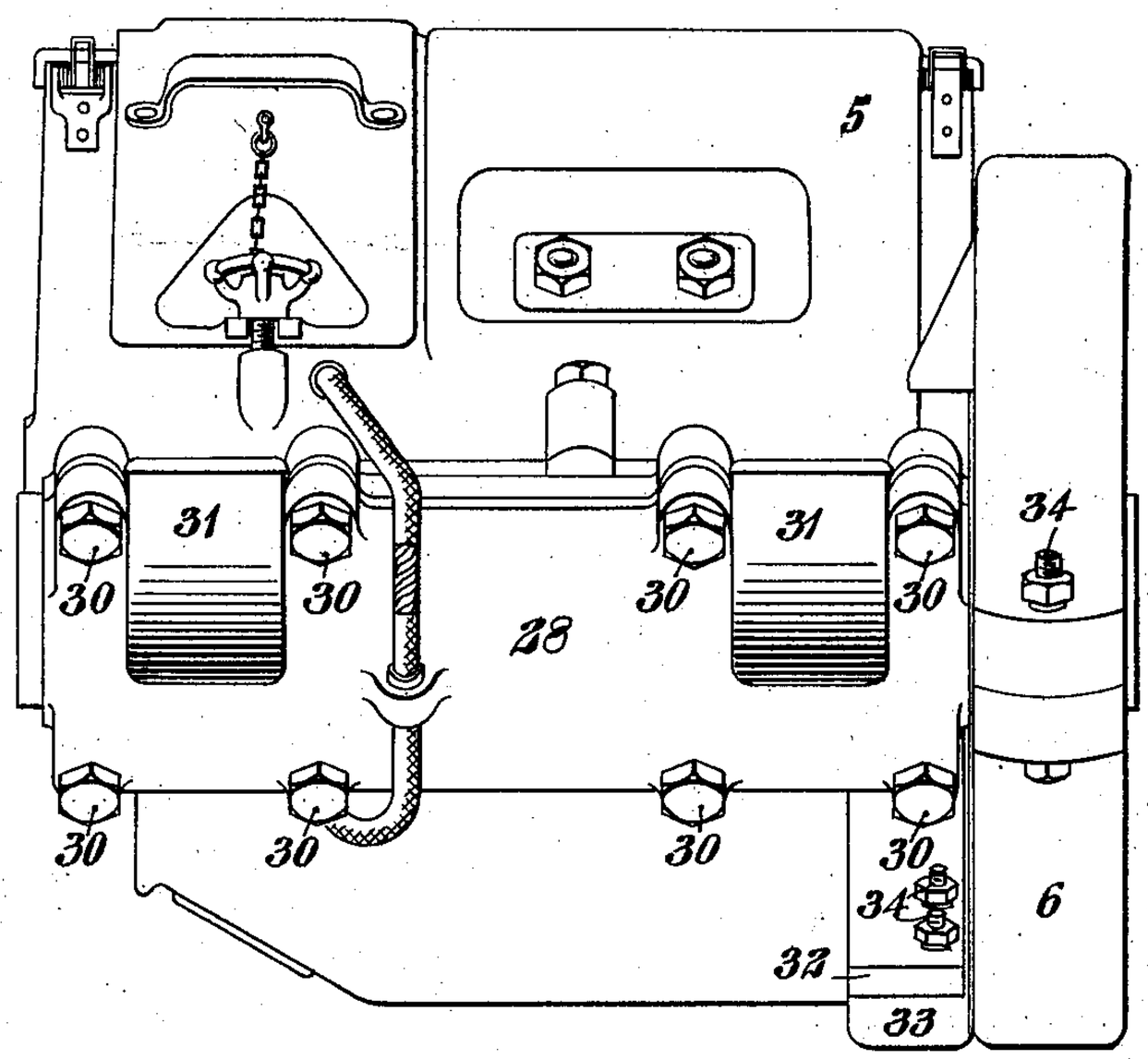
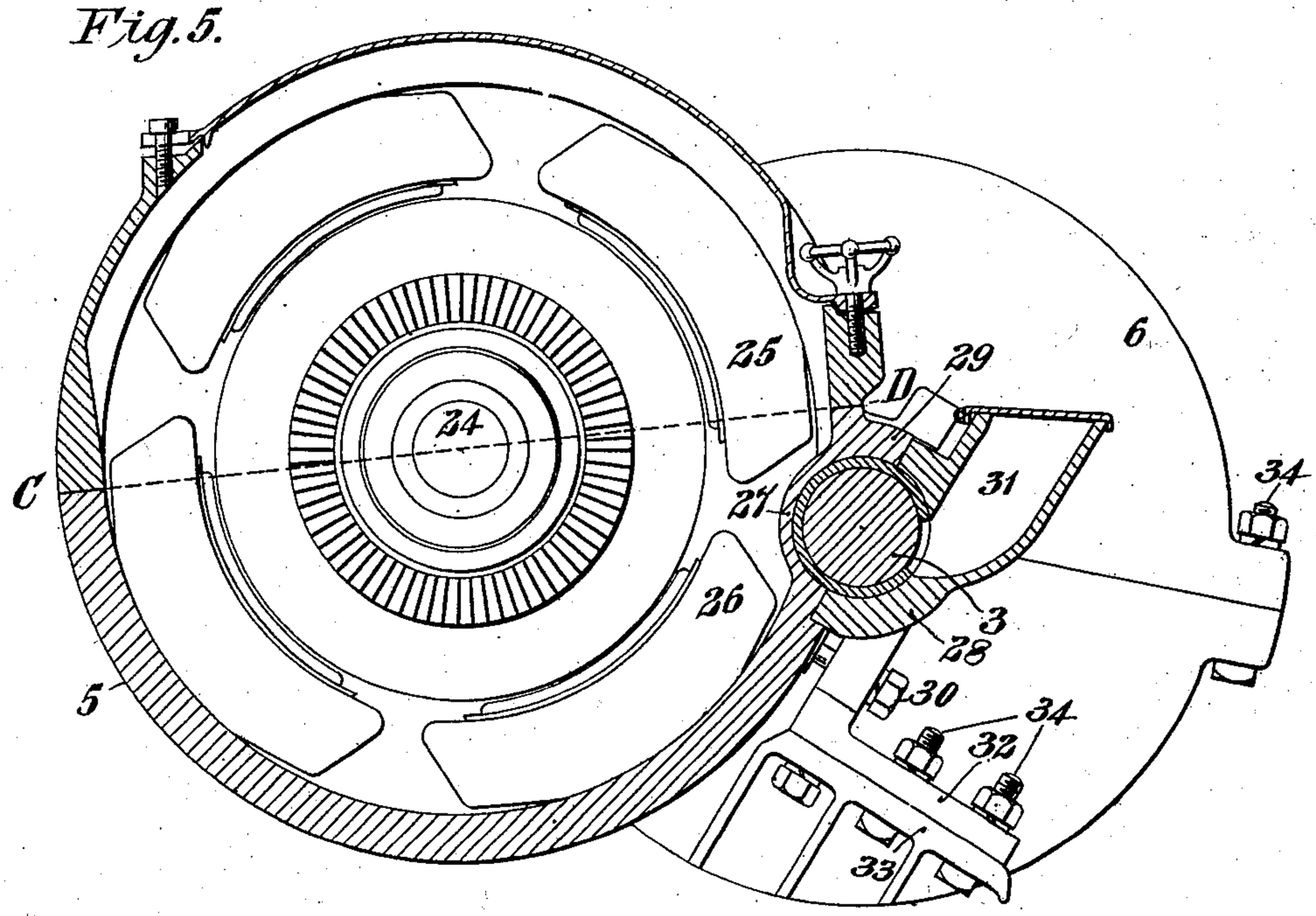



*Fig. 5.*

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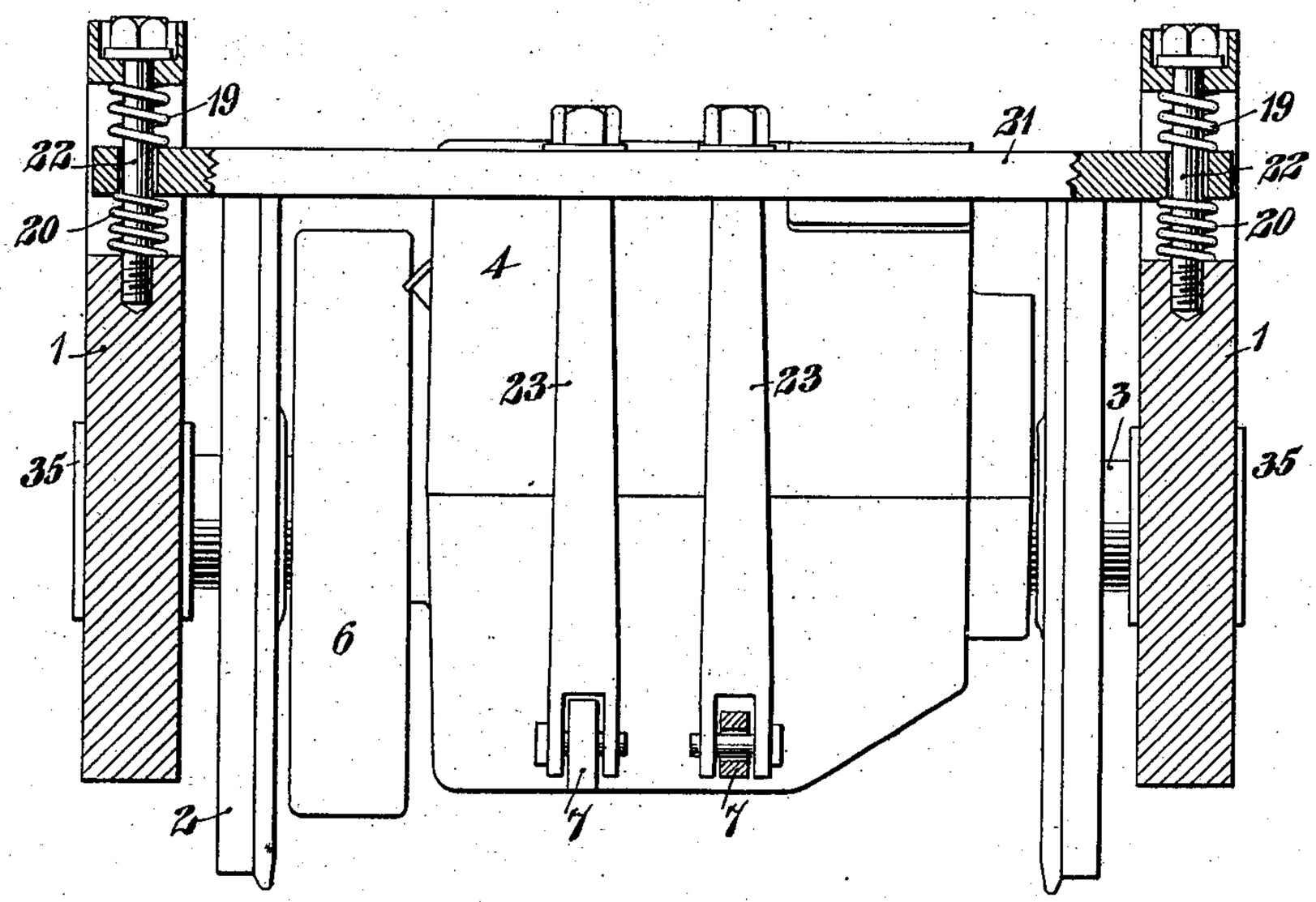
APPLICATION FILED MAY 2, 1903.

NO MODEL. 4 SHEETS—SHEET 4.

*Fig. 6.*

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# UNITED STATES PATENT OFFICE.

ROBERT SIEGFRIED, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

## ELECTRIC RAILWAY-MOTOR.

SPECIFICATION forming part of Letters Patent No. 753,925, dated March 8, 1904.

Application filed May 2, 1903. Serial No. 155,429. (No model.)

*To all whom it may concern:*

Be it known that I, ROBERT SIEGFRIED, a citizen of the United States, and a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Electric Railway-Motors, of which the following is a specification.

My invention relates to electric railway-motors; and it has for its object to provide a motor-frame of improved construction and a simple and efficient suspension means therefor which are mutually adapted to each other and to the service in which they are to be employed.

My invention is primarily designed for embodiment in motors used in the propulsion of mining-locomotives, though not necessarily limited to such use.

A very desirable feature in electric locomotives for mining use is a short wheel-base and the consequent reduction in the size of the complete locomotive. In order to secure this advantage, it is necessary to make the motors as compact as possible and to reduce to a minimum the distance between the center of the armature-shaft and that of the driving-axle.

It is a usual practice when climbing grades in mines to use sharp sand on the rails in order to increase to a maximum the friction between the driving-wheels and the rails, the result being that the wheels wear so rapidly as to necessitate frequent replacement. In order to facilitate such replacement or the replacement of axle-bearings, it is desirable that the motors be so suspended and of such construction that the driving-axles may be easily and expeditiously removed by disturbing a minimum number of parts. The improvements herein described are designed to accomplish this result and to meet the peculiar conditions which are imposed by the shape of the locomotive-frame; and the specific objects of such improvements are, first, to provide electric railway-motors of such construction that they shall occupy a minimum amount of space and shall have a minimum distance between the centers of the armature-shafts and those of the corresponding driving-axles, shall be easily accessible and be readily removable from the locomotive frame or truck by disturbing a minimum number of parts; second, to provide each motor with a flexible and pivoted suspension, which, by means of a link motion between the motor and its suspension-rod, permits at all times of a vertical straight-line motion of the locomotive journal-boxes; third, to provide an axle-cap in one piece to cover the driving-axle bearings and all portions of the driving-axle between said bearings, said cap being easily and expeditiously removed without opening the motor or disturbing the other parts, and, fourth, to so support the gear-case that its lower half may be removed simultaneously with the axle-cap.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of two motors as they appear when mounted in running position on the locomotive-truck, only parts of the latter being shown. Fig. 2 is a view similar to Fig. 1, but showing only a portion of one of the motors, the axle-cap of the other motor being removed and the locomotive-frame being raised to nearly the height necessary for removal of the axles from their boxes. Fig. 3 is an end elevation of one of the motors in running position looking at the suspension end. Fig. 4 is an end elevation of a motor looking at the axle end. Fig. 5 is a transverse section through the motor and the truck-axle, and Fig. 6 is an end elevation corresponding to Fig. 3 and showing a modified form of suspension means.

The locomotive-frame 1, a portion only of which is shown, is supported by four wheels 2 and in turn serves in conjunction with the axles 3 of said wheels to support two electric motors 4 and 5 by a means and in a manner to be hereinafter more fully described. It will be understood that the locomotive-frame 1 may, if desired, be so constructed as to constitute a truck-frame upon which is supported a vehicle-body of any suitable form and dimensions or which constitutes a partial support for such vehicle-body, one or more other

trucks being utilized in connection therewith for such purpose. The two motors 4 and 5 are reversely arranged, so that the gears (not shown) and cases 6 necessitate an offset relation of the two with reference to the central plane of the locomotive or truck. This offset or staggered arrangement of the motors permits of a simple and convenient arrangement of supporting means for the adjacent ends, as will be now described.

Each motor-frame is provided with a lug or nose 7, to which is pivotally attached the bifurcated lower end of a suspension-rod 8, the upper end of which is screw-threaded and provided with a nut 9, which rests upon a bar or plate 10 of such length as to receive the two rods 8 through holes at its respective ends. A suspension-bar 11, constituting a part of the locomotive-frame 1, is bolted to the side plates, as indicated in Fig. 3, and has a depressed middle portion 12, which may be of approximately the same length as the bar or plate 10, and between this portion and the plate the suspension-rods are surrounded by supporting and cushioning springs 13. I have also shown a third spring 14, located between the said parts 10 and 12 and intermediate the springs 13, which surround the suspension-rods 8; but obviously the number and arrangement of such springs may be varied from what is shown.

Each suspension-rod 8 is provided with a shoulder 15, and upon the two shoulders rests a bar 16, between which and the part 12 of the suspension-bar 11 are also located three coil-springs 17, two of which surround the respective suspension-rods 8 and the other of which is located intermediate the same. The holes 18 through the suspension-bar, which receive the suspension-rods 8, are of larger diameter than the rods in order that the latter may be free to swing or move laterally within certain limits.

In Fig. 6 is shown a modification of the suspension-bar illustrated in Fig. 3. Cushioning-springs 19 and supporting-springs 20 are placed at both ends of the straight suspension-bar 21, surrounding the bolts 22, which secure said bar to the locomotive-frame 1. Suspension-rods 23 are bolted directly to the suspension-bar 21, substantially as shown. Obviously the details of the construction of the suspension-bar and suspension-rods may be varied further within considerable limits without departing from the scope of my invention.

It will be observed that each motor-frame is split along a line which passes through the center of the armature-shaft 24, but is located above the center of the corresponding driving-axle 3, this arrangement being such as to permit of removing the motor from the axle or the axle from the motor without opening the motor-casing. Heretofore motors of this type have been split symmetrically with respect to the field-magnet poles—that is, on a line midway between the poles. In order to reduce to a minimum the distance between the centers of the armature-shaft and the driving-axle, the motor herein described is split unsymmetrically, as indicated by line C D in Fig. 5. Advantage is taken of the usually unoccupied space between the field-magnet coils 25 and 26, adjacent to the axle 3, by making the axle-bearing housings to project into said space, substantially as shown in Fig. 5. The axle-bearing is entirely separated from the inside of the motor by means of a wall 27, so that it is impossible for oil to run into the motor and injure the insulation of the field-magnet coils, as is often the case in motors which are split on a line through the center of the armature-shaft and that of the driving-axle. It will be understood that the plane of division of the motor-frame may be below instead of above the axle, if desired.

Each axle-cap 28 is formed in one piece, which extends throughout the entire length of the axle, and therefore serves to effectively exclude all dust and dirt. The bearing-housing 29, of which the cap constitutes a part, is divided at a suitable angle with reference to the vertical plane, so that when the motor is tilted to substantially the position indicated in Fig. 2 and the axle-cap removed the axle may be readily withdrawn from its bearings. The axle-cap 28 is fastened in position by means of eight tap-bolts 30 and is also provided with cups 31 for supplying oil to the bearings. The axle-cap is also provided with a lug 32, which may be cast integral with it and have such location and dimensions as to provide a support for the gear-case 6, the lower half of the latter being securely fastened thereto by means of a corresponding lug 33 and bolts 34. A more rigid support is thus provided for the gear-case than would be possible if it were secured to an axle-cap covering only one bearing. To remove the gear-case, it is only necessary to remove the bolts 34, securing its upper half to its lower half, and the said lower half is then removable simultaneously with the axle-cap 28.

The journal-boxes 35 are mounted in guides 36, with which the sides of the locomotive-frame are provided, so as to move vertically therein, springs 37 being interposed between the boxes and the frame.

It will be seen that the hereinbefore-described means for supporting the inner ends of the motors are such as to permit of a free straight-line motion of the journal-boxes in their guides and that the construction and arrangement of bearing-housings and gear-cases are such as to permit of the ready removal of the axles and gear-cases, the approximate positions assumed by the several parts when such removal is effected being indicated in Fig. 2.

From the drawings and the foregoing description it is evident that I have provided an

electric railway-motor of very compact construction, having a minimum distance between the center of the armature-shaft and that of the driving-axle, and one having a frame that is split in a manner to best secure the said advantages and also to facilitate the removal of the motor, the locomotive or truck frame, or the wheels and axles. It will be further observed that I have also provided a flexible suspension for railway-motors which allows a sufficient link motion between the motor and the suspension-rods to permit of a vertical straight-line motion of the journal-boxes at all times, and particularly when the driving-axle is to be removed from the locomotive-frame, and an axle-cap and gear-case so constructed and united that the driving-axle may be removed by the disturbance of a minimum number of parts.

It is obvious that the details of construction may be varied within limits without departing from the scope of my invention, and I wish it expressly understood that my invention should not be limited to use on mining-locomotives only, as it is practicable to use the same type of suspension and construction on other railway-vehicles.

I claim as my invention—

1. The combination with a four-wheel truck-frame, of two electric motors having their outer ends journaled upon the axles, a single cross suspension-bar, substantially vertical suspension-rods the lower ends of which are respectively attached to the inner ends of the motors and the upper ends of which are attached to the suspension-bar and springs interposed between the suspension-rods and the bar.

2. The combination with a four-wheel truck-frame, of two electric motors having their outer ends journaled upon the axles of the truck-wheels, substantially vertical suspension-rods having their lower ends respectively pivotally connected to the inner ends of the motor-frames, a cross suspension-bar and supporting and cushioning springs interposed between said bar and the upper ends of the supporting-rods.

3. The combination with a four-wheel truck-frame, of two electric motors having their outer ends journaled upon the axles of the truck-wheels and having lugs at their inner ends, substantially vertical suspension-rods having their lower ends pivotally connected to the respective lugs, a suspension-bar extending from side to side of the truck-frame above the motors and having holes of greater diameter than the suspension-rods through which said rods project, bars or plates fastened to said rods above and below the suspension-bar and springs interposed between said bar and said plates.

4. The combination with a four-wheel truck-frame, of two electric motors having their inner ends flexibly suspended from said frame and having their outer ends journaled upon the axles of the truck-wheels, bearing-housings comprising removable caps and two-part gear-cases one part of each of which is fastened to and removable with the corresponding cap.

5. In a truck having an electric motor journaled at one end upon a truck-axle, a bearing-cap for such axle which extends the entire length of the axle.

6. In an electric locomotive, an electric motor having a two-part bearing-housing that completely incloses the axle, the plane of division between the two parts being angularly disposed with reference to both the vertical and the horizontal.

7. A truck-frame having vertical guides in combination with axles having boxes mounted in said guides, springs interposed between the frame and the boxes, electric motors having their outer ends journaled on said axles and flexible, link-motion suspension devices for the inner ends of the motors.

8. The combination with a truck, of an electric motor having one end journaled upon a truck-axle and its other end flexibly suspended from the truck-frame, and a removable axle-cap which extends the entire length of the axle.

9. The combination with a truck, of an electric motor removably supported at one end upon a truck-axle and having its frame split on a plane through its armature-axis but at one side of the supporting-axle and unsymmetrically with reference to the field-magnet pole-pieces.

10. The combination with the wheels and axles of a truck, of a frame supported upon the axle-boxes so as to have a vertical movement relative thereto, electric motors removably journaled at their outer ends upon said axles, a cross-bar rigidly supported by the truck above the inner ends of both motors and means for flexibly suspending said inner ends from the cross-bar.

11. An electric motor having a two-part frame the plane of division of which is through the armature-axis but is unsymmetrically located with reference to the pole-pieces of the motor field-magnet.

12. An electric railway-motor having a two-part frame journaled at one end upon a truck-axle the plane of division of which is through the armature-axis, and unsymmetrically located with reference to both the field-magnet pole-pieces and the axle.

13. An electric railway-motor having a two-part frame journaled at one end upon a truck-axle below the plane of division, said plane being central but unsymmetrical with reference to the field-magnet pole-pieces.

14. An electric railway-motor having a two-part frame provided with an axle-bearing housing at one end that projects into the space between adjacent pole-pieces, the plane of division being through the armature-axis and at one side of the bearing-housing.

15. An electric railway-motor having a two-part frame supported at one end upon a truck-axle, and having a two-part bearing-housing one of the parts of which is integral with the frame and projects into the space between adjacent pole-pieces at one side of the division-plane of the frame.

16. An electric railway-motor having a two-part frame supported at one end upon a truck-axle and having a two-part bearing-housing that completely incloses the axle.

17. An electric railway-motor having a two-part frame supported at one end upon a truck-axle and having a two-part bearing-housing that completely incloses the axle, one of the parts of which is integral with the motor-frame and projects into the space between adjacent pole-pieces.

18. An electric railway-motor having a two-part frame supported at one end upon a truck-axle and having a two-part bearing-housing that completely incloses the axle, and one part of which is integral with the frame and projects into the space between adjacent pole-pieces at one side of the division-plane of the frame.

19. In an electric railway-motor, an axle-bearing housing having a removable cap that extends from end to end of the axle and is provided with oil-cups and with means for attaching a gear-casing thereto.

20. The combination with the wheels and axles of a truck, of a frame supported upon the axle-boxes, electric motors supported at their outer ends upon said axles, a cross-bar and two substantially vertical suspension-rods respectively hinged at their lower ends to the inner ends of the motors and loosely suspended from said cross-bar.

21. The combination with the wheels and axles of a truck and a frame supported thereby, of electric motors the outer ends of which are supported upon said axles, a cross-bar supported by said frame between and above the motors and two suspension-rods depending from said cross-bar and having a loose, cushioned connection therewith and a hinge connection between the lower end of each rod and the inner end of the corresponding motor.

In testimony whereof I have hereunto subscribed my name this 30th day of April, 1903.

ROBERT SIEGFRIED.

Witnesses:
GEO. V. MILLIGAN,
OTTO S. SCHAIRER.