(No Model.) 3 Sheets—Sheet 1.

W. ROBINSON.

MAGNETIC TRACTION APPARATUS FOR MOTOR CARS.

No. 566,800. Patented Sept. 1, 1896.

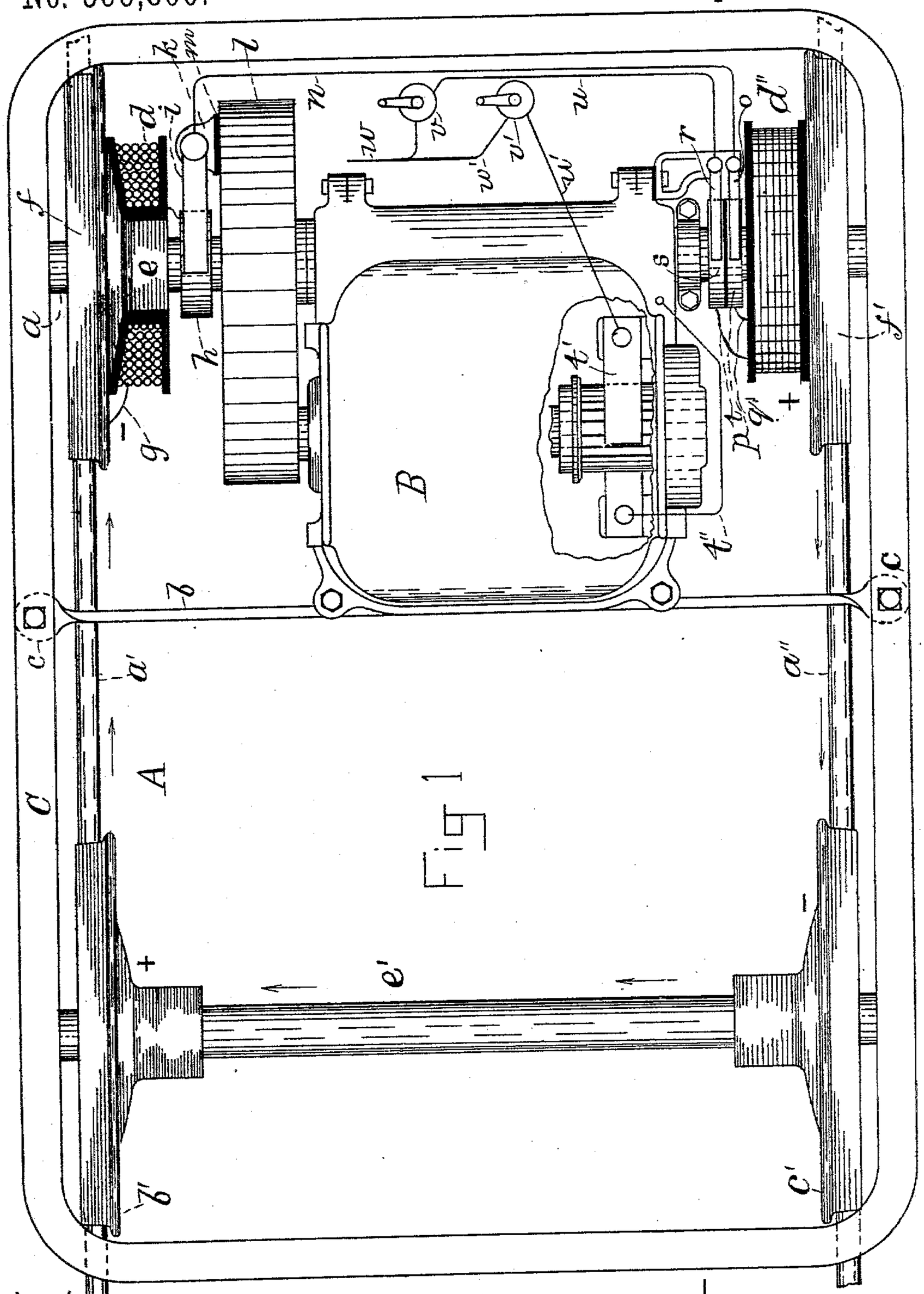

Fig 1

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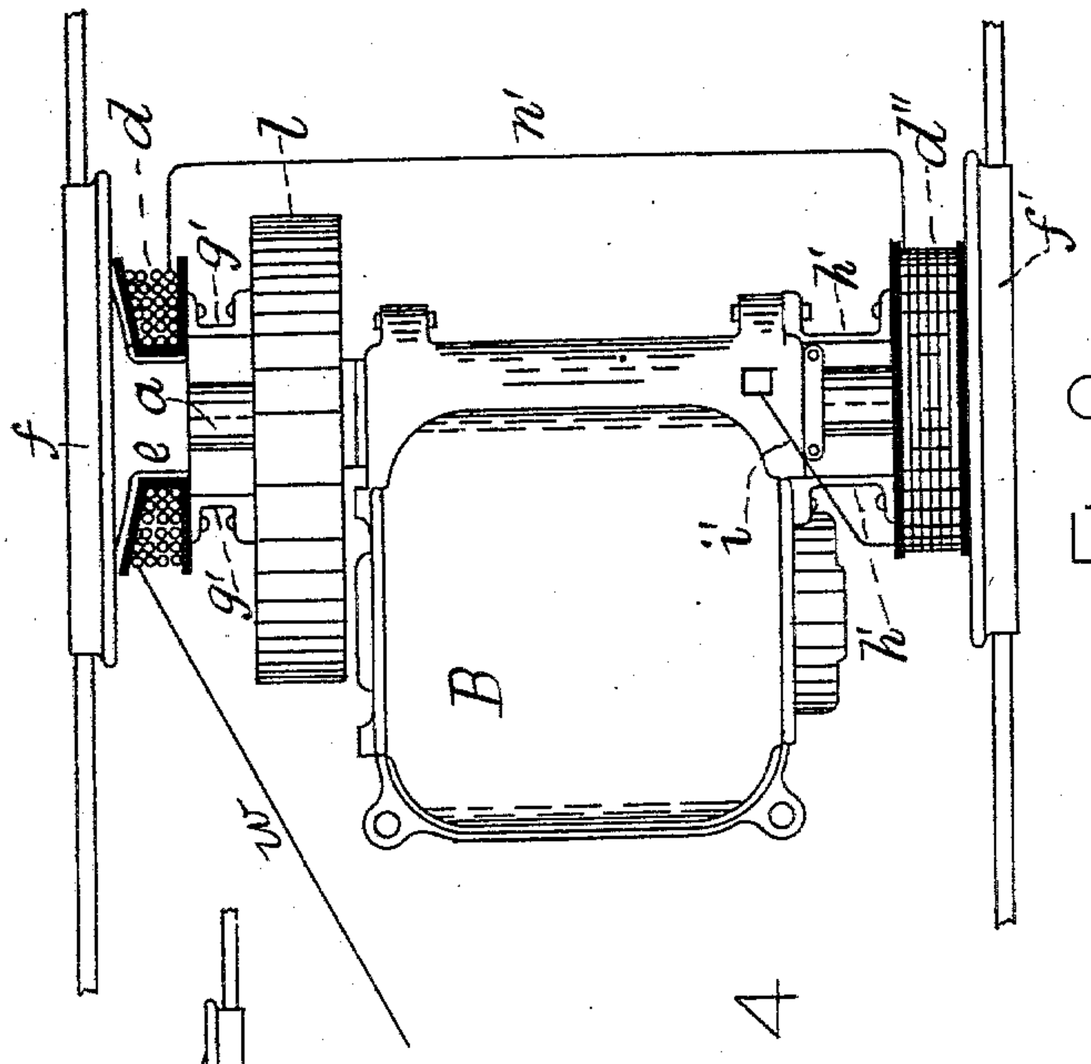

Fig 2

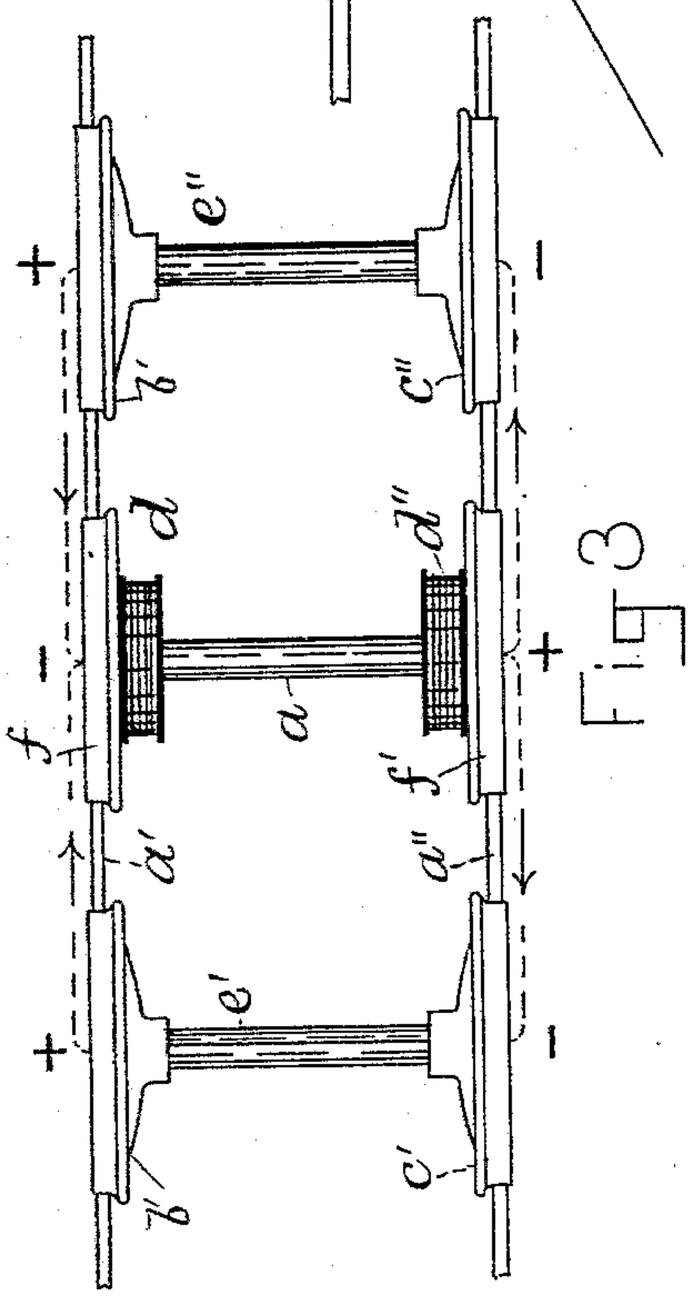

Fig 3

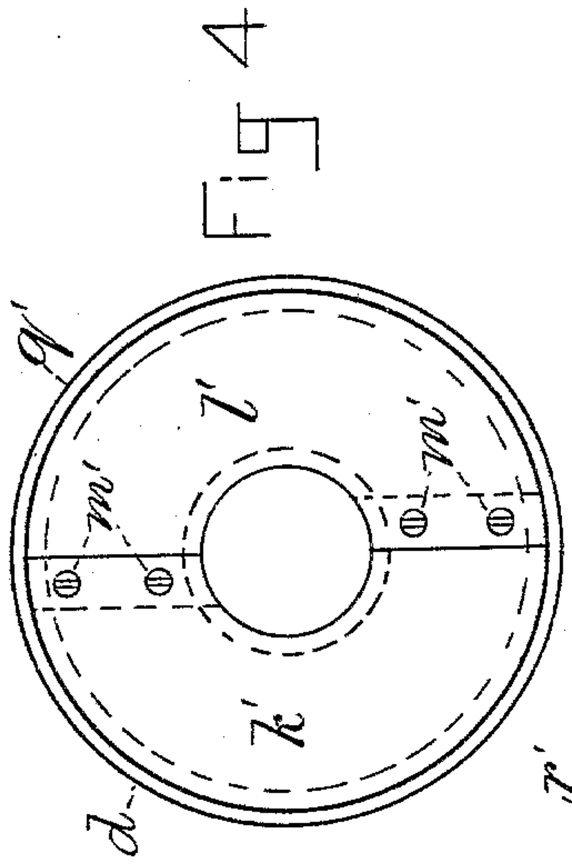

Fig 4

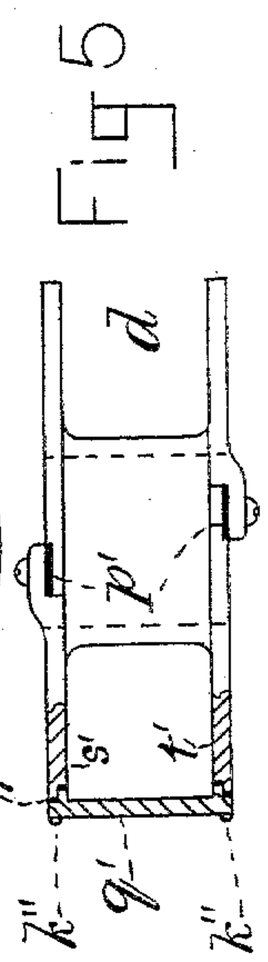

Fig 5

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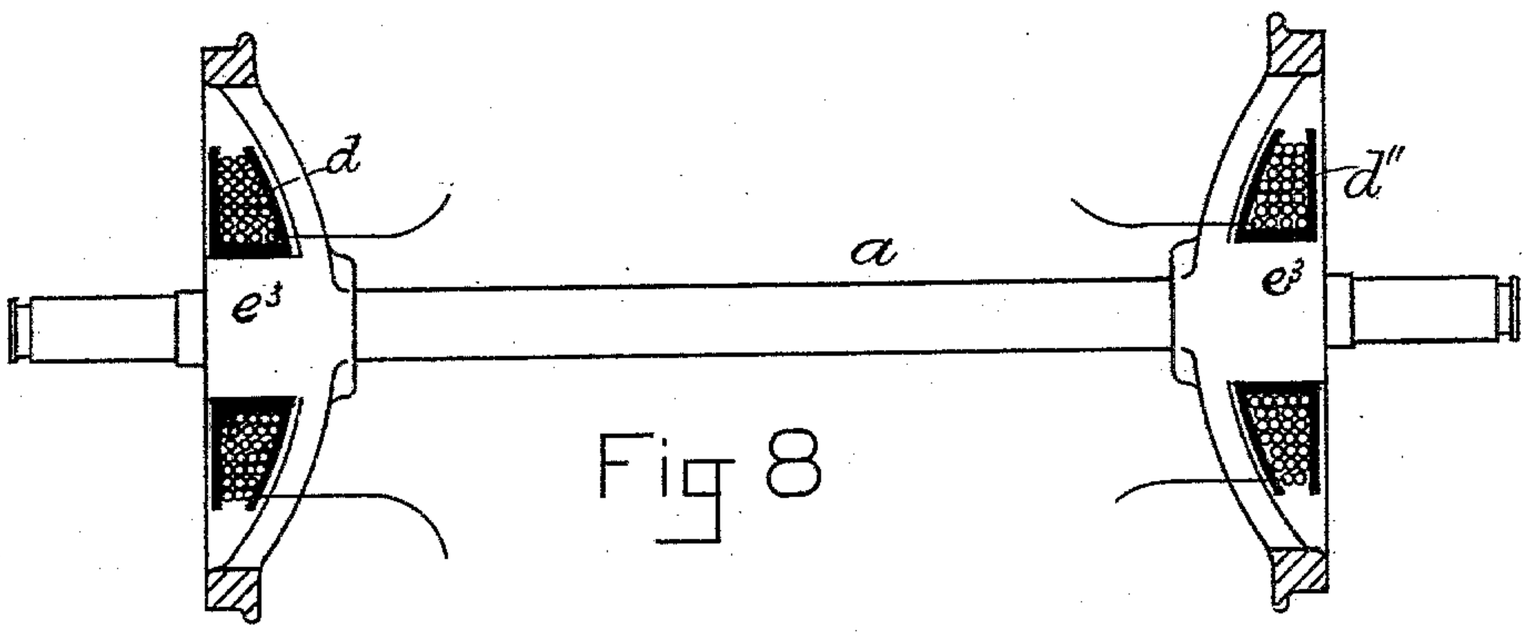

Fig 8

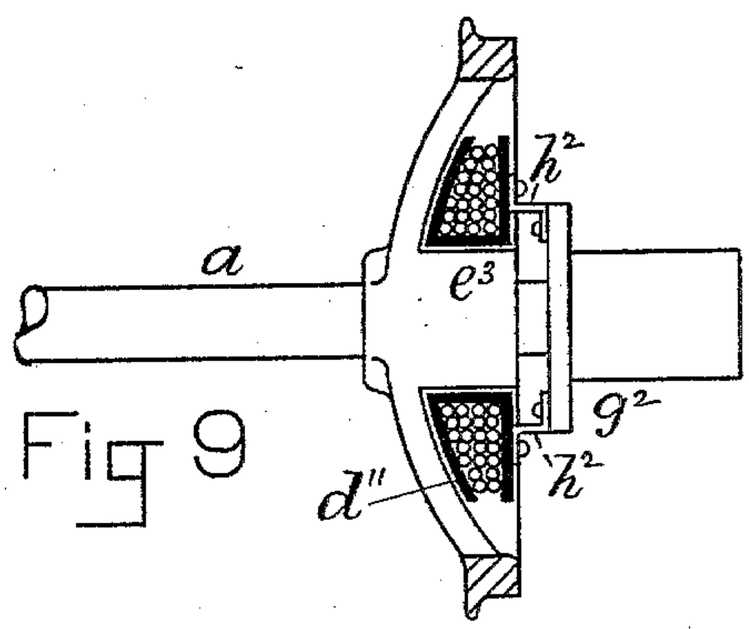

Fig 9

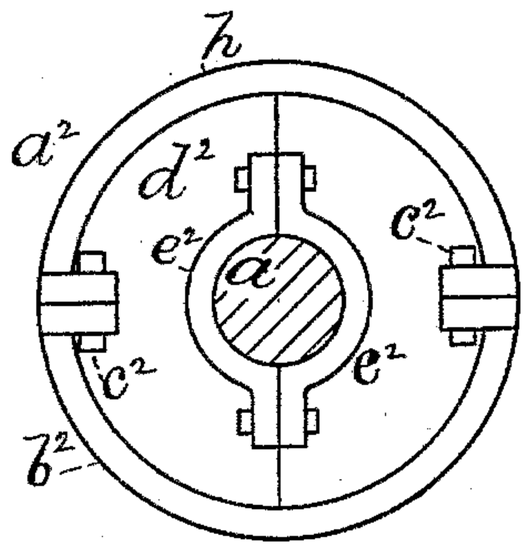

Fig 6

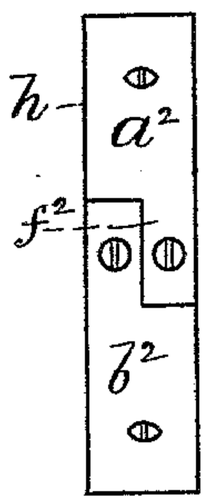

Fig 7

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UNITED STATES PATENT OFFICE.

WILLIAM ROBINSON, OF BOSTON, MASSACHUSETTS.

MAGNETIC TRACTION APPARATUS FOR MOTOR-CARS.

SPECIFICATION forming part of Letters Patent No. 566,800, dated September 1, 1896.

Application filed October 12, 1891. Serial No. 408,466. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM ROBINSON, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful Magnetic Traction Apparatus for Motor-Cars, of which the following is a specification.

The principal object of my invention is to increase the traction of the driving-wheels of motor-cars and locomotives by magnetizing the same and completing the magnetic circuit through said wheels at their points of contact with the rails.

The nature of my invention will be understood from the description which follows, reference being had to the accompanying drawings, which form a part of this specification, in which—

Figure 1 is a plan view of a four-wheeled motor car or truck, illustrating, substantially, my invention. Fig. 2 shows the invention as applied to the driving-axles of a truck, the traction device in this case being supported by the motor. Fig. 3 is a diagram showing the magnetic circuits of a six-wheeled truck. Fig. 4 is a side view, and Fig. 5 a top view, partly in section, illustrating the spool, on which electric wire is or may be wound in applying my device. Fig. 6 is a side view of the insulated contact-ring surrounding the axle. Fig. 7 is an edge view of the same. Fig. 8 shows one method, and Fig. 9 another, of applying my invention to the outside of the wheels for convenience or when there is not room between the wheels; and Fig. 10 shows another method of magnetizing the wheels.

Similar letters of reference indicate corresponding parts in all the figures.

A is a car-truck having the driving-axle *a* mounted therein in the usual manner. The truck A is provided with the motor B, having one end supported on the axle *a* and the other end supported by another portion of the truck, as the cross-bar *b*, which has its opposite ends connected to the truck-frame C, as shown at *c c*.

The axle *a* is provided with the spools of insulated wire *d d''* at opposite ends between the wheels, the spools *d d''* being placed, preferably, over the inwardly-projecting hubs *e* of the wheels *f f'*. When said spools *d d''* are secured to the hubs *e* of the wheels *f f'* and revolve with said wheels, the arrangement shown in Fig. 1 is used. In this case the spools *d d''* are fixed on the hubs *e* and the wire *d'* of said spools *d d''* has one end, *g*, grounded by connection with the wheel *f* or with the axle at any convenient point. The other end of said coil is connected to the insulated ring *h*, surrounding the axle *a*. Upon the ring *h* rests the brush *i*, which is connected to the holder *k*, said holder *k* being secured to the gear-cover *l*, but insulated therefrom by the insulating material *m*. The wire *n* connects the brush *i* to the brush *o* at the opposite end of the motor. The brush *o* rests upon the ring *p*, which is insulated from the axle *a* in the same manner as the ring *h*. The brush *r* in like manner rests upon and makes electric connection with the insulated ring *s*, which is also secured to but insulated from said axle *a*. One end, *q*, of the coil of wire surrounding the spool *d''* is connected to the insulated ring *p*, while the other end, *t*, of said coil is connected to the insulated ring *s*.

From the brush *r* extends the conductor *u* to the switch *v*, and from the switch *v* extends the conductor *w* to the trolley, which may derive its electric supply from an overhead wire, an underground conduit, or from any other source of electric supply. The conductor *w* might also derive its electric supply from a primary or secondary battery carried on the car. Thus, it will be seen, the circuit is completed through the wire *w*, switch *v*, wire *u*, brush *r*, insulated ring *s*, the coils of the spool *d''*, thence through the insulated ring *p*, brush *o*, conductor *n*, brush *i*, insulated ring *h*, coils of the spool *d*, and wire *g* to the wheel *f*, thus completing the circuit through the rails and the ground.

It will be observed that the current may be cut off from the coils *d d''* at will by the switch *v*.

The motor B receives its electric supply also from the conductor *w* by the branch wire *w'*, switch *v'*, wire *u'*, brush *t'*, and wire *t''*, which is connected, as shown, to the motor B, thence through the axle to the ground in the usual manner. Thus, as is evident, the cutting off of the current from the motor B does not affect or cut off the current from the

coils $d\ d''$, which are preferably operated independently of the operation of said motor, although receiving their electric supply from the same source.

The operation is as follows: The passage of an electric current through the coils $d\ d''$ magnetizes the wheels $f\ f'$, since they are connected together by the axle a, which, with the wheels $f\ f'$, acts as the core of a magnet, having the coils $d\ d''$ to give said wheels magnetic force and polarity. The magnetic poles of said wheels $f\ f'$ are changeable, and will be found wherever the peripheries of said wheels are magnetically connected by iron bars, plates, or other devices. As shown in Fig. 1, the magnetic circuit from the wheels $f\ f'$ is completed from said wheels through the rails $a'\ a''$, the wheels $b'\ c'$, and the axle e'. The direction of the magnetic circuit is indicated by the arrows. Thus the positive pole is found at the contact-point between the wheel f' and the rail a''. Thence said circuit extends by said rail a'' to the contact-point between the wheel c' and said rail a'', this being the point of negative magnetic polarity. Thence the circuit extends to the positive point of contact between the wheel b' and the rail a', thence to the negative point of contact between the wheel f and the rail a'', thus completing the magnetic circuit. Thus, it will be observed, the wheels $b'\ c'$, with their axle e' and the rails $a'\ a''$, act, in closing the magnetic circuit of the magnet formed by the wheels $f\ f'$ with their axle a, in the same manner as an ordinary armature when brought in contact with the poles of an ordinary electromagnet. It will be perceived that by this arrangement the wheels $f\ f'$ necessarily adhere with great force to the rails $a'\ a''$, so that while they roll along said rails with perfect freedom it is practically impossible, when powerfully magnetized, to turn said wheels without progressing, that is, it is practically impossible to make said wheels slip on the rails, from which circumstance it is evident that a single pair of driving-wheels, when magnetized in this manner, will give much better results than can possibly be secured by putting on said wheels even a very great amount of dead-weight.

It will be understood that the changing magnetic poles of the wheels $f\ f'$ are always at the points of contact of said wheels with the rails $a'\ a''$, however rapidly said wheels may be revolving. Furthermore, the wheels $b'\ c'$, being also in the magnetic circuit, will adhere powerfully to said rails $a'\ a''$, although their adhesion will be less in degree than is the case with the wheels $f\ f'$, which are directly magnetized by the coils $d\ d''$. Thus it is evident that when the wheels $b'\ c'$, with their axle e', are also used for drivers much greater adhesion will be secured than if they were not in the magnetic circuit with the wheels $f\ f'$. Nevertheless, where both sets of wheels $f\ f'$ and $b'\ c'$ are to be used as drivers, I prefer to put the electric coils on the hubs of the wheels $b'\ c'$, as well as on those of the wheels $f\ f'$, care being taken in such case that the electric current shall pass around the various coils in such direction as to have the polarity of the contact-points between the wheels and rails in series, as already described.

In Fig. 2 the spool d is shown secured by the brackets $g'\ g'$ to the gear-cover l of the motor B, said spool d preferably not touching the hub e of the wheel f, although surrounding the same very closely. In like manner the spool d'', like the spool d, is mounted so as to allow the hub of the wheel to turn within said spool d'', said spool surrounding said wheel-hub very closely. In this case the wire n' connects the coils of said spools $d\ d''$ directly without the intervention of brushes and insulated rings, as described in connection with Fig. 1. In this case, also, one end of the coil of the spool d'' is connected to the motor B by the wire i', thus reaching the ground through said motor and the axles and wheels upon which the same rests.

The current from the wire w passes through the coils of the spool d, thence through the conductor n', the coils of the spool d'', and the wire i' to the ground, thus completing the circuit. This method of supporting the spools $d\ d''$ I prefer to that described in connection with Fig. 1, when it can be used conveniently, since it is simpler. In this case it will be understood the magnetic circuit is completed in the same manner as described in connection with Fig. 1.

When a six-wheeled truck is used, as illustrated in Fig. 3, the center axle a is used as a driver and is provided with the spools $d\ d''$, as already described. In this case the magnetic circuit is completed in the direction of the arrows, that is, from the plus-point of contact of the wheel f' with the rail a'', which is positive. The magnetic circuit passes in both directions, as shown by the arrows, the points of contact of the wheels $c'\ c''$, respectively, with the rail a'' being both negative. In like manner the points of contact of the wheels b' and b'' with the rail a' are both positive, while the point of contact of the wheel f and the rail a' is negative. Thus the magnetic circuit passes in both directions along the rails from the wheels $f\ f'$, through the wheels $b'\ c'$ with their axle e' and the wheels $b''\ c''$ with their axle e''.

In order that the spool d may be conveniently placed around the axle a after the wheels have been mounted on said axle, I prefer to make said spool in two sections $k'\ l'$, which are readily placed in position around the axle or the hub of the wheel and then joined together by the means of the screws m'. Between the sections $k'\ l'$ I place the packing p', in order to make the joints waterproof, and also surround the spool d with the

cover q', which fits over the outer peripheries of the sides s' t' of said spool. I place the packing r' between said cover q' and the sides s' t' aforesaid, thus rendering the spool d and the wire contained therein waterproof. The cover q' is secured to the sides s' t' of the spool d by means of screws k''.

The ring h is preferably made of two parts a^2 b^2, bolted together by the bolts c^2 around the insulated material d^2, which insulates said ring h from the axle a. The ring h, with its insulating material d^2, is secured to the axle a by the clamps c^2 c^2, as shown in Fig. 6. The insulated sections a^2 b^2 of the ring h have their ends overlapping, as shown at f^2, Fig. 7, in order that the brush i may be certain to strike one section before leaving the other, by which means it will be impossible for the circuit to be interrupted at the points of junction f^2.

When the motor occupies so much of the axle that it will not be practicable to put the spools or coils d d'' between the wheels, I arrange them as shown in Fig. 8 or 9, in both of which cases the wheels are dished materially inwardly. In Fig. 8 the spools d d'' are secured on the outwardly-projecting hubs e^3 of the axle a. These spools come practically within the lines of the cavity formed by the dishing of the wheels, as shown in Fig. 8.

When the spools d d'' are secured to the outward hubs e^3, as described, the ends of their coils are connected to insulated rings, and the operation is substantially the same as described in connection with Fig. 1.

Fig. 9 shows the spool d'' secured to the axle-box g^2 by the brackets h^2, by which means the spools or coils of wire are held in position, while the outward hubs e^3 of the wheels turn freely within said spools or coils. In this case, it will be understood, the insulated rings and brushes described in connection with Fig. 1 will be dispensed with, and the operation will be substantially the same as that described in connection with Fig. 2.

In Fig. 10 the wheel f is shown as having its spokes provided with coils of insulated wire i^2, whereby the current passing through said coils i^2 will magnetize said wheel f. The wheel f being magnetized in this manner its poles will be at the point of junction with the rail, and the operation and the magnetic circuit will be the same as described in connection with Fig. 1.

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

1. The combination, substantially as described, of a car-axle and its wheels, a motor arranged to drive the same and coils of insulated wire surrounding the hubs, of said wheels exterior to the surface of the latter and arranged to magnetize the same, said coils being electrically connected together.

2. The combination, substantially as described, of a car-axle and its wheels, a motor arranged to drive the same, and coils of insulated wire surrounding the hubs of said wheels, said hubs extending beyond the face of the wheels, said coils of wire being electrically connected together and arranged to magnetize said wheels.

3. The combination, substantially as described, of a car-axle and its wheels, a motor arranged to drive the same, insulated coils surrounding the hubs of said wheels exterior to the surface thereof, arranged to magnetize the same, and an electric connection between said insulated coils, said coils and motor receiving current from a common source of electric supply.

4. The combination, substantially as described, of a driving-axle and its wheels, a motor arranged to drive the same, and insulated coils surrounding the hubs of said wheels, exterior to the surface thereof, said coils being electrically connected together, said coils and motor receiving current independently of each other, from a common source of electric supply.

5. The combination, substantially as described, of a car-axle and its wheels, coils of insulated wire surrounding the hubs of said wheels exterior to the surface of the latter, and arranged to magnetize the same, and means for supporting said coils independently of said wheels, said coils remaining stationary with reference to the revolving wheels.

6. The combination, substantially as described, of a car-axle and its wheels and coils of wire surrounding the hubs of said wheels and arranged to magnetize said wheels, and means for supporting said coils in a fixed position relatively to said revolving wheels.

7. The combination, substantially as described, of a driving-axle and its wheels, a motor arranged to drive the same, and coils of wire surrounding the hubs of the wheels, exterior to their surface, and arranged to magnetize said wheels, said coils being supported by said motor or an attachment thereto, in a fixed position relatively to said wheels and axle revolving within or independently of, said coils.

8. In a railway car or truck, the combination, substantially as described, of a driving axle and its wheels, a motor arranged to drive the same, coils of insulated wire surrounding the hubs of said wheels exterior to the surface of the latter, and arranged to magnetize the same, an additional axle with its wheels, in the same truck, and rails connecting the corresponding wheels of said adjacent axles, whereby the magnetic circuit of said magnetized driving-wheels will be completed through the rails and the adjacent wheels and axle.

9. In a car or truck, the combination, substantially as described, of a car-axle and its wheels, coils of insulated wire surrounding the hubs of said wheels exterior to the surface of the latter, and arranged to magnetize the same, a source of electric supply arranged to supply current to said coils, another axle

with its wheels, in the same car or truck, and rails connecting said two pairs of wheels, whereby the magnetic circuit is completed and all of said wheels polarized at their points of junction with said rails.

10. In combination, the spool *d* wound with insulated wire, the waterproof cover *q'* and the packing *r* between said spool and cover, substantially as and for the purpose described.

11. The spool *d*, made in sections, as described, and arranged to surround the car-axle or a portion of the wheels without removing the latter from the axle, said spool having its joints provided with packing adapted to make said spool waterproof, substantially as described.

12. In combination, substantially as described, the car-axle *a*, the insulated material d^2 clamped thereto, and the insulated ring *h* secured to said insulated material d^2, the whole constructed in such a way that said ring, with its insulation, may be readily secured to or removed from, said axle, without interfering with the car-wheels.

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