No. 684,950. Patented Oct. 22, 1901.

C. ROBINSON.

ELECTRIC MINE LOCOMOTIVE.

(Application filed Sept. 14, 1895.)

(No Model.) 5 Sheets—Sheet 1.

Fig. 1

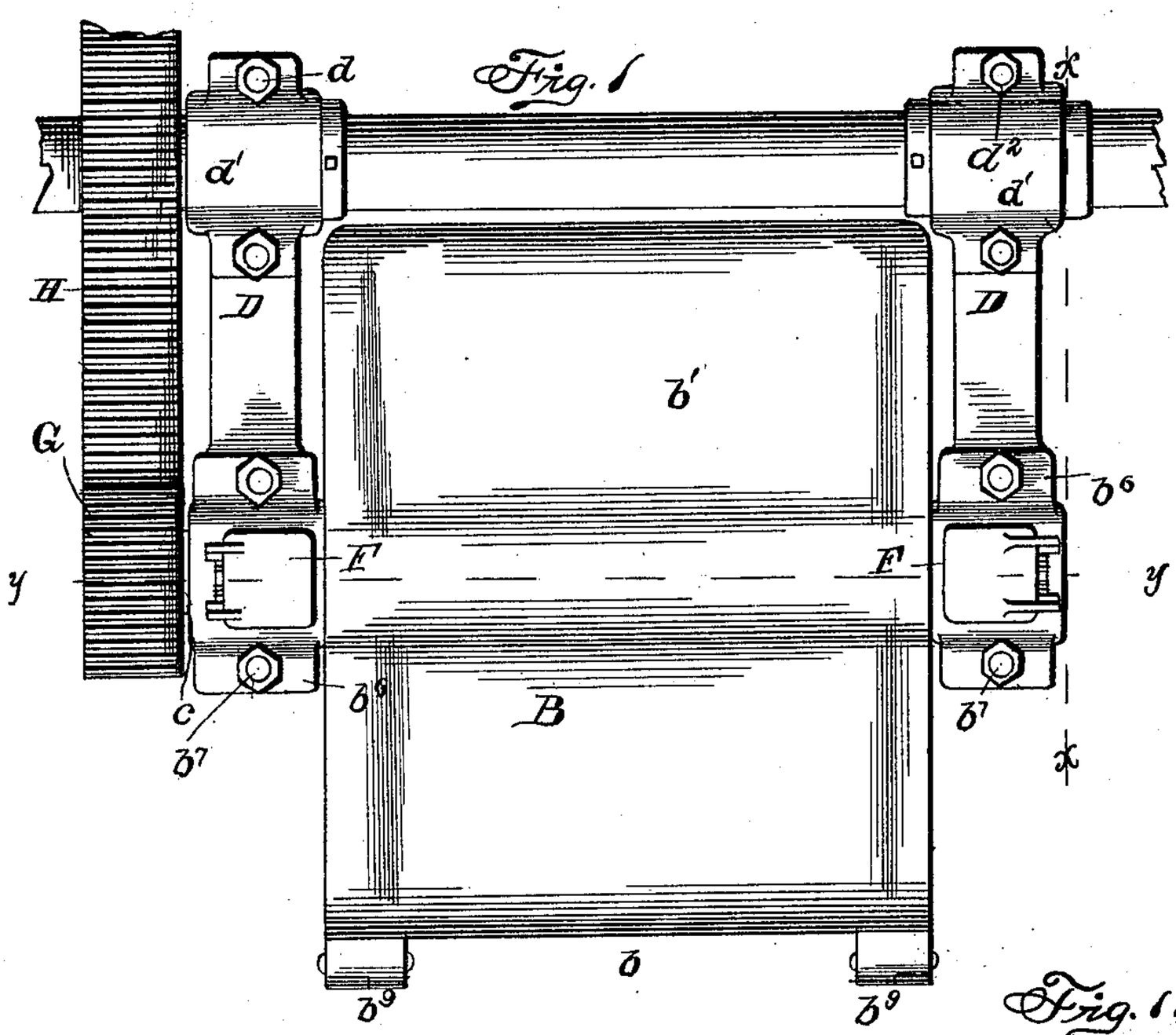


Fig. 12.

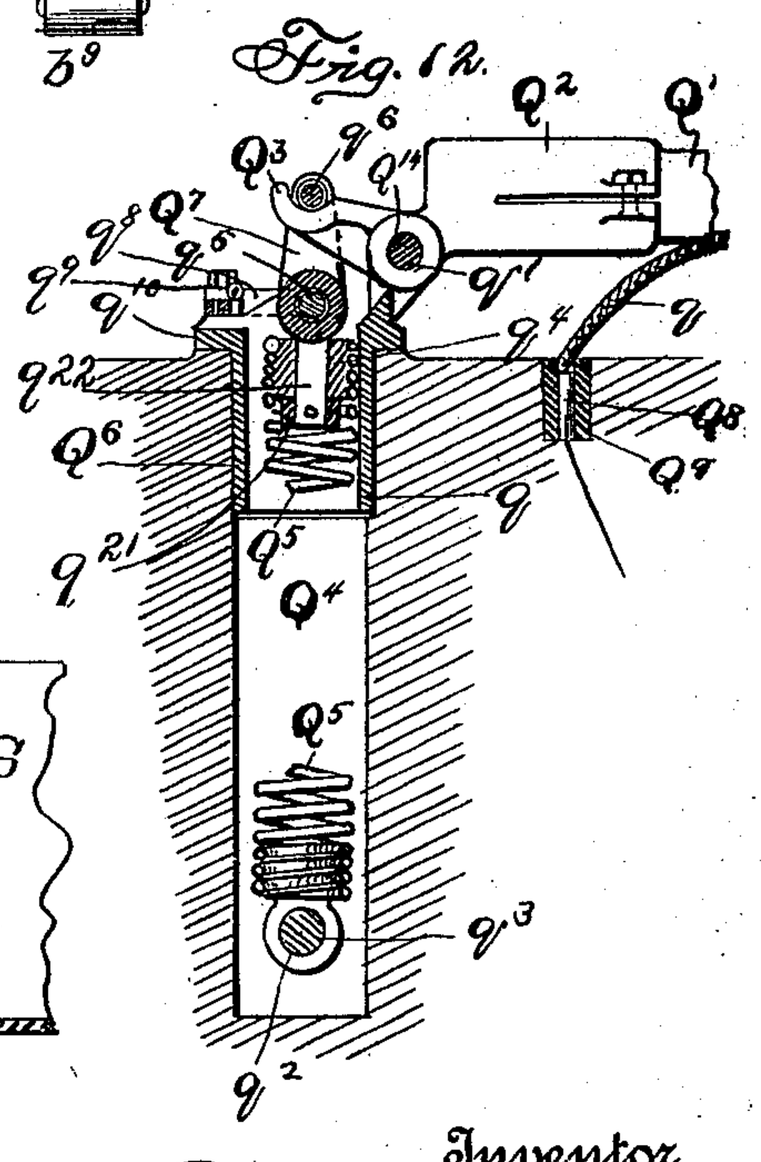
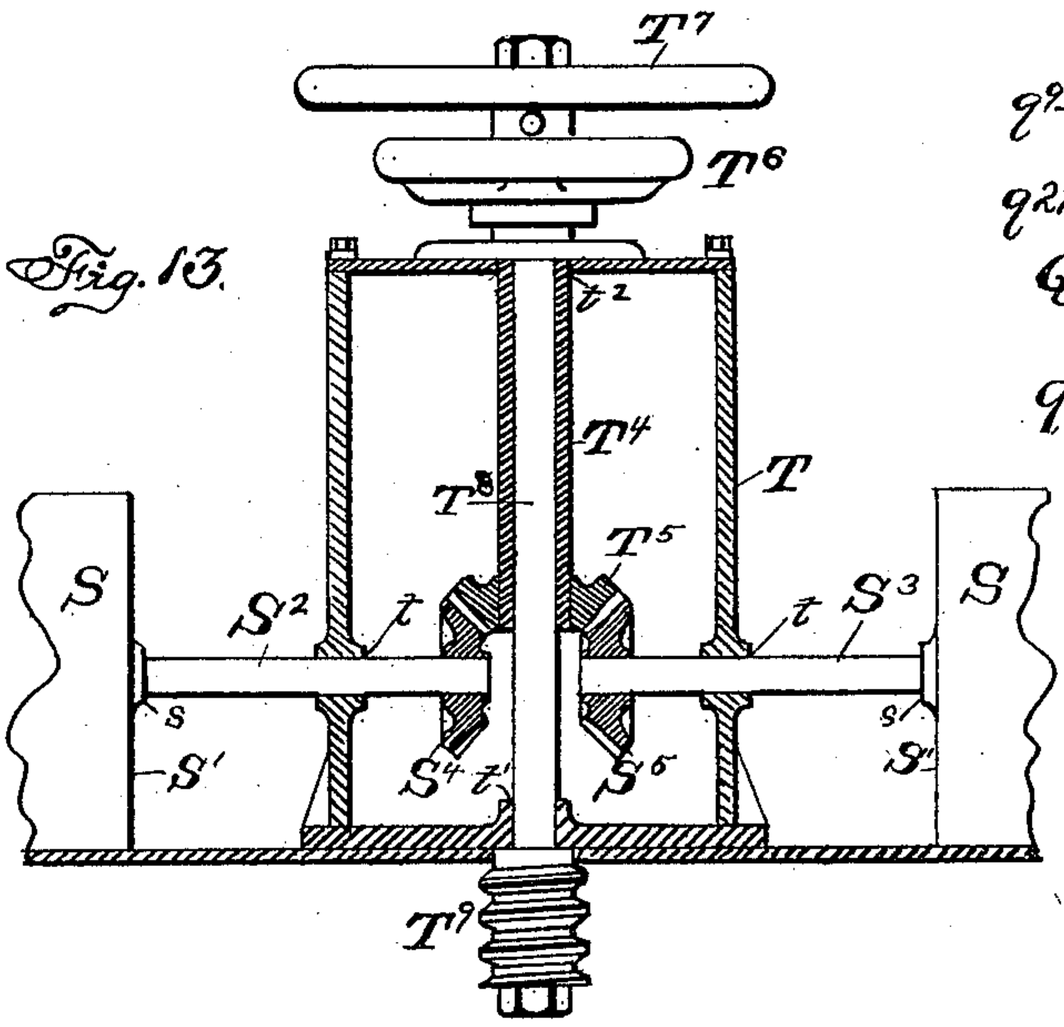


Fig. 13.



Witnesses
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No. 684,950. Patented Oct. 22, 1901.

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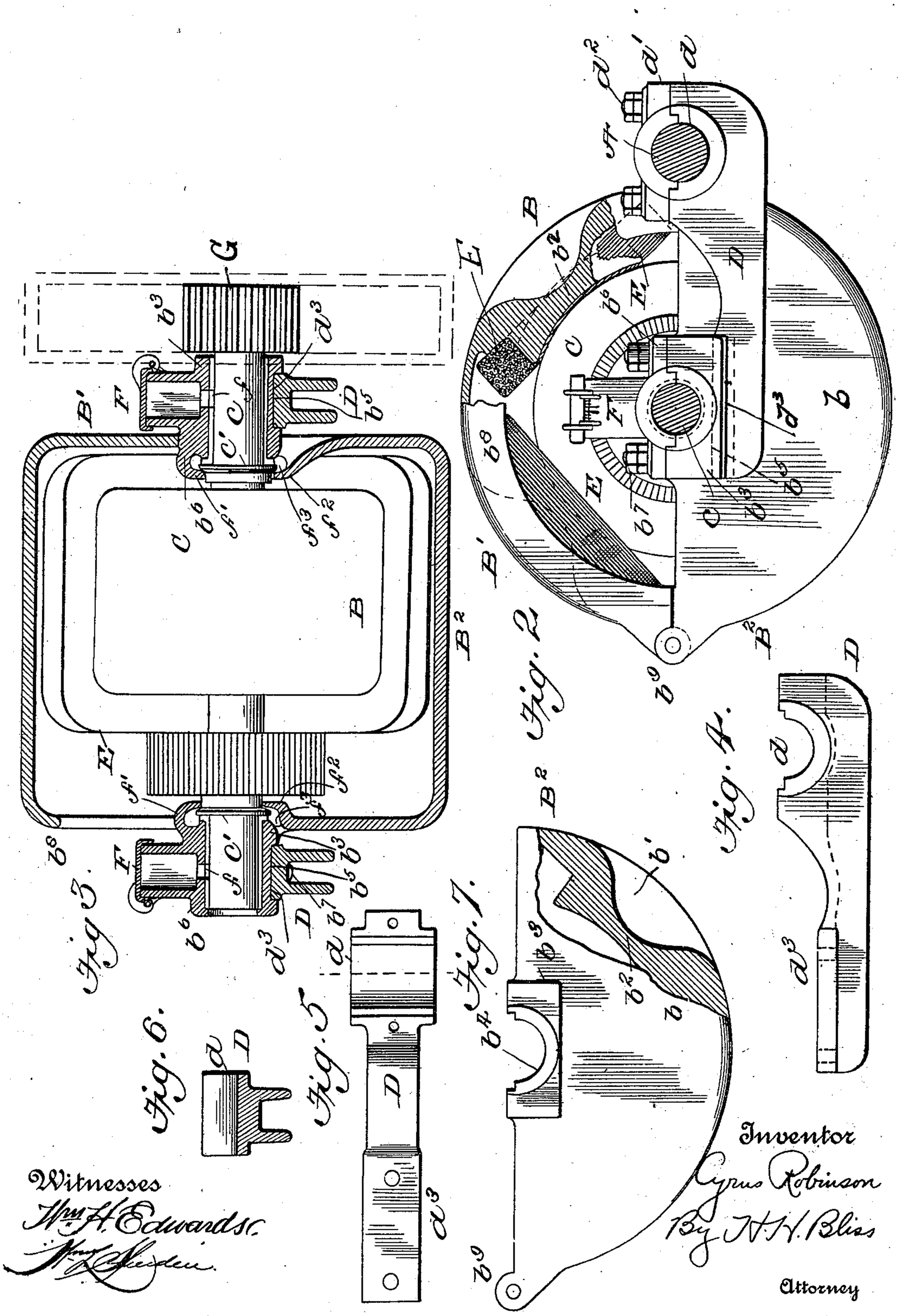
ELECTRIC MINE LOCOMOTIVE.

(Application filed Sept. 14, 1895.)

(No Model.) 5 Sheets—Sheet 2.



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(No Model.) 5 Sheets—Sheet 3.

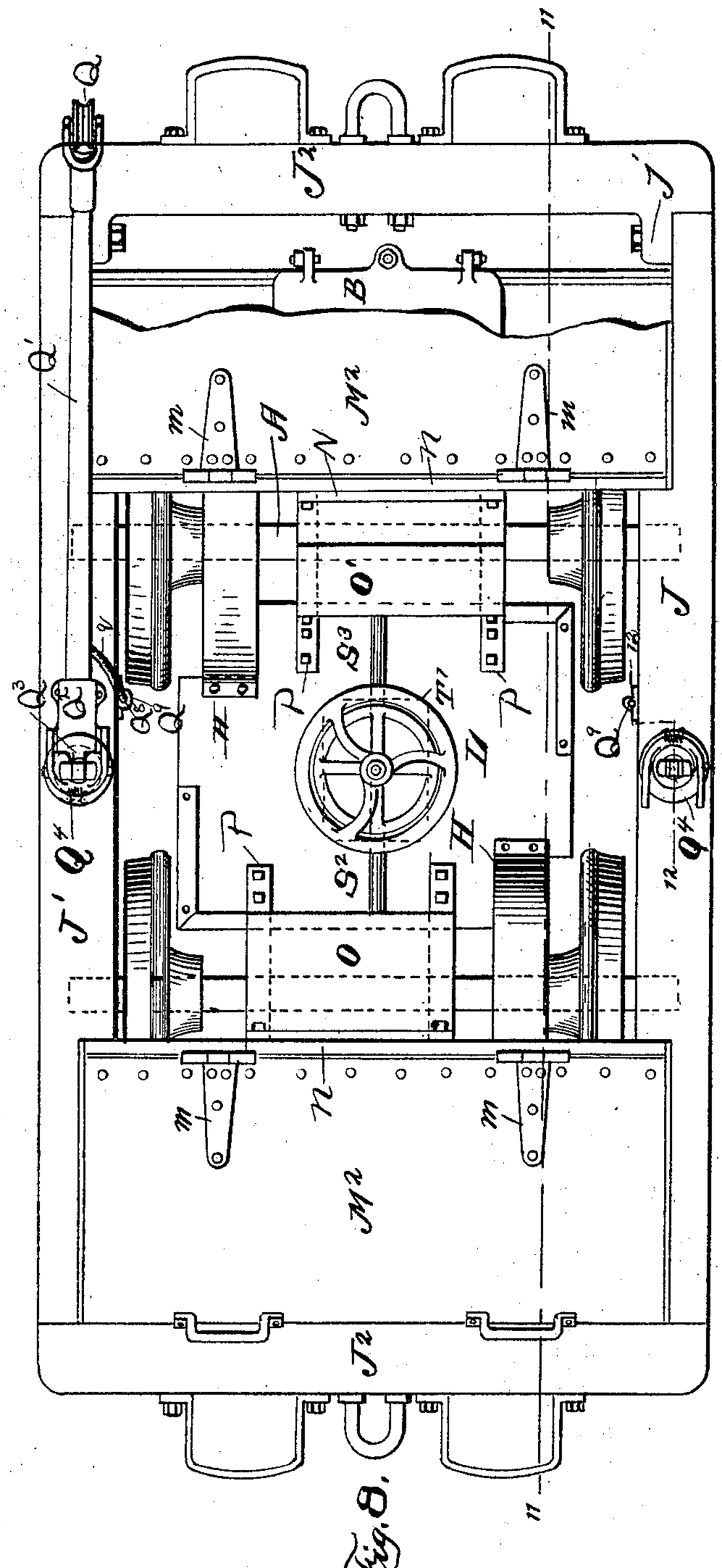

Fig. 8.

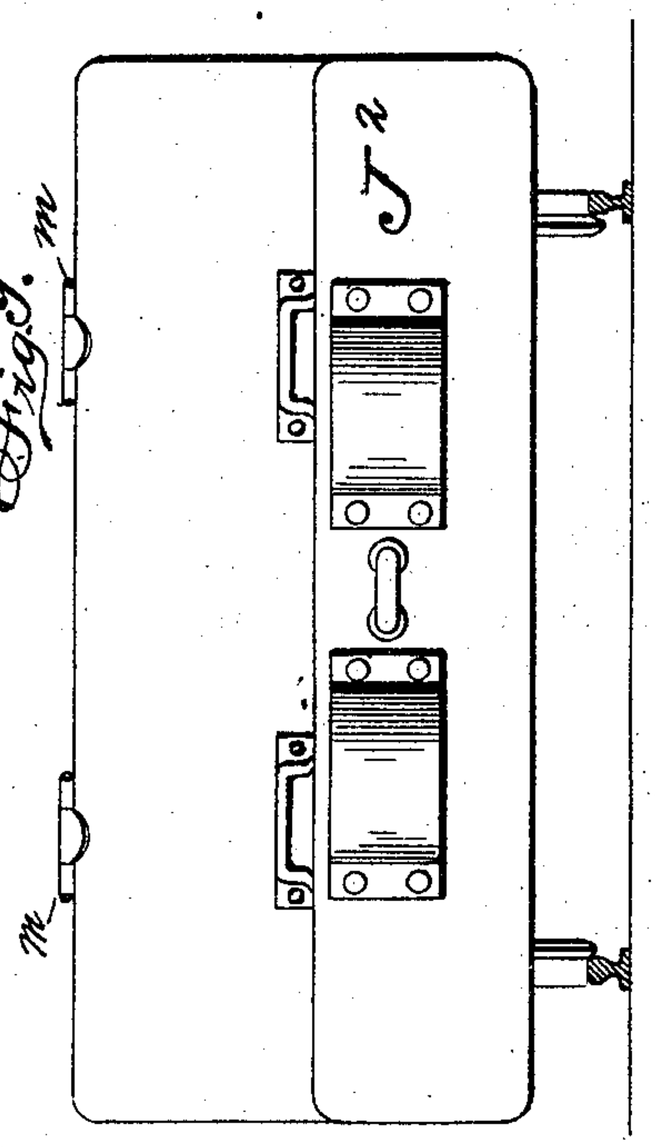

Fig. 9.

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(No Model.) 5 Sheets—Sheet 4.

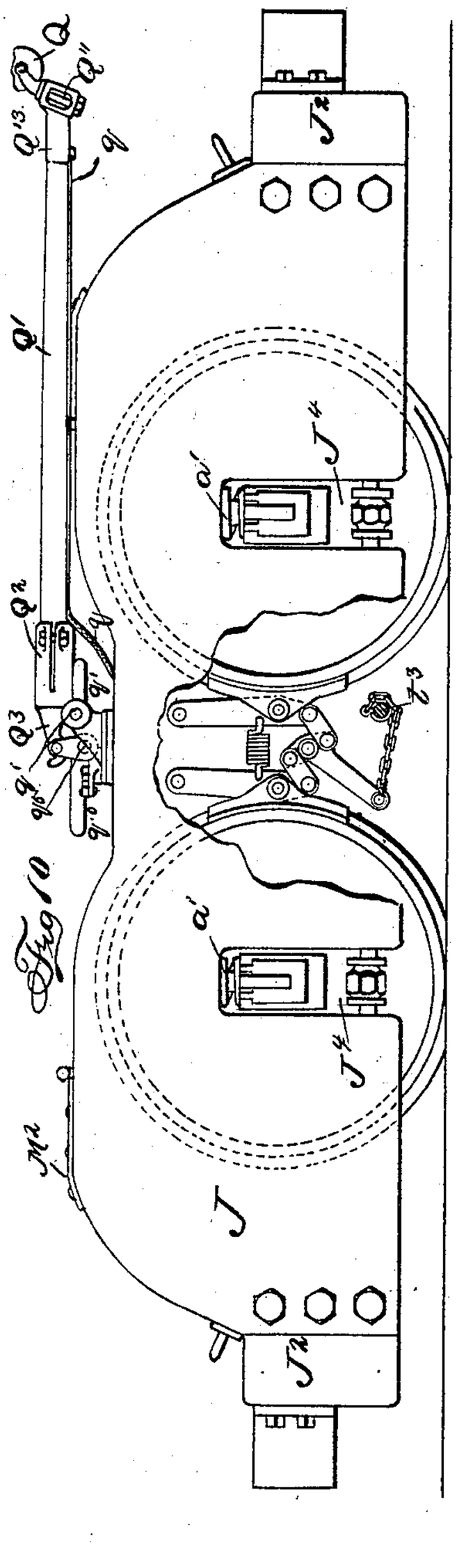

Fig. 10.

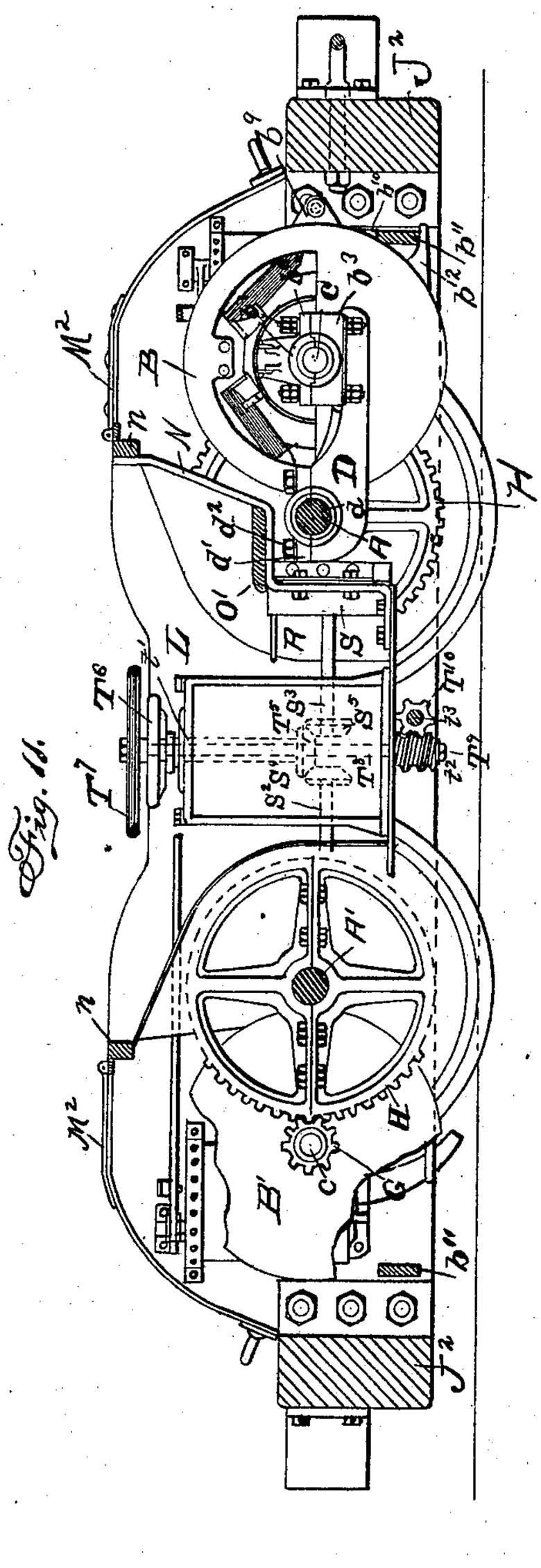

Fig. 11.

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(No Model.) 5 Sheets—Sheet 5.

Fig. 17.

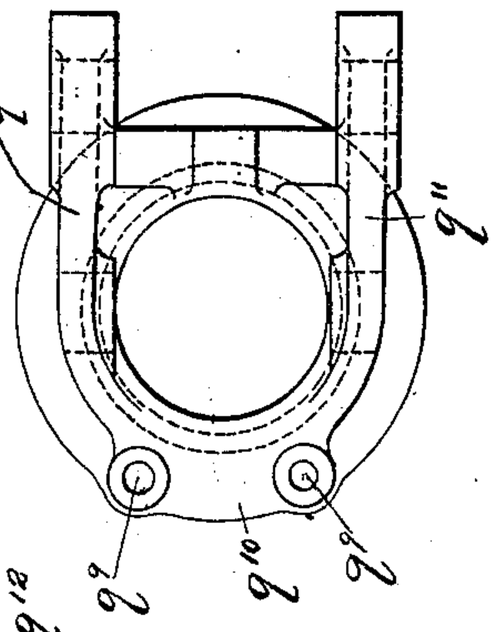


Fig. 23.

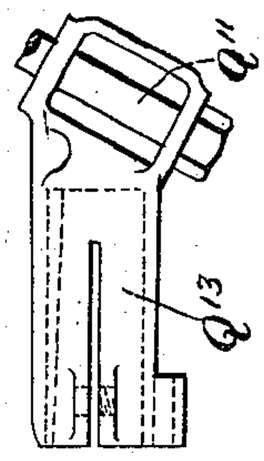


Fig. 24.

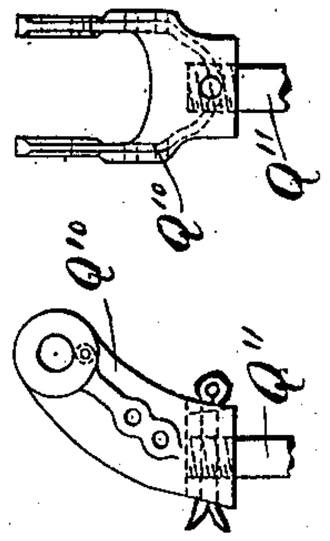


Fig. 16.

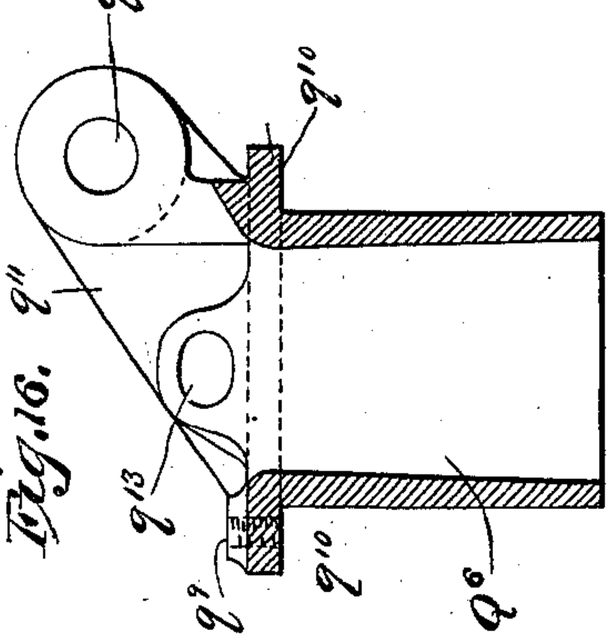


Fig. 20.

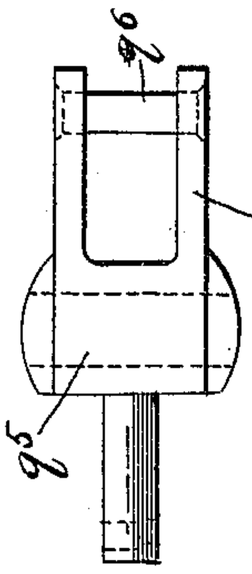


Fig. 21.

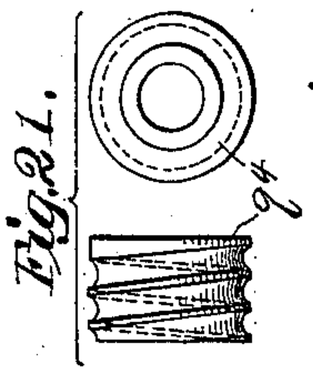


Fig. 22.

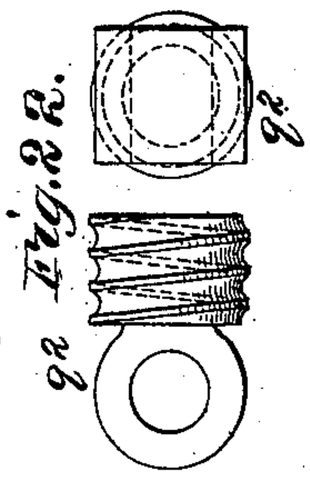


Fig. 14.

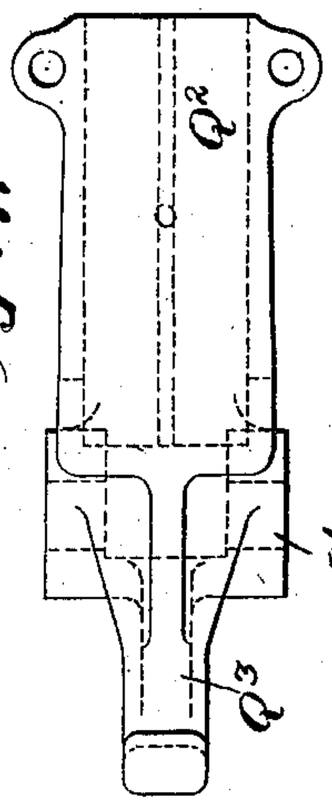


Fig. 15.

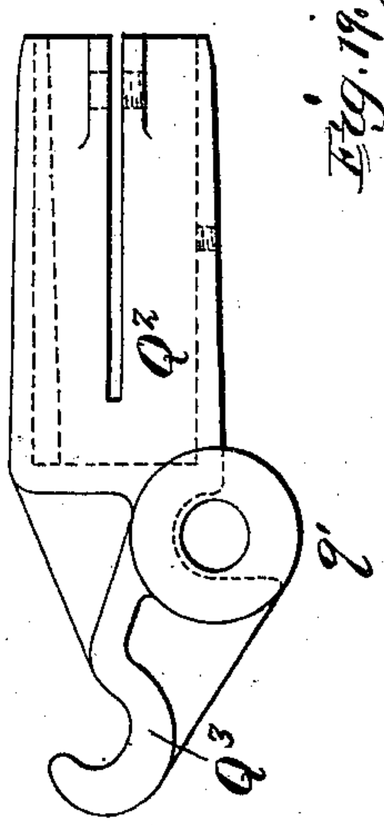


Fig. 19.

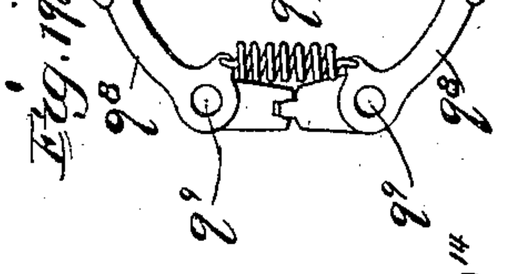


Fig. 19a.

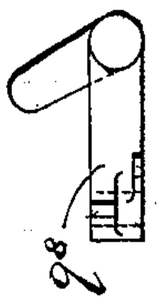
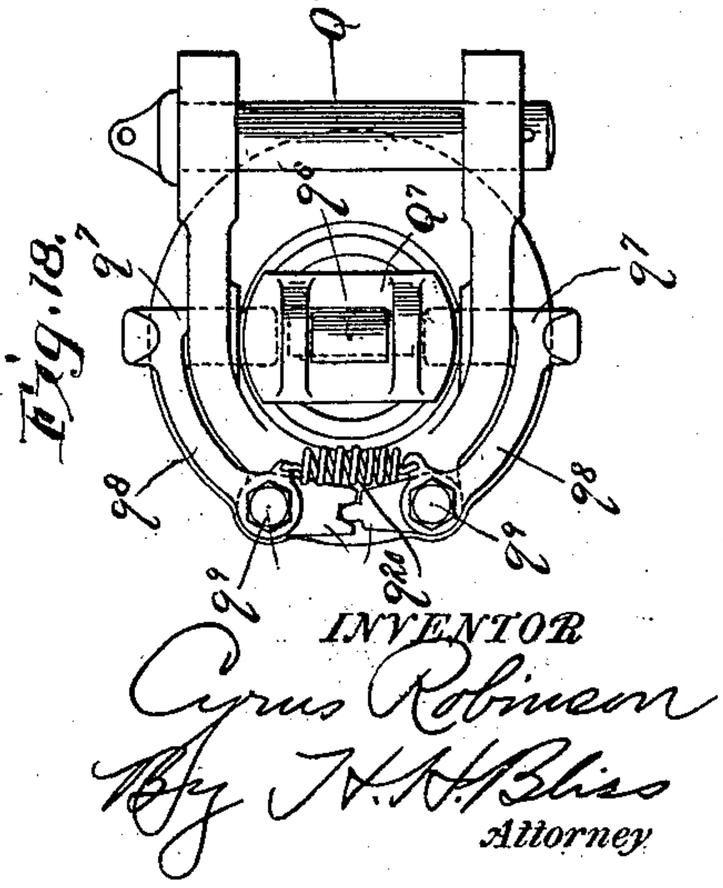


Fig. 18.



WITNESSES

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ELECTRIC MINE-LOCOMOTIVE.

SPECIFICATION forming part of Letters Patent No. 684,950, dated October 22, 1901.

Application filed September 14, 1895. Serial No. 562,496. (No model.)

To all whom it may concern:

Be it known that I, CYRUS ROBINSON, a subject of the Queen of Great Britain, residing at Columbus, in the county of Franklin and State of Ohio, have invented certain new and useful Improvements in Electric Mine-Locomotives; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

Figure 1 is a plan view showing a car-axle having a motor secured thereto in such way as to illustrate the manner of carrying out one part of my invention. Fig. 2 is a sectional view on the line *x x* of Fig. 1. Fig. 3 is a section on the line *y y* of Fig. 1. Fig. 4 is a side view, Fig. 5 a plan view, and Fig. 6 a cross-section, of one of the motor-supporting arms. Fig. 7 is an end view of the lower half of the motor-field frame or box. Fig. 8 is a plan view of a car or locomotive having my improved motor applied thereto. Fig. 9 is an end elevation of the same. Fig. 10 is a side elevation, partly broken away. Fig. 11 is a section on the line 11 11 of Fig. 8. Fig. 12 is a section on the line 12 12 of Fig. 8. Fig. 13 is a detail view, on an enlarged scale, of the means for controlling the motors. Fig. 14 is a plan view, on an enlarged scale, of the socket-piece at the lower end of the trolley-staff. Fig. 15 is a side elevation of the same. Fig. 16 is a sectional view of the horizontal rotatable support for the trolley. Fig. 17 is a plan view of the same. Fig. 18 is a plan view of said support and parts connected directly therewith, the trolley-staff being detached. Fig. 19 is a plan view, and Fig. 19ª an edge or end view, of the pivoted locking-pins. Figs. 20 and 21 are detail views of the connecting devices at the upper end of the tension-spring. Fig. 22 illustrates the connection at the lower end of said spring. Fig. 23 is a side elevation of the socket-piece at the outer end of the trolley-staff. Fig. 24 illustrates the support for the trolley-wheel carried by the last said socket-piece.

Referring to the drawings, it being understood that some of the matters which more particularly characterize the present invention are applicable to any of the numerous forms of cars now known and adapted to have electric motors applied thereto for the purpose of propulsion, A indicates the axle of a car.

One of the objects of the invention is to provide a motor and a support therefor which shall comprise fewer parts, and therefore be simpler and cheaper in construction than those heretofore made, and which can be more easily cleaned and kept in repair than those of the makes with which I am acquainted.

It has been customary to provide a more or less complex framework or supporting device for suspending the motors from the axles. In the present construction the motor is indicated as a whole by B. It comprises the upper part B′ and the lower part B^2 of the field frame or box, and the armature C, having the shaft *c*. In some of the earlier constructions the armature was mounted directly upon the field-magnet frame, the latter being in turn mounted upon the axle or upon an interposed framework. In others the armature-shaft was mounted upon the interposed supporting-frame and the field-magnet frame was more or less supported upon the shaft. In the construction herein shown the armature and the field parts are supported practically independently of each other, although held at a common place upon the frame connected to the axle.

D D indicate arms, one for one end and the other for the other end of the motor. Each has a bearing at *d*, adapted to rest against the under side of the axle and to be held to it by means of a strap *d′*, secured by bolts at d^2. At the front end each arm D is provided with a rest of the form of a horizontal plate d^3.

The motor box or frame has the lower portion B^2 cast with the semicircular ends *b* and the intermediate wall *b′* approximating a semicylinder, the latter having radially-arranged inwardly-projecting extensions b^2 to serve as cores for the magnet-coils E. It is also formed with laterally-extending enlargements or thick projecting masses of metal, as at b^3, so that they can be snugly fitted to the aforesaid plates or rests d^3 on the supporting-

arms D. The armature-shaft is seated in the cavities at b^4 and is held therein by the caps b^6, there being bolts b^7, which pass through the caps, the enlargements b^3, and the rests or plates d^3. When the parts are arranged in this way, it will be seen that the armature and the field parts are held in the desired relations to each other, and yet are supported practically independently on the frame-bars which project from the axle. It will also be seen that the motor is held rigidly in position upon the bars D—that is to say, that the field frame or box is prevented from moving in any direction with relation to these bars—and that these several ends are accomplished by two pieces of metal supplemental to the two bolts and the cap-piece. The motor can be held approximately in the desired position as to the axle in any suitable way. In the embodiment of my invention herein illustrated I have shown that the lower part B^2 of the field-casing can be cast or otherwise provided with a forwardly-projecting arm or lug b^{10}, adapted to be supported on a cross-bar b^{11}, carried by the car-frame, with or without interposed springs, there being a similar lug or projection b^{12} extending out from the motor-casing below said cross-bar in the main frame.

The upper part B′ of the field frame or box has a semicircular wall b at one end, a semi-annular wall b^8 at the other, and an intervening substantially semicylindrical wall b', similar to that of the lower half B^2. By leaving partially open the end wall adjacent to the wall b^8 access can be conveniently had to the brushes, the commutator, and other interior parts. It will be understood, however, that in practice I shall use a jacket or shield for the purpose of inclosing and protecting the entire motor, or more or less thereof, as may be required. The upper and the lower parts B′ B^2 are cast with counterpart ears b^9 for receiving hinge devices, whereby the upper half can be turned upward relative to the lower for the purpose of exposing the armature or permitting its removal. The caps b^6 are cast with lubricant-boxes F, which by ports f communicate with the journal-chambers. The armature-shaft has flanges c' at the inner ends of the journal parts, which serve to prevent the lubricant from passing in along the shaft to the commutator or armature. The caps are also cast with curved flanges f', which have chambers that receive the flanges c' on the upper side of the armature-shaft. Below the lower side there are inwardly-turned flanges f^2, cast on the above-described lower half B^2 of the field box or frame. At f^3 there are apertures or passages extending from the chambers formed by the flanges f' f^2 and through which the surplus lubricant escapes to the outside of the field-piece B^2. The motor is geared directly to the axle, G being a pinion on the motor-shaft and H the gear-wheel on the axle, which meshes therewith, the present construction being in this respect one of the class which dispenses with shafting and gearing placed intermediately between the motor and the axle.

I have shown my improved motor as being applied to a car or locomotive of the sort used in mine-haulage. For this purpose cars of a peculiar conformation and dimension are found necessary. They must be of small dimensions and must have all their parts placed compactly in the smallest space possible, and yet there must be sufficient weight to provide the necessary traction. I attain these ends by constructing and arranging the parts as follows: A′ indicates the second axle, and B′ indicates the second motor, substantially similar to that above described.

In mine-cars the axles A A′ must be comparatively close together, so that it is impossible to conveniently arrange the motors B B′ between the two axles. I utilize the space between the axles for the support of the motorman and arrange the motors so that they are respectively outside of their axles, as is shown. There is a comparatively large depression or chamber L, wherein can be placed the motorman's seat and also the device by means of which he controls the motors and the car.

The frame of the locomotive is formed with side bars or plates J J′ and end bars J^2. The side pieces J J′ extend continuously from end to end, and said side pieces are swelled or expanded, so as to provide a shield or cover for the outside of the wheels and also furnish mass of traction metal which shall be properly disposed with respect to the dimensions of the machine. The end pieces J^3 have ears j, by means of which they are bolted to the side parts J J′.

Slots or passage-ways J^4 are formed in the side pieces to receive the axle-boxes and the mounting-springs a', if used. The box or compartment L is formed of sheets of metal N, having their upper edges secured to cross-bars n and curved, as shown, and carried down to a line as near the bottom of the wheels as possible. At O O′ seats are placed, these and the sheet-metal shields or walls being supported by a frame P, which is secured and suspended from the main frame of the car. At M^2 there are doors or covers hinged at m to the cross-bars n. They serve to tightly inclose the motors and their chambers, but can be lifted whenever it is desired to get access to the motor. These doors are hinged so as to swing oppositely to the upper halves B′ of the motors.

In the embodiment of my invention here illustrated the doors M^2 extend continuously from the said cross-bars n to the end bars J^2 of the main or body frame of the locomotive. Thus it will be seen that the motors, the axles, the track-wheels, and all of the driving-gearing are covered and protected from dust, moisture, &c. The current is conveyed from the conductor-main through a trolley-wheel Q, and a conductor-section q, supported by a rod Q′, which carries the trolley-wheel and

which is flexibly connected to the car-body, as follows: The rod Q′ is at its lower end clamped in a socket Q^2, which at the rear end has a hook Q^3, and is also formed or provided with perforated or tubular trunnions q'. There are sockets or cavities Q^4, one in each side wall J J′, preferably formed at the time said walls are cast. In each cavity is placed a spring Q^5, which at the lower end is provided with an eye q^2, secured in place by a bolt or pin q^3. At the upper end of each cavity there is a tube Q^6, extending partly into and having a flange q^{10}, which rests on the top of the wall of said cavity. The tubular part Q^6 above the said flange q^{10} is provided with parallel upwardly-extending inclined ears or flanges q^{11}, in which are formed near the outer ends passages or apertures q^{12}, which when the parts are assembled aline with the passages in the trunnions q' on the socket-piece Q^2. The said socket-piece Q^2 and the tubular member Q^6 are adapted to be connected by a pin Q^{14}. In the upwardly-projecting side flanges q^{11}, referred to, near the lower ends thereof, are formed apertures q^{13} for a purpose hereinafter explained. The upper end of the spring is secured to the holder q^4, and in this holder there is swiveled a stirrup Q^7, which has a bottom cross-bar at q^5 and a top cross pin or bar at q^6. The stirrup Q^7 is prevented from moving vertically through the holder q^4 by means of the cross-bar q^5, which rests on the top of said holder, and by means of a stop-block q^{21}, secured to the lower end of the stirrup-stem q^{22}, that extends down from the aforesaid bottom cross-bar q^5. The socket-piece Q^2 of the trolley-rod can be detachably engaged with the stirrup by means of its hook Q^3 engaging with the top pin q^6. The stirrup is detachably locked in position by means of the two pins q^7, adapted to extend through the aforesaid apertures or passages q^{13} and to enter sockets in the lower cross-bar q^5 of said stirrup. The said locking-pins are carried by swinging arms q^8, which are pivoted to the top flange q^{10} of the member Q^6 at q^9. A spring q^{20} tends to draw the pins inward and they can be opened or thrown out whenever desired. When the hook Q^3 of the socket-piece Q^2 at the lower end of the trolley-staff is engaged with the top cross-bar q^6 of the swiveled stirrup, the locking-pins q^7 are withdrawn from engagement with said stirrup and the tension of the spring Q^5 acts to hold the trolley-staff in the desired inclined position to cause the trolley-wheel to contact with the overhead conductor, the said cross-bar q^5 being held below the apertures q^{13}; but when it is desired to detach the trolley-staff from the stirrup Q^7 the outer end of said staff is lowered or pulled down until the cross-bar q^5 of the stirrup Q^7 comes into planes of the apertures q^{13}, when the spring q^{20} acts to instantly force the free ends of the pins q^7 inward into the sockets in the ends of said cross-bar. After this the hook Q^3 is easily detached from the top cross-bar q^6 of the swiveled stirrup, the strain of the spring Q^5 being taken entirely by the said pin q^7. The section q of the conductor terminates in a detachable contact Q^8, which is connected at Q^9 to the terminals of the motor-circuit.

It will be seen that the trolley and its rod can be instantly detached from either side of the car by removing the hook Q^3 from the cross-bar q^6 and separating the parts at Q^8 and Q^9 and then readily applied to the other side of the car. As the stirrup is swiveled in the upper end of the spring and as the tube Q^6 can rotate freely in the socket Q^4, the trolley-rod can turn in either direction, as desired, and hence there is not only freedom in vertical vibration, but also in horizontal oscillation. The trolley-wheel is carried in a fork Q^{10}, having a pivoted rod Q^{11}, which permits it to oscillate freely with respect to the trolley-rod. This rod Q^{11} is preferably mounted in bearings formed in a socket-piece Q^{13}, fitted to the outer upper end of the trolley-staff.

Between the terminals of the trolley and the motors are interposed resistance and a controller. Beneath each of the seats there is a rheostat, the two being connected together. The rotary arm or switch of each resistance-box and its opposing terminals are contained within a resistance-box S. The details of the rheostat and of its contact-arm and terminals may be of any proper sort. Each box S is formed with a bearing at s in its front wall S′.

S^2 S^3 are shafts, each having one of its ends mounted in a bearing at s and the other in a bearing at t.

S^4 S^5 are beveled pinions on the ends of the shafts S^2 S^3. The bearings t t are at or near the lower end of the standard T. This standard forms a vertical passage-way, with bearings at t' and t^2. In the latter there is mounted a vertical tubular shaft T^4, to the lower end of which is secured the bevel T^5, which meshes with the wheels S^4 and S^5.

T^6 is a hand-wheel secured to the hollow shaft T^4.

The standard T is in the center of the chamber or compartment L for the motorman, and he can have convenient access to the controlling-wheel T^6 in whichever direction the car is moving. He has control of the brakes which engage with the wheels for stopping the car, their mechanism being mounted on the same vertical axis as the parts just described.

T^7 is a hand-wheel secured to the shaft T^8, the latter passing downward through the tube T^4 and having at its lower end a worm T^9. This engages with a worm-wheel T^{10} on the cross-shaft t^3. This shaft is connected with the brake-shoes, the latter, their supports, and attachments being of any preferred sort.

From the above description and the drawings it will be seen that with such a construction as that herein the motorman has within easy reach all of the devices for controlling

the movements of the locomotive. The trolley-supports are arranged on opposite sides of the car in line with the central depressed compartment, so that the motorman is enabled without leaving said compartment to readily shift the trolley from one side of the locomotive to the other to reverse the direction of travel.

I am aware of the fact, as above recited, that numerous forms of motor and motor mounting have been constructed or suggested for the purpose that the present one is intended for; but I believe myself to be the first to have devised parts constructed and related in the way shown for the attaining of the utmost economy in manufacture and simplicity and durability in structure. Thus it has been proposed to support a motor within and by a heavy quadrangular-shaped frame having one side bar extending along the axle and the opposite side bar extending along and connected with a transverse frame-bar on the car. In the construction referred to the field-pieces were hinged together and the armature was held in bearings formed in the lower edges of the sides of the upper field-piece; but such a construction is objectionable and not adapted for the purposes of my improvements, because of the relatively great amount of space required for the supporting-frame and because of the fact that the armature can only be removed for the purpose of examination or repair by first bringing the motor into position over a pit and allowing the lower field-piece to swing down, after which the armature can be lowered out of its bearings in the top field-piece.

As hereinbefore pointed out and as illustrated in the drawings, my improvements are particularly adapted and designed for use in mine-locomotives. In such mechanisms, which from the nature of their employment are subject to rough usage and require frequent access to and removal of parts, it is important that the parts be reduced in number and be compactly arranged. With my construction it will be seen that the two arms D are independent of each other and occupy but a limited amount of room. Again, the parts are so arranged that the upper field can be swung backward to expose the armature at any time without affecting any of the supports or other parts. I am also aware that it has been proposed to form the lower field-piece of a motor with integral bearings adapted to receive the axle of a car; but my present improvements are clearly distinguishable from constructions of that style. The supports D in my construction are independent of the motor, thus reducing the weight of the latter and permitting the same to be entirely removed, if desired, without destroying the connection with the axle of the supporting devices. It will also be seen that with my construction all of the parts of the mechanism are readily controlled by a single operator seated within the central compartment L and that the axles being relatively close together and the height of all parts reduced to a minimum I provide a compact apparatus specially adapted for mine haulage.

What I claim is—

1. The combination with the car-axle, of the independent arms D D secured to the axle, the electric motor having the field formed with the lower casting B^2 provided with the laterally-extending enlargements fitted to the forward ends of the said arms D, the armature having its shaft mounted in the said enlargements, and the cap-bolts binding together the parts B^2 and D, substantially as set forth.

2. The combination with the axle, of the two independent arms D D connected to the axle, said arms being formed with the rests or plates d^3, the motor having the field-box or frame formed in an upper and a lower half, the lower half having an enlargement b^3 bolted to the forward ends of the said arms D, the armature mounted in cavities in the said enlargements, and the caps having bolts which bind together all the said parts, substantially as set forth.

3. The combination with the axle, of the motor disconnected from the axle and having its field-magnet formed in two semicylindrical parts hinged together on the front side, the two supporting-arms D D independent of each other secured to the axle and having the lower part of the field-magnet secured to their front ends, and the armature-shaft mounted directly over said front ends, substantially as set forth.

4. A mine-locomotive having in combination the axles A A′ relatively close together, the motors B B′ hinged to the axles, and placed respectively on the outside thereof, the depending support for the motorman arranged in a substantially centrally arranged compartment between and extending below the axles to a line near the bottom of the wheels, the current-controlling mechanism in the said central compartment, and car-braking mechanism in said compartment, said mechanism being substantially in the horizontal planes of the axle, substantially as set forth.

5. In an electric locomotive for mine-cars, the combination of the axles A A′ relatively close together, the frame supported thereon and formed with the side walls J J′ which are duplicates of each other, and each having duplicate end parts extending continuously from end to end and from a line below the axles and near the bottom of the car-wheels to lines above the same, the central depressed chamber or compartment, and the current-controlling device and car-braking mechanism both in the said compartment and both mounted on the same vertical axis, whereby room is economized between the axles, substantially as set forth.

6. The herein-described trolley-support for a locomotive having in combination the spring

permanently connected to the car, the rotary support, the loosely-mounted holder in said support, the trolley-rod detachably pivoted to the said holder, and means for locking the holder, substantially as set forth.

7. In a trolley-support, the combination of a tube mounted to rotate in a socket or tubular support, a trolley-staff hinged to said tube, a spring, means for locking the spring under tension, and a connecting device detachably joining the spring to the trolley-staff, substantially as set forth.

8. The combination with a trolley-staff, of the rotary tubular base detachably connected to the staff, the stationary or fixed spring, and a rotary connection between said spring and the staff, substantially as set forth.

9. The combination with a trolley-staff, of a rotary, tubular, base detachably connected to the staff, a spring arranged at the axis of said base, means for detachably connecting the staff with said spring, and means for holding the spring under tension when detached from the staff, substantially as set forth.

10. The combination with a trolley-staff, of a rotary base, a clamp on the staff adapted to be detachably connected with said rotary base, a spring, and a connection device adapted to engage with said clamp on the staff and having a swiveling connection with said spring, substantially as set forth.

11. The combination with a trolley-staff, of a rotary tubular base for said staff, a tension-spring arranged at the axis of said base, means for detachably connecting the staff with said spring, and one or more laterally-movable, spring-pressed, pins adapted to hold said spring under tension when disengaged from said staff, substantially as set forth.

12. The combination with a trolley-staff, of a rotary base, a tension-spring, a clamp or socket-piece fitted to the trolley-staff and having a hook adapted to be detachably connected with the tension-spring, detachable means for pivotally connecting said socket-piece to the rotary base, and means for holding the spring under tension when disengaged from said hook, substantially as set forth.

13. The combination with a trolley-staff, and a tension-spring held stationary, of a rotary base or support, and a connecting device hinged to the rotary base and adapted to be connected with both the staff and the tension-spring, substantially as set forth.

14. The combination of a trolley-staff, a tension-spring, a connecting device rotatably connected with the said spring and adapted to be engaged with the staff, and means for engaging said connecting device, when the latter is disengaged from the staff, to hold the spring under tension, substantially as set forth.

15. In a trolley, the combination of a support or base, a staff having at its lower end an attachment having a transverse extending passage formed therein, a detachable pin adapted to extend through said passage in the attachment on the staff and engage with said support or base, whereby the base and staff will be detachably hinged together, a tension-spring, and means for detachably connecting said spring with the lower end of the staff, substantially as set forth.

16. In a trolley the combination of a base-piece or support, a trolley-staff, an attachment for the lower end of the staff, having a transverse passage at an intermediate point of its length, a detachable hinge-pin adapted to extend through said transverse passage in said attachment and to engage with said base or support, a tension-spring, and means for detachably connecting said spring with the free end of the attachment on the staff, substantially as set forth.

17. In a trolley the combination of a base or support having upwardly-projecting ears or flanges, q^{11}, a staff, a removable pin for detachably hinging the staff to said ears or flanges on the base, a tension-spring, and devices adapted to detachably connect the spring with the lower end of the staff, substantially as set forth.

18. In an electric locomotive for mine-cars, the combination of the track-wheels, the axles for said wheels, the motors, gearing connecting the motors and axles, a frame supporting the aforesaid parts and having the relatively large side pieces extending from a point near the bottom of the track-wheels to points above said wheels and the motors, a support for the motorman arranged below the horizontal plane of the axles, motor-controlling devices within reach of the motorman when on said depressed support, trolley-supports mounted on opposite sides of said depressed support for the motorman, and a trolley adapted to be detachably connected with either of said supports, substantially as set forth.

19. In an electric locomotive for mine-cars, the combination of the track-wheels, the axles for said wheels, the motors, gearing connecting the motors and axles, a frame supporting the aforesaid parts and having the side pieces extending from a line near the bottom of the track-wheels to points above said wheels and the motors, and having sockets formed in their upper edges, trolley-supports at the upper end of said sockets, a trolley-staff adapted to be detachably engaged with either of said supports, a depressed support for a motorman arranged between said sides of the frame, and motor-controlling devices arranged adjacent to said support, substantially as set forth.

20. In an electric locomotive for mine-cars, the combination of the track-wheels, the axles for said wheels, a motor for driving said wheels, a supporting-frame for the aforesaid parts extending to a line near the bottom of the track-wheels, a casing covering said parts and having a portion removable to permit inspection of the interior driving devices, a support for the motorman extending to points below the horizontal plane of the axles, and motor-controlling devices arranged adjacent

to said depressed support, substantially as set forth.

21. In an electric locomotive for mine-cars, the combination of the track-wheels, the axles for said wheels, the motors extending in opposite directions from and geared to the axles, the supporting-frame for the aforesaid parts extending downward to a line near the bottom of the track-wheels, a casing covering said motors, axles and wheels and forming a centrally-arranged compartment for a motorman between the axles and the motors, motor-controlling devices supported within said compartment, trolley-supports arranged on opposite sides of said central compartment, a stationary spring arranged adjacent to each of said supports, and a trolley adapted to be detachably engaged with either of said supports and its adjacent spring, substantially as set forth.

22. In an electric locomotive for mine-cars, the combination of the track-wheels, the axles for said wheels, the motors, one geared to each of the axles, extending toward opposite ends of the locomotive, and each having its lower field portion held stationary and its upper field hinged to said lower field, a frame for supporting all of the said parts and extending down to a line near the bottom of the track-wheels, the sides of said frame extending to points above said wheels and the motors, and having trolley-supports thereon, a trolley adapted to be detachably engaged with either of said supports, and a casing covering the motors, axles and track-wheels, and having removable sections above the motors whereby the upper field-pieces can be swung upwardly and outwardly to permit inspection of the armature, without removing the motor from its position, substantially as set forth.

23. In an electric locomotive for mine-cars, the combination of the axles, A, A′, arranged relatively close together, the motors supported from said axles and geared thereto, the casing surrounding said parts and forming a central depressed compartment between the motors, a vertical shaft mounted centrally within said compartment, gearing connecting said shaft with the controlling devices of both motors, a hand-wheel for operating said shaft, brake mechanism, a shaft for operating said brakes mounted in said compartment about the same axis as the aforesaid shaft, and a hand-wheel for operating the last said shaft, substantially as set forth.

24. In an electric locomotive for mine-cars, the combination of the axles, A, A′, arranged relatively close together, the motors arranged between the ends of the car-frame and the axles, gearing connecting the armatures of the motors with the axles, a casing inclosing the aforesaid parts and forming a centrally-arranged depressed chamber or compartment between the axles, said chamber being of such form as to provide a seat above each axle, a rotary trolley support or base on one side of said central chamber, a corresponding support or base on the opposite side of said chamber, and devices for controlling both motors and the brake mechanism arranged within said compartment, within reach of an operator seated on either of the seats therein, substantially as set forth.

25. In an electric locomotive for mine-cars, the combination of the axles, A, A′, the motors geared to said axles, the casing inclosing said parts and forming a centrally-arranged depressed compartment, a shaft arranged within said compartment and having a bevel-gear thereon, shafts for operating the current-controlling devices of the motors, a bevel-gear on each of said shafts meshing with the aforesaid bevel-gear, and a hand-wheel secured to the shaft carrying the last said gear, substantially as set forth.

26. In an electric locomotive for mine-cars, the combination of the axles, A, A′, the motors geared to said axles, the casing inclosing said parts, and forming a chamber or compartment between the axles, a tubular vertical shaft mounted in said compartment, gearing connecting said tubular shaft with the current-controlling devices of the motors, a hand-wheel on said tubular shaft, brakes adapted to engage the wheels of the locomotive, a vertical shaft extending through said tubular shaft and having a hand-wheel thereon, and gearing connecting said shaft with the devices for actuating the brakes, substantially as set forth.

27. The combination with a car-axle, of the independent arms, D, D, secured to the axle, and the electric motor having the field formed with the lower casting, B^2, provided with laterally-extending enlargements fitted to the said arms, D, D, and with lugs, b^{10}, b^{12}, extending on opposite sides of a bar connected to the car-frame, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

CYRUS ROBINSON.

Witnesses:
E. W. BRINKER,
CHAS. W. MILLER.