(No Model.) 2 Sheets—Sheet 1.

R. A. WILDER.

ELECTRIC APPARATUS FOR USE ON RAILWAY TRAINS.

No. 464,090. Patented Dec. 1, 1891.

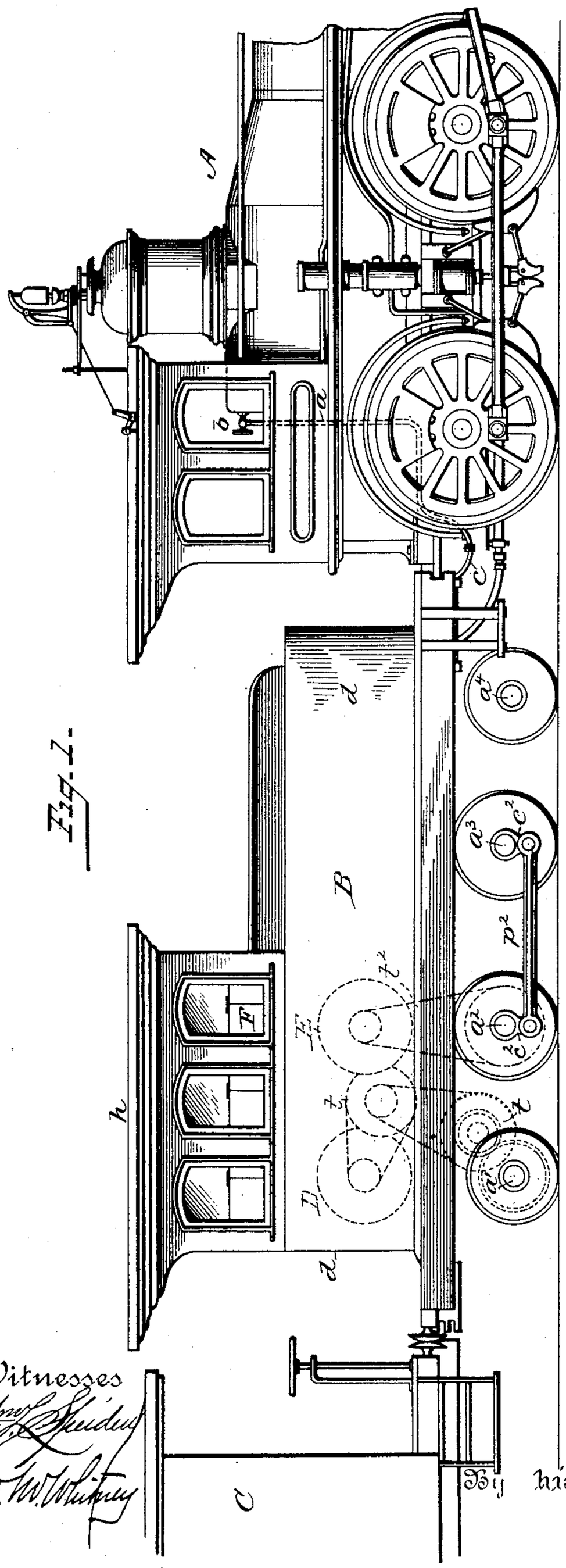

Fig. 1.

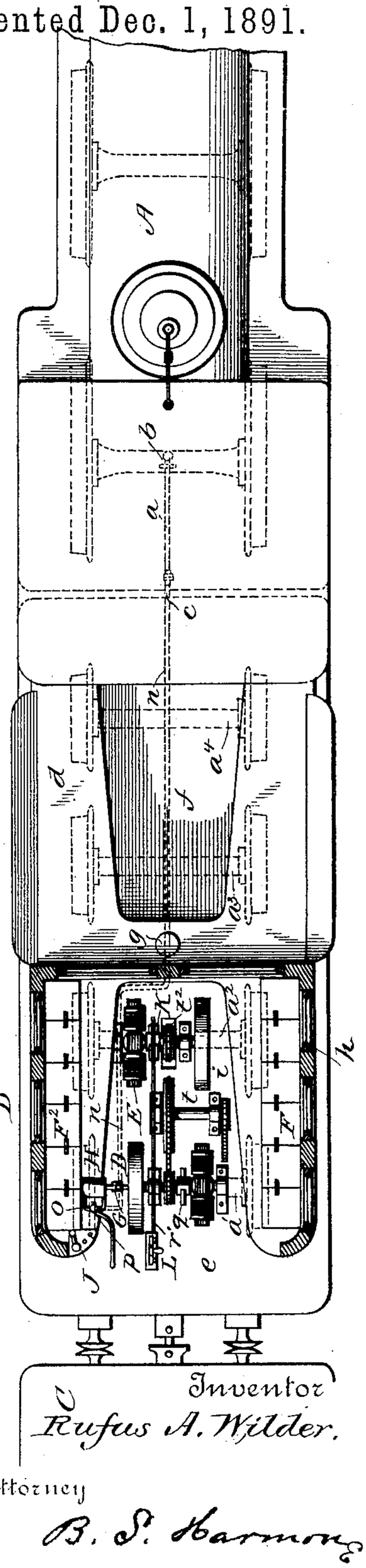

Fig. 2.

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Fig. 5.

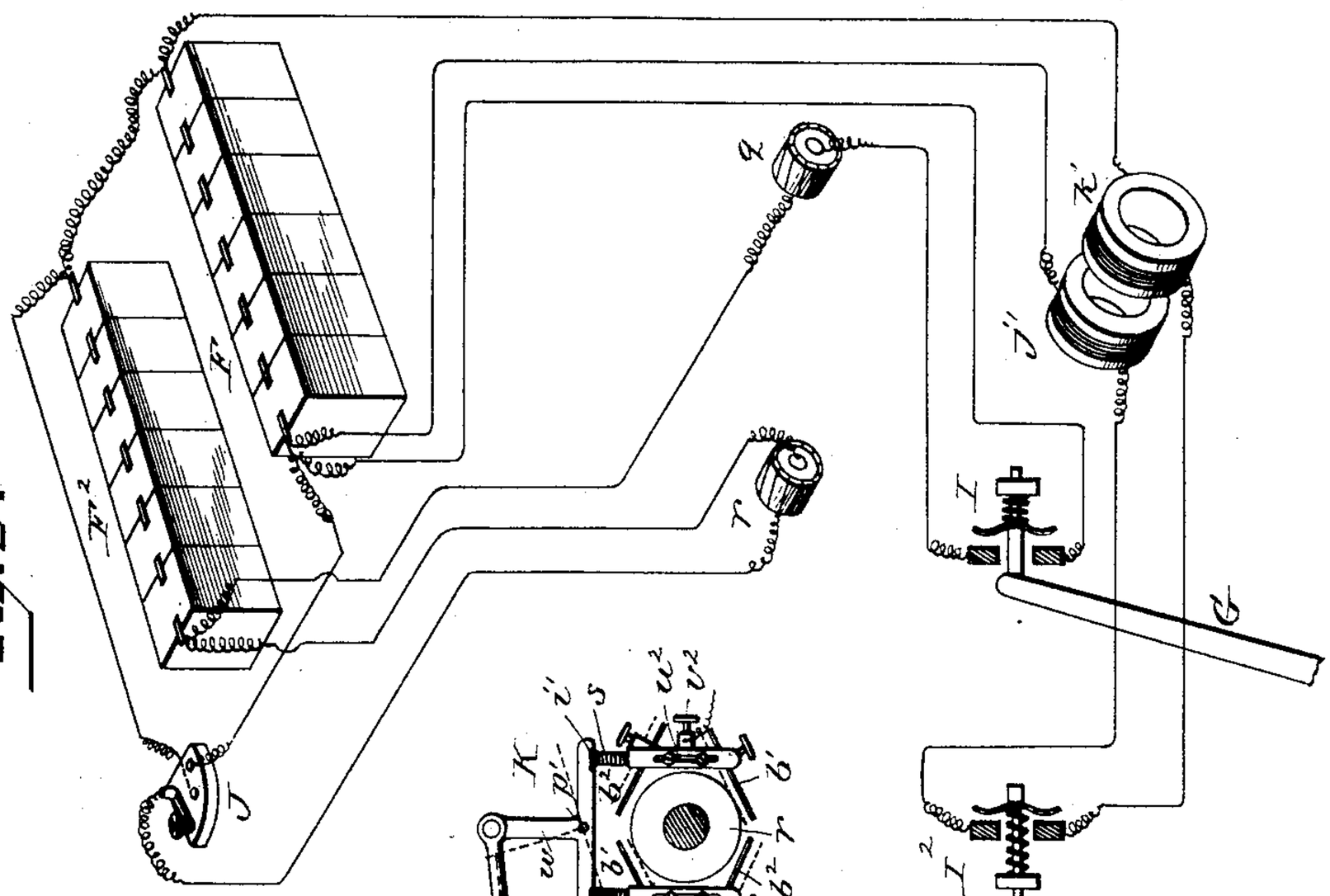


Fig. 4.

Fig. 2.

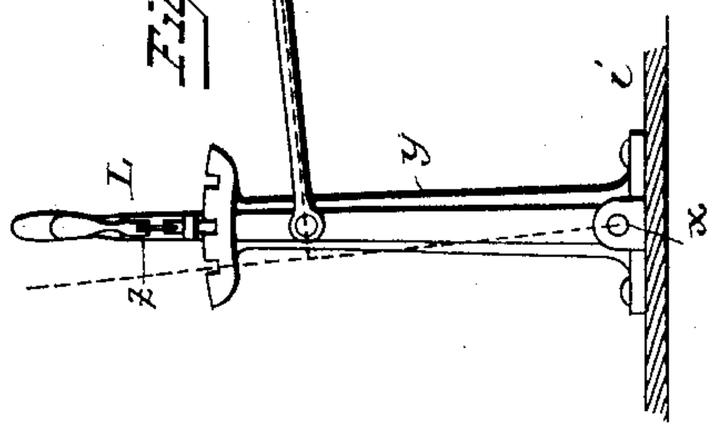
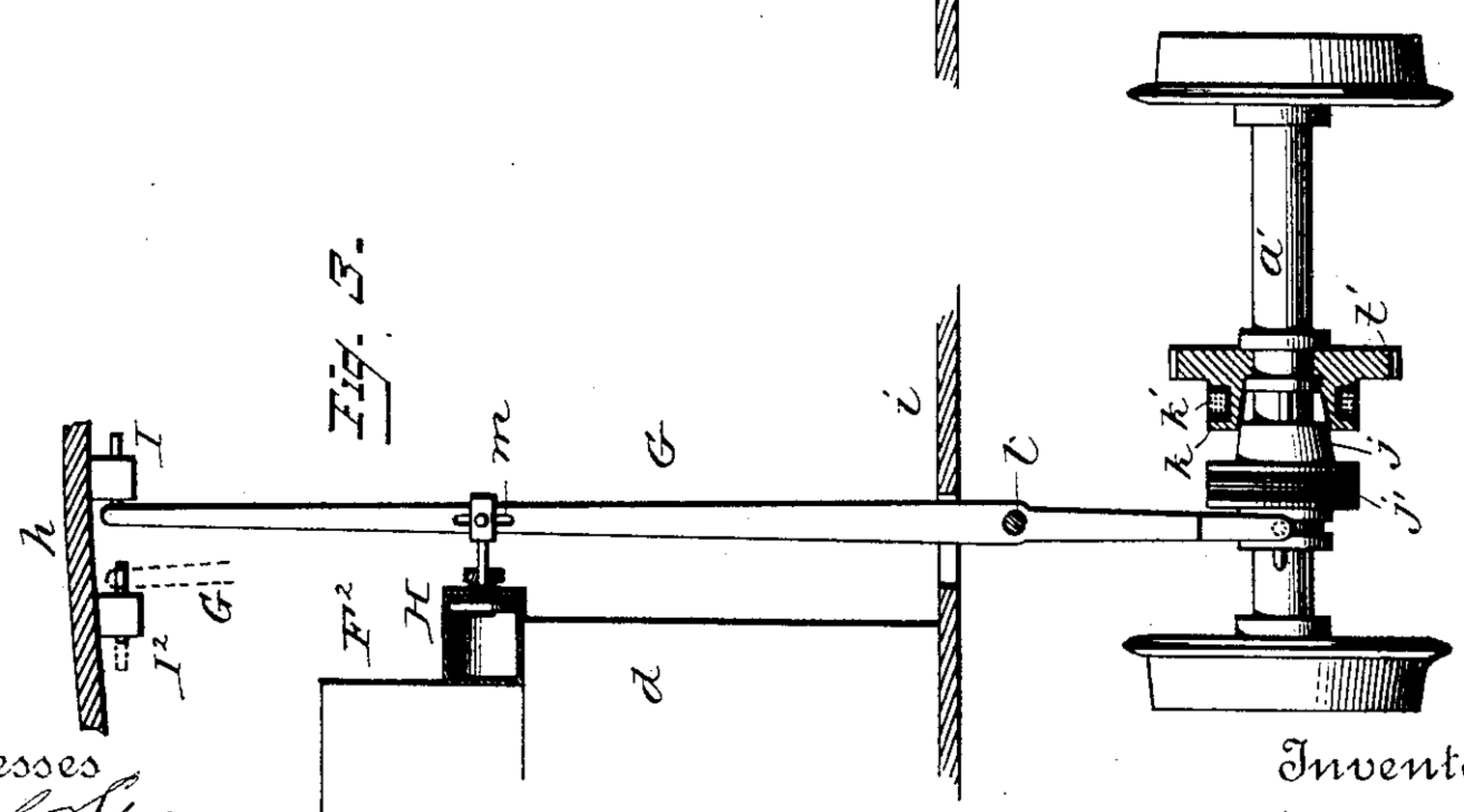


Fig. 3.



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UNITED STATES PATENT OFFICE.

RUFUS A. WILDER, OF CRESSONA, PENNSYLVANIA.

ELECTRIC APPARATUS FOR USE ON RAILWAY-TRAINS.

SPECIFICATION forming part of Letters Patent No. 464,090, dated December 1, 1891.

Application filed January 9, 1891. Serial No. 377,258. (No model.)

To all whom it may concern:

Be it known that I, RUFUS A. WILDER, a citizen of the United States, and a resident of Cressona, in the county of Schuylkill, in the State of Pennsylvania, have invented a new and useful Improvement in Electric Apparatus for Utilizing the Potential Energy of Railway-Trains, of which the following is a specification.

This invention consists in what may be termed a "combination-tender" for the steam-locomotive of a railway-train, the same embodying certain novel combinations of parts, as hereinafter set forth and claimed.

The primary object of the invention, as expressed in its title, is to utilize the potential energy of railway-trains by means of electric apparatus. Means for doing this to a limited extent, as for braking and lighting purposes, have heretofore been proposed.

An object of the present invention is to utilize, as fully as practicable, the energy otherwise wasted on descending grades and straight and level track to assist the locomotive in hauling the train up the next ascending grade or grades and to overcome the resistance of curves.

Another object is to confine all alterations to the tender, which may be utilized for carrying all the electric apparatus without necessarily reducing to any extent its capacity for carrying fuel and water for the locomotive, one or more of the axles of the tender being adapted to drive a dynamo, which is operated wholly by the force of the moving train and converts the surplus train energy into electricity and stores the same in suitable storage-batteries or accumulators, while the wheels of one or more other axles of the tender are converted into driving or traction wheels, from which the power or train-energy so stored by such dynamo can be utilized at will through an electric motor to assist the locomotive.

Another object of the invention is to facilitate clutching and unclutching the dynamo at will, so that the tender-axle by which it is driven may be wholly relieved from driving strain when the dynamo is not at work, and to prevent slipping when the dynamo is coupled to the axle.

Another object is to permanently connect the electric motor with the locomotive and with the supplemental traction-wheels to which the motor is geared, so that the motor will not have to be started up every time it is needed, but simply to be energized through the medium of a suitable reversing-gear, such reversing-gear being also preferably of novel construction, as hereinafter set forth.

Two sheets of drawings accompany this specification as part thereof.

Figure 1 of these drawings is a side elevation of a portion of a railway-train, illustrating this invention. Fig. 2 is a plan of the same. Fig. 3 is a detail view, partly in vertical transverse section in the plane of the rear axle of the tender, illustrating the dynamo-clutch. Fig. 4 is a like view, partly in section in a vertical longitudinal plane, illustrating the motor-reversing gear; and Fig. 5 is a diagram illustrating the several electric connections of the apparatus as a whole.

Like letters of reference indicate corresponding parts in the several figures.

A, Figs. 1 and 2, represents an ordinary steam-locomotive, the only addition to which is a steam-pipe *a*, having a stop-cock *b*, which is preferably located within the locomotive-cab, and a flexible hose connection *c*, of any approved description, leading rearwardly therefrom.

B represents my combination-tender, hereinafter more particularly described, and C represents one or more cars coupled to the locomotive through the medium of said tender and completing a railway-train.

The particular tender shown at B has a water-tank *d*, of H shape in plan, a space *e* for the electric apparatus at rear similar to the customary fuel-space *f* at front, with a central filling-neck *g* in the transverse connecting portion of the tank, and with a hood *h*, extending rearwardly from said connecting portion over said space *e* to form a cab for inclosing the electric apparatus and accommodating an attendant therefor. I do not limit myself to this particular arrangement; but for clearness the electric apparatus will be hereinafter described as disposed within said cab in the manner represented in Figs. 1 and 2. Within said space *e* a dynamo D and an electric motor E are securely bolted to the floor *i* of the tender and connected through suitable openings in said floor with two of

the tender-axles beneath, through the medium, respectively, of a speed-increasing train t and a power-increasing train t^2, of chain-gearing, for example, for which any suitable transmitting-gear may be substituted. A storage-battery of a sufficient number of cells is conveniently supported within the hood h in two equal sections F F^2, located upon the respective rear ends of the tank d, so as to balance each other. A clutch-lever G, extending downward through an opening in the tender-floor i, a small direct-acting steam-engine H, the cylinder of which is conveniently supported upon the adjacent rear end of the tank d for actuating said lever, a pair of electric contact-makers I I^2, Figs. 3 and 5, an electric switch J, controlling the motor-circuit, a reversing-gear K, combined with the motor E, and a hand-lever L, with its appurtenances for actuating said reversing-gear, are also conveniently arranged within the tender-cab, as represented. The dynamo D, together with the speed-increasing train t, through the medium of which it is actuated, may be of any approved make and organization, except that said train preferably includes an electro-magnetic friction-clutch carried directly by the tender-axle a', from which said dynamo is driven, as shown in Fig. 3. This clutch comprises a cone-sleeve j, of soft iron, which slides upon a central splined portion of said axle a', to which it is fitted, and is shifted by said clutch-lever G, a clutch-box k, of soft iron, integral or united with the first wheel t', Figs. 3, of said train t, Figs. 1 and 2, concentric therewith and fitted to the cone end of said sleeve j, and insulated electric coils j' k', surrounding the respective parts of the clutch, said first wheel t' and clutch-box k being loose on the axle a', as regards rotation, when they are not clutched thereto by said cone-sleeve j, which rotates continuously with the axle. Said clutch-lever G turns on a pivot l, Fig. 3, and the connection between the same and the piston of said small engine H comprises a slot m, for example, in the lever. The cylinder of said small engine H receives steam from the locomotive-boiler through said pipe a, cock b, and hose connection c, Figs. 1 and 2, and a pipe n, Fig. 2, on the tender, to which said hose connection is coupled. The admission and exhaust of steam to and from said cylinder may be controlled by a suitable three-way cock o, actuated by a hand-lever p, Fig. 2, or in any approved way.

The contact-makers I I^2 represent ordinary electric details for successively (or simultaneously) closing the dynamo-circuit and the circuit through which the clutch-coils j' k' are energized when the clutch j k is closed. In the example as illustrated in Figs. 3 and 5 the coaction of the clutch-lever G with said contact-maker I opens the dynamo-circuit—that is to say, the circuit which connects the dynamo-commutator q, Figs. 2 and 5, with the storage-battery F F^2 when the dynamo is unclutched, as shown—and closes said circuit as soon as the lever G is moved to clutch the dynamo, and upon the completion of the clutching movement of the lever G by the small engine H said lever coacts with the normally-open contact-maker I^2 to close the clutch-circuit. The clutch-circuit may instead be independent, so that the coils need only be energized when the power of the small engine is insufficient, or may be adapted to fully open and close the clutch alone, or a larger clutching-engine may be employed, so as to dispense with the clutch-coils; but a suitable combination of these devices is preferred.

The switch J represents ordinary electric devices for putting the motor-commutator r, Figs. 4 and 5, into circuit with one or more sections of the storage-battery F F^2 at will and for cutting out the motor E when its assistance is not required. This may be effected in the manner represented in Fig. 5 or in any approved way.

The reversing-gear K is shown in full lines in Fig. 4 in a neutral position, which it should occupy when the motor E is cut out by means of the switch J, as represented in Fig. 5 and in dotted lines in one of its two alternative positions for energizing the motor. The novel reversing-gear so represented comprises a pair of sliding brush-holders u u^2, supported and guided, for example, by pairs of screws within slots in the respective holders and each provided with a pair of brushes b' b^2, those for simultaneous use, as b' b', being diagonally opposite each other. Each holder is further provided with central wire-attaching devices v v^2. The holders are preferably vertical and are connected at their upper ends by spiral springs s with the lateral arms of a T-shaped lever w, which turns on a pivot p' and in the aforesaid arrangement is connected by a rod r' with said hand-lever L. Insulators i' are introduced in customary manner wherever they are required, as at the ends of said arms of said lever w. Said hand-lever L is pivoted at x, Fig. 4, adjacent to a notched sector-stand y, and is provided with a detent z to engage with the respective notches of said stand in the respective positions of the reversing-gear. When the hand-lever is in its central position, as shown in full lines in Fig. 4, all the brushes are out of contact with the motor-commutator, the motor being supposed to be out of circuit, as in Fig. 5, as aforesaid. In the dotted-line position of the hand-lever the brushes b' b' are pressed against the periphery of the commutator r, and in its reverse position said brushes b' are retracted and the brushes b^2 b^2 are pressed against the periphery of the commutator. In either case the spiral springs s render the pressure of the brushes elastic and adapt them to be themselves more rigid than would otherwise be practicable. When the motor-circuit is closed by means of the switch J or its equivalent and the appropriate brushes, as b' b', are brought into co-

tact with the motor-commutator r, as above, the power stored in the battery F F^2 or its equivalent accumulator, or in that portion of the same which is so brought into circuit, is exerted in aid of the locomotive A through the electric motor E, power-transmitting train t^2, and traction-wheels, with which one or more, and preferably two, central axles a^2 a^3 of the tender are provided, such wheels or their axles, as in the example, when more than one axle is so provided being suitably connected, as by cranks c^2 and pitmen p^2, Fig. 1. The front axle a^4 of the tender may conveniently be mounted in a "pony-truck," or provision may be made in any other approved way for the accommodation of the tender-wheels as a whole to curves in the track.

Details which have not been specified may be of any approved description, and I do not limit my respective claims as to mechanical or electrical details and accessories, except as therein stated.

As a modification of the within-described system a separate dynamo or dynamos may be employed on any part or parts of the train and connected by suitable conductors with the storage-battery on the tender, the tender in this case to carry the battery, motor, and controlling and transmitting mechanisms, with or without an additional dynamo, as may be desired.

Having thus described the said improvement, I claim as my invention and desire to patent under this specification—

1. In a railway-train, the combination, with the main traction-wheels and their motor or motors, of supplemental traction-wheels on one or more axles, and apparatus for converting the surplus energy of the locomotive and train into electricity, storing the same, and applying it at will through the medium of such supplemental traction-wheels to assist the locomotive, substantially as hereinbefore specified.

2. In a railway-train, the combination, with the locomotive and cars, of a tender having traction-wheels on one or more of its axles and provided with apparatus for converting the surplus energy of the locomotive and train into electricity, storing the same, and applying it at will through the medium of such traction-wheels to assist the locomotive, substantially as hereinbefore specified.

3. In a railway-train, the combination, with the locomotive and cars, of a tender having a friction-clutch on one of its axles, a speed-increasing train of suitable gearing, the first wheel of which is attachable at will to said axle by said clutch, a dynamo driven by said speed-increasing train, a lever for shifting the sliding member of the clutch, a small direct-acting steam-engine coupled to said lever for actuating the same, and a steam-conduit connecting the locomotive-boiler with the cylinder of said engine, substantially as hereinbefore specified.

4. In a railway-train, the combination, with an electro-magnetic friction-clutch on one of the axles of a speed-increasing train, of suitable gearing the first wheel of which is attachable at will to said axle by said clutch, a dynamo driven by said speed-increasing train, a storage-battery or accumulator in circuit with said dynamo, and an electric circuit and accessories for connecting said battery or accumulator with said clutch at will, substantially as hereinbefore specified.

5. In a railway-train, the combination of a splined rotary axle provided with an electro-magnetic friction-clutch, a speed-increasing train the first wheel of which is attachable at will to said axle by said clutch, a dynamo driven by said speed-increasing train, a storage-battery or accumulator in circuit with said dynamo, a steam-actuated lever for shifting the sliding member of said clutch, and electrical connections for energizing the coils of the closed or partly closed clutch, substantially as hereinbefore specified.

6. In a railway-train, the combination, with the main traction-wheels and their motor or motors, of supplemental traction-wheels on one or more axles, an electric motor for assisting the locomotive, means for supplying the same with electricity at will, and a power-transmitting train of suitable gearing permanently connecting said electric motor with said supplemental traction-wheels, substantially as hereinbefore specified.

7. The combination, in the motor-reversing gear, of sliding brush-holders, a T-shaped lever for shifting said holders, and spiral springs connecting said lever with the respective holders, substantially as hereinbefore specified.

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