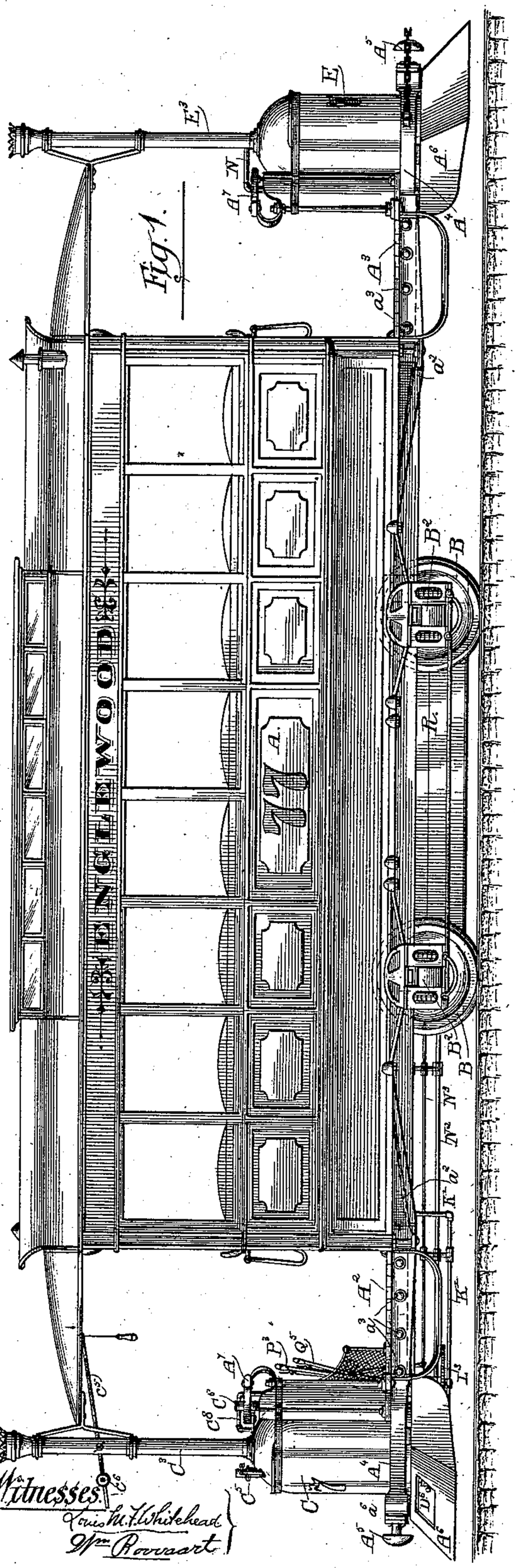
(No Model.) 5 Sheets—Sheet 1.

W. VOGEL.

STEAM STREET CAR MOTOR.

No. 381,192. Patented Apr. 17, 1888.

Fig. 1.



Witnesses:
Louis M. Whitehead
Wm. Bouvaart

Fig. 5.

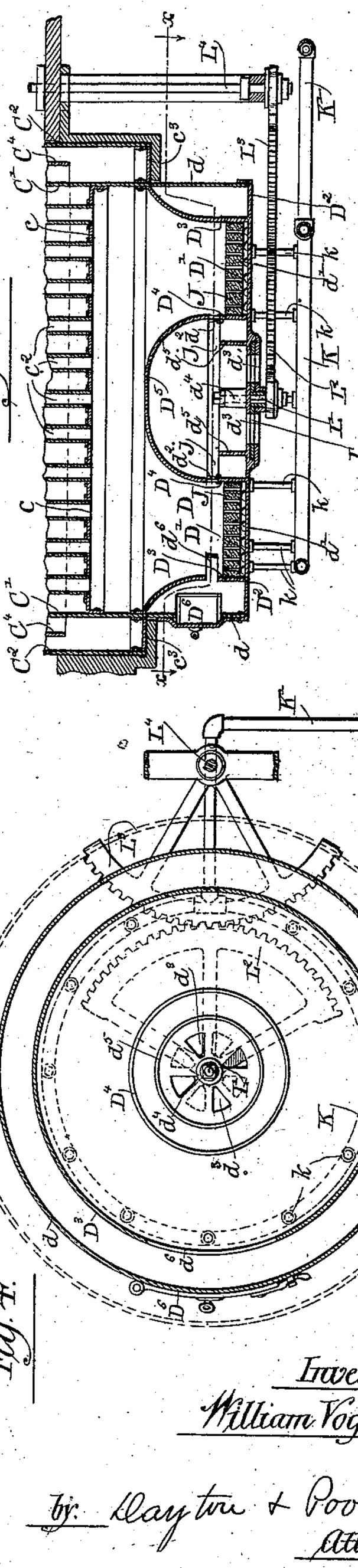


Fig. 4.

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(No Model.) 5 Sheets—Sheet 2.

W. VOGEL.

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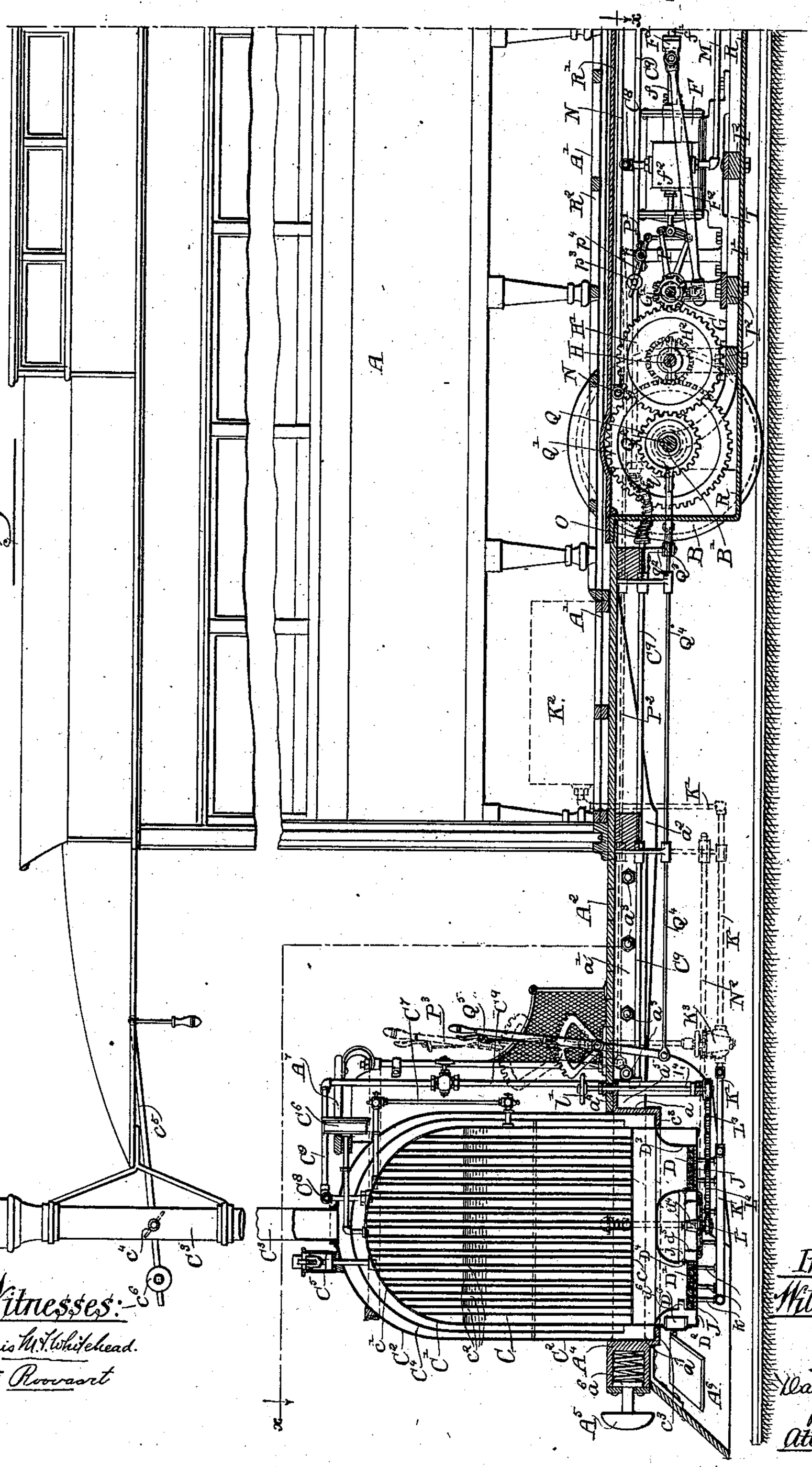

Fig. 2.

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(No Model.) 5 Sheets—Sheet 3.

W. VOGEL.

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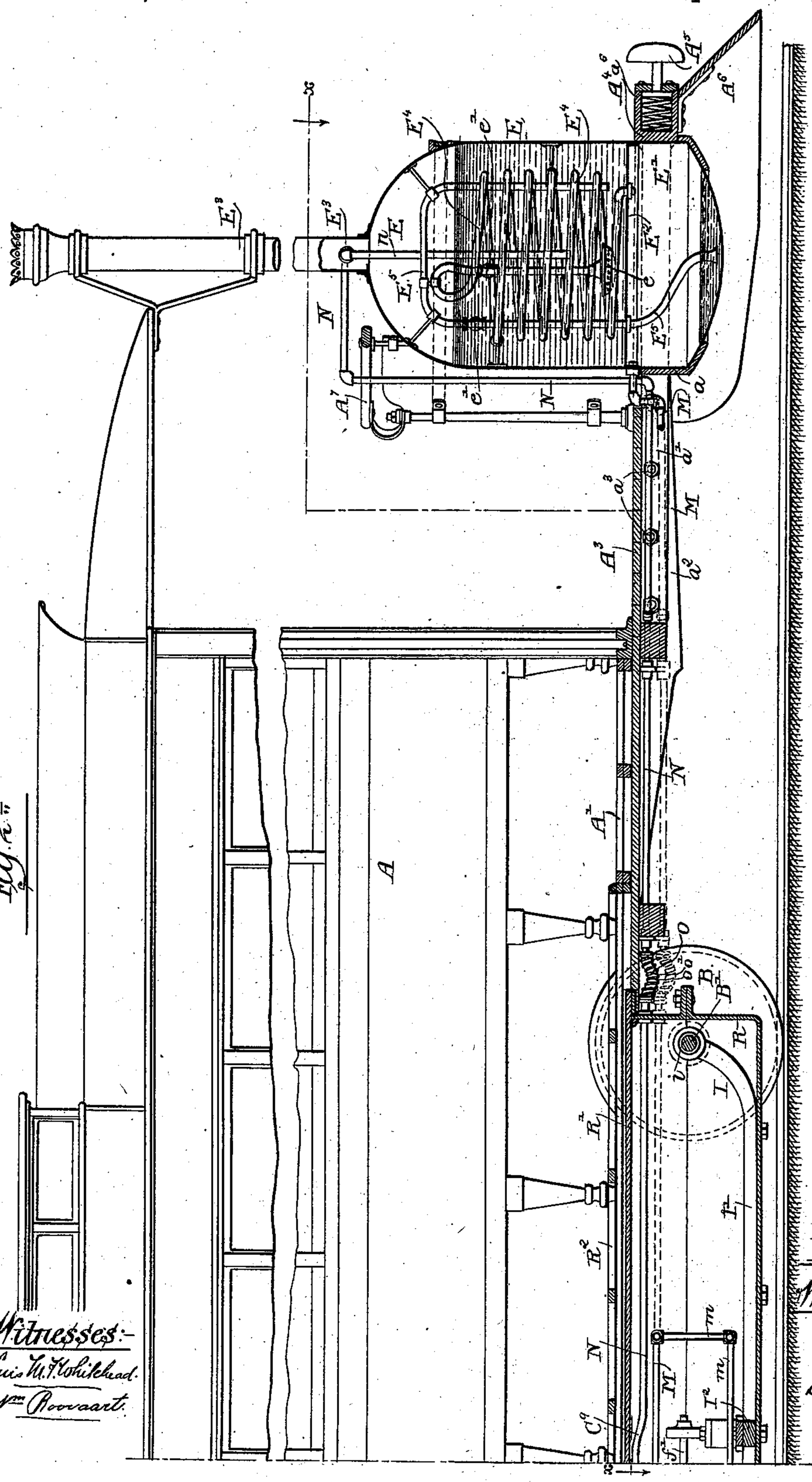

Fig. 2.

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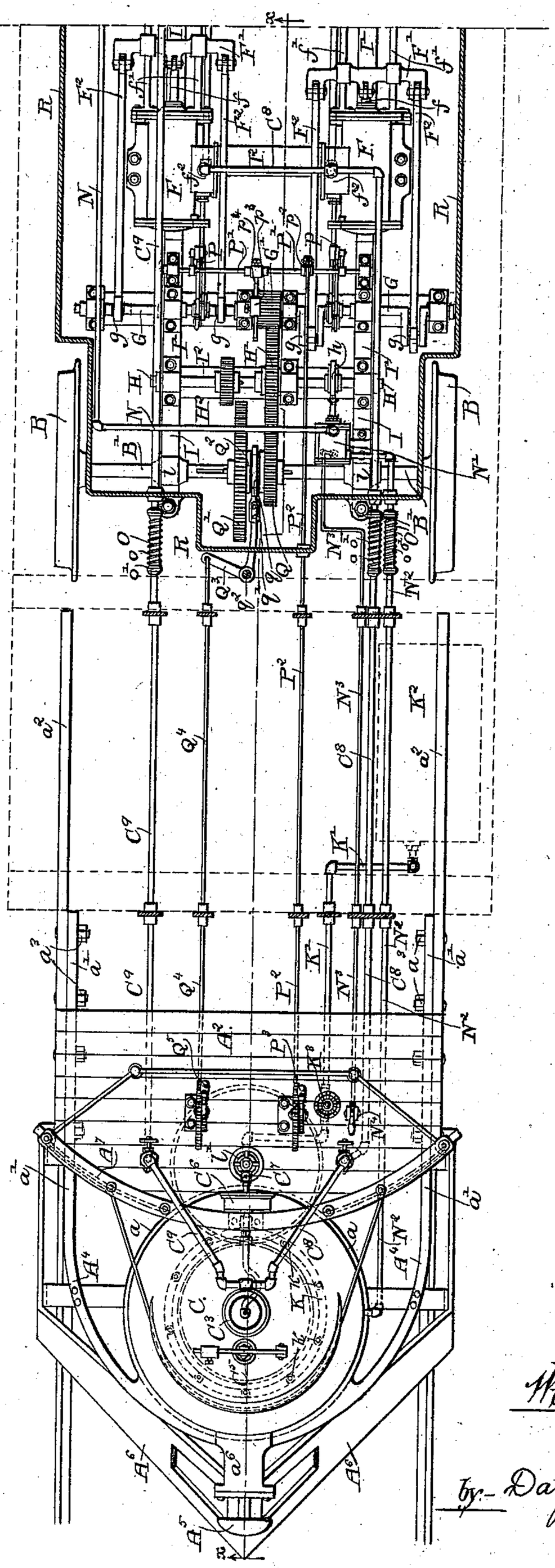
(No Model.) 5 Sheets—Sheet 4.

W. VOGEL.

STEAM STREET CAR MOTOR.

No. 381,192. Patented Apr. 17, 1888.

Fig. 3.



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(No Model.) 5 Sheets—Sheet 5.

W. VOGEL.

STEAM STREET CAR MOTOR.

No. 381,192. Patented Apr. 17, 1888.

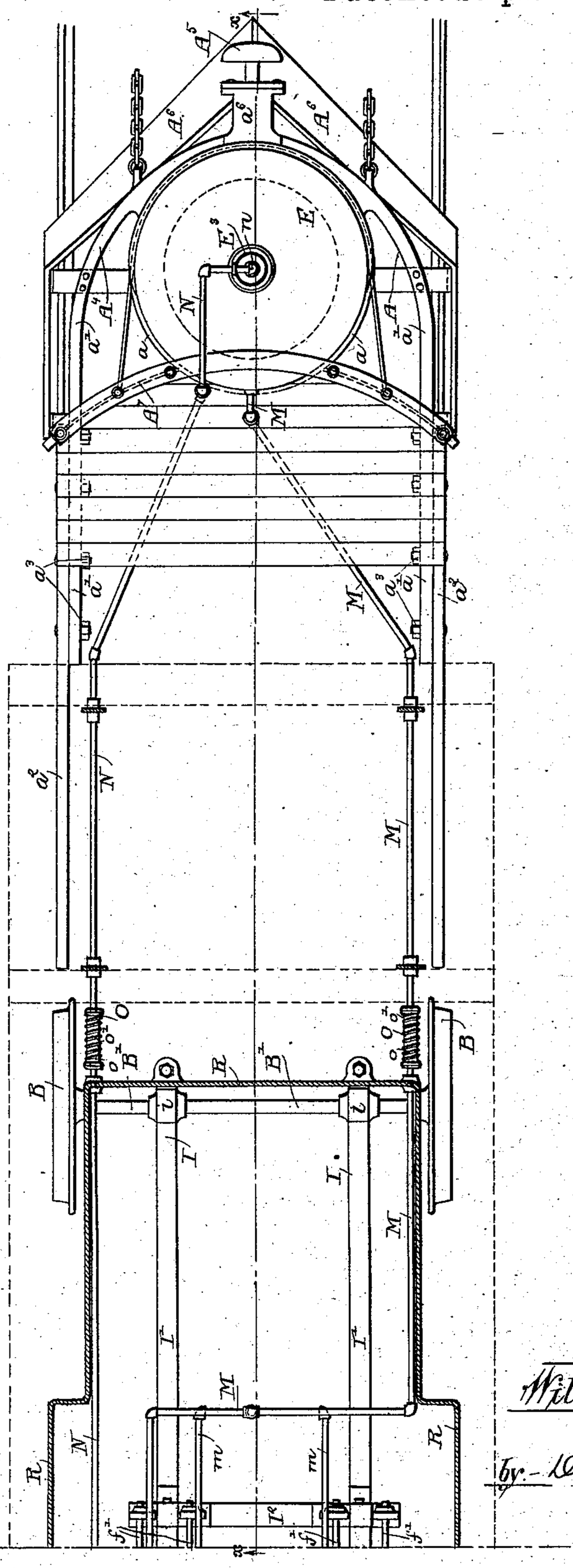

FIG. 3.

Witnesses:-
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W^m Roovaart.

Inventor:-
William Vogel.
by:- Dayton & Poole
Attorneys.

UNITED STATES PATENT OFFICE.

WILLIAM VOGEL, OF CHICAGO, ILLINOIS, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE VOGEL PETROLEUM HEATING COMPANY, OF SAME PLACE.

STEAM STREET-CAR MOTOR.

SPECIFICATION forming part of Letters Patent No. 381,192, dated April 17, 1888.

Application filed October 18, 1886. Serial No. 216,595. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM VOGEL, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Steam Street-Car Motors; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to an improved steam-motor for street-cars; and it consists in the matters hereinafter described, and pointed out in the appended claims.

The invention embraces an improved steam-generating apparatus especially adapted for steam street-car motors, an improved steam driving-gear, and other novel features of construction in motors of the character set forth, as will hereinafter appear.

The novel steam-generating apparatus herein shown embraces means for applying to a steam-generator certain novel features of construction in an oil-burning apparatus of the kind shown and claimed in a prior application, Serial No. 210,046, filed in the United States Patent Office August 5, 1886.

The invention may be more fully understood by reference to the accompanying drawings.

In the said drawings, Figure 1 is a side elevation of a street-car provided with a motor constructed in accordance with my invention. Figs. 2 and 2^a illustrate in central longitudinal vertical section the car shown in Fig. 1. Figs. 3 and 3^a illustrate in sectional plan view, taken upon line $x\ x$ of Figs. 2 and 2^a, the devices shown in said Figs. 2 and 2^a. Fig. 4 is an enlarged sectional plan view of the oil-burner by which the steam is generated, taken upon line $x\ x$ of Fig. 5. Fig. 5 is an enlarged central vertical section of the said burner and adjacent parts of the boiler.

As shown in the said drawings, A is the car-body, which is provided with the usual floor frame-work, A′, and with platforms A^2 A^3 at its opposite ends.

B B are the supporting-wheels of the car, which are rigidly secured to axles B′ B′, mounted in boxes B^2 upon the car-body in the usual manner.

C is a boiler within which steam for actuating the car is generated.

D is an oil-burner for heating said boiler C.

E is a tank or receptacle constructed to contain feed-water, and provided with means whereby the latter is heated by the exhaust-steam from the motor.

The boiler C is located at the outer part of the platform A^2 at one end of the car, and the tank E is similarly located upon the platform A^3 at the opposite end of the car. The driving-gear of the motor is located beneath the car-body between the wheel-axles B′ B′, and comprises two horizontally-arranged steam-cylinders, F F, which are provided with piston rods $f\ f$, attached to sliding cross-heads F′, held in guides $f'\ f'$. To each of said cross-heads are pivotally attached two connecting-rods, F^2 F^2, which are located upon opposite sides of the cylinders and engage cranks $g\ g$ upon a crank-shaft, G, arranged transversely of the car.

H is a shaft arranged parallel with the shaft G and provided with a spur-wheel, H′, which intermeshes with a pinion, G′, upon the shaft G. The shaft H is located adjacent to one of the wheel-axles B′, and is adapted for connection therewith by suitable gearing, as will be hereinafter described.

The cylinders F and the other operative parts above referred to are supported upon a metal frame-work, I, which is sustained solely by the said axles B′ independently of the car-body, said frame being provided with suitable bearings, $i\ i$, embracing the car-axles, as clearly shown in the drawings.

To describe more in detail the several parts of the motor:

The boiler C illustrated is of the multitubular type and consists of a cylindric shell, C′, having a flat bottom, c, a curved or dome-shaped top, c', and a plurality of tubes, c^2 c^2, connected with and opening through the said bottom and top plates. The boiler constructed in the manner described is surrounded at its top and sides by an exterior shell or casing, C^2, communicating at its top with an exit-pipe or smoke-stack, C^3, and between the boiler-

shell C′ and the said exterior shell, C², is placed a bottomless shell, C⁴, which extends about the top and sides of the boiler proper and divides the space inclosed between the exterior shell and the boiler into two parts or chambers. The exterior casing, C², is extended at its lower edge below the bottom plate, *c*, of the boiler, and the side walls of the boiler-shell C′ are similarly extended below the said bottom plate, and the space between the said boiler-shell and the outer casing at their lower margins is closed by a flat annular plate or ring, *c*³. The intermediate shell, C⁴, terminates at its lower edge short of the bottom of the passage or chamber formed by the boiler-shell and the outer casing, in the manner described, thereby affording passage around the said lower edge of the shell at this point.

The oil-burner D, or other heating apparatus employed in connection with a boiler thus constructed, is located immediately beneath the bottom plate, *c*, and the flame and heated products of combustion pass upwardly through the tubes *c*², then downwardly in the space between the boiler-shell and the shell C⁴, around the bottom of said shell C⁴, and then upwardly adjacent to the exterior casing, C², and make their escape through the smoke-pipe. The boiler illustrated is provided with the usual safety-valve, C⁵, pressure-gage C⁶, and water-gage C⁷. C⁸ is a steam-pipe leading from the top of said boiler to the engine-cylinders F F, said steam-pipe, as more clearly shown in Figs. 1 and 2, being extended from the top of the boiler downwardly through the floor of the car-platform, and then horizontally to the point opposite the said cylinders, where it is carried across the car, and is connected with the steam-chests *f*² *f*² of the cylinders by means of suitable branch pipes. A branch, C⁹, of the pipe C⁸ is connected with the latter at a point adjacent to the top of the boiler, and extends downwardly through the car-platform and beneath the bottom of the car, and is connected with the exhaust-pipe from the cylinders, as will hereinafter fully appear.

The oil-burner D, herein shown as applied to heat the boiler C, is constructed as follows: The burner consists, in its essential features, of a porous or perforated bed or filling, J, made of fire-brick, asbestus, or other porous substance, but which may be made of sand or gravel or of cast-iron vertically perforated, as shown, and a shallow receptacle or trough, D′, which is adapted to receive and hold the said porous bed or filling. The said trough D′ is supplied with oil or other liquid hydrocarbon by means of a supply-pipe, K, the oil delivered to the trough rising through the porous bed and being burned at the top of the said bed, in the manner set forth in the said prior application hereinbefore referred to.

In the particular construction of the parts herein illustrated the porous bed J is of annular form and the trough D′ is of similar shape. As a convenient construction in the parts, a casing constructed to surround and support the parts of the burner is formed by a cylindric side wall, *d*, herein shown as forming a continuation of the shell of the boiler, and a flat bottom plate, D². Upon this plate are formed or attached two concentric annular flanges or rings, D³ D⁴, forming, with the plate, the annular trough D′. The said plate D² is preferably provided with a series of studs or prominences, *d*′, upon which the porous bed rests, thereby forming a space or opening beneath the said bed. With this space the oil-supply pipe K, which in this case is made of circular form and located beneath the plate D², is connected by means of short vertical branches *k*. (More clearly shown in Fig. 5.) The supply-pipe K is connected by a branch, K′, with an oil-tank, K², which is preferably located beneath the seat at one end of the car, as indicated in dotted lines in Figs. 2 and 3, said supply-pipe being preferably provided with a regulating-valve, K³—such, for instance, as is shown in a prior application, Serial No. 210,047, filed in the United States Patent Office August 5, 1886. The ring D³, which forms the outer wall of the trough D′ in the particular construction illustrated, extends considerably above the top of the porous bed, and is curved outwardly and attached at its upper margin to the wall *d* of the casing. The ring D⁴, forming the inner wall of the trough, terminates slightly above the level of the top of the porous bed, and the upper edge of said wall, in connection with the lower edge of a concave or flanged casting, D⁵, sustained centrally within the burner, forms a narrow annular passage, *j*, by which air to support combustion is admitted to the top of the porous bed. The casting D⁵ may be conveniently sustained by legs *d*², resting upon the plate D² in the manner shown. Air is admitted to the central space of the burner through openings *d*³, formed for the purpose in the middle of the plate D², the air entering the said space passing therefrom through the annular passage *j* to the space over the porous bed, where combustion takes place. For controlling the openings *d*³ *d*³ a suitable valve is provided, herein shown as consisting of a rotating plate, L, pivoted at the center of the plate B² and provided with apertures *d*³. For operating the valve L the latter is preferably attached to a vertical shaft, L′, mounted to rotate in a hub, *d*⁴, upon the plate D², to the lower end of which shaft is attached a spur-wheel, L², which is engaged by another spur-wheel, L³, mounted upon a shaft, L⁴, which extends upwardly through the floor of the car-platform, and is provided with a hand-wheel, *l*′, by which the shaft may be turned and the valve moved. An additional means for controlling the burner is herein shown, consisting of a valve in the smoke-pipe C³, said valve being actuated by a lever, *c*⁵, provided with a weight, *c*⁶, holding the valve normally open.

*d*⁵ is an annular flange formed or attached upon the upper surface of the plate D² between the frame D⁴ and the air-inlet openings

d^3, for the purpose of confining any oil which may overflow from the trough D^2. Any oil overflowing in the manner described remains upon the plate d' until vaporized by the heat of the burner.

D^6 is a door applied to the side wall, d, of the burner-casing, and d^6 is an opening placed in the ring D^3 opposite the said door and adjacent to the top of the porous bed, said door and opening d^6 being for the purpose of allowing access to said bed for the purpose of lighting the oil in starting the fire.

I prefer to construct the boiler and burner made as above described of such size and shape and to so locate them upon the car-frame that the top of the boiler will not extend materially higher than does the hand-rail (indicated at A^7) commonly present upon car-platforms. This construction obviously enables the driver or operator to command an unobstructed view of the track and roadway ahead when standing upon the platform. It is to be understood, however, that the proportions or size of the generating apparatus may be varied in practice from these shown—as, for instance, the top of the generating apparatus located in the manner shown may be considerably higher than the hand-rail A^7 without obstructing the view of a person standing upon the platform.

The feed-water tank E, which is located at the end of the car opposite that at which the boiler C is placed, consists of a cylindric vessel of generally the same shape and size as the exterior casing of the generating apparatus. Beneath the said tank is located a second smaller tank or chamber, E′, these tanks in the particular construction illustrated being formed by a single cylindric shell divided by a horizontal partition, E^2, so as to form the tanks or chambers mentioned. The said upper chamber or tank, E, is connected at its top with an open tube or pipe, E^3, by means of which the interior of the tank is placed in free communication with the outer air.

The tank E contains the feed-water for the boiler, which is introduced therein through the open pipe or tube E^3, or otherwise, and which, while in said tank, is free from steam or other pressure.

E^4 is a pipe which is connected at one end with the top of the chamber E′, and is provided at its opposite discharge end with an enlarged and perforated head, e, located in the lower part of the upper chamber, E. The part of the pipe E^4 between its ends is extended to a point above the usual water-level of the tank E, so as to prevent the passage of water by gravity from the said tank to the chamber E′. Said pipe E^4 is preferably made of considerable length and arranged spirally within the tank E.

E^5 is a pipe extending from the lower part of the chamber E′ upwardly to a point above the water-line of the tank E and opening into the lower part of said tank.

M is the exhaust-pipe from the engine-cylinders, said pipe being connected by branches m with the cylinders, and being extended beneath the car-floor to the chamber E′, within the upper part of which it discharges, as clearly shown in Fig. 2^a. The water within the tank E fills the greater part of the said tank and covers the coiled portion of the pipe E^4, and the steam entering the said chamber E′ through the exhaust-pipe is forced by the pressure of the exhaust-steam through the said tube E^4, and passes from the perforated head e thereof into the water which is within the said tank. In its passage through the coiled part of the pipe E^4 the pipe is heated and a portion of the heat of the steam is thus transmitted to the water, while at the same time a part of the steam is condensed within the pipe and returns to the chamber E′. The exit end of the said tube E^4 is preferably provided with the perforated head e, in order that the steam may be divided into fine jets as it enters the water, thereby facilitating its condensation. The chamber E′ is employed mainly for the purpose of equalizing the pressure of the steam, which obviously comes in puffs through the exhaust-pipe, and thereby prevents the noise which would be caused by the passage of the steam directly from the exhaust-pipe into the water.

A considerable part of the steam delivered into the chamber E′ will obviously be condensed therein, and the water of condensation from the coil E^4 returns to the said chamber, so that in the operation of the device water will accumulate in considerable quantities in the bottom of said chamber E′. The pipe E^5 is for the purpose of causing the continual discharge from the said chamber of the water which thus accumulates therein, and for this purpose the open lower end of the said pipe E^5 is located at a point close to the bottom of said chamber E′, so that said lower end of the pipe will always be beneath the surface of the water contained in the chamber. It is entirely obvious that when the parts are thus constructed the pressure of the exhaust-steam within the chamber E′ upon the top of the water therein contained will force the said water upwardly through the pipe E^5, and thereby cause its discharge into the chamber E. The discharge end of the pipe E^5 may be located either in the upper or lower part of the tank E, its location at the lower part of the tank being preferred, in order to insure against the free escape of steam from the chamber E′ to the open air in case the water is low in the tank and the water is forced out of the chamber E′ faster than it accumulates, so as to allow steam to follow the water through the said pipe E^5. When the pipe E^5 is arranged as shown in the drawings, it will preferably be provided with a check-valve, e', to restrain any backward flow of water therein, and to thereby prevent the water in the tank being siphoned into the chamber E′ when the steam-pressure is removed from the said chamber.

The steam-generating device, consisting of

the boiler and the burner connected therewith in the manner described and the water-tank E, may be sustained upon the frames of the car-platforms in any suitable way. One desirable construction for this purpose is herein shown in Figs. 2 and 3, in which the parts mentioned are each supported by a circular casting or ring, A^4, which is provided with an inwardly-extending flange, *a*, adapted to engage the offset or shoulder at the lower part of the boiler-casing C^2 in one case and to fit beneath the bottom of the chamber E in the other case. The said ring A^4 is desirably supported upon the car-frame by means of arms *a' a'*, cast integral therewith and extending rearwardly along the inner side of the platform-support a^2, to which they are secured by bolts a^3. At their sides and adjacent to the platform the rings A^4 A^4 are desirably provided with horizontal flanges a^4, extending over and resting upon the transverse frame-piece a^5 of the car-platform. In the device shown the castings A^4 are formed to provide sockets a^6 a^6 for spring-buffers A^5 and are constructed to support track-clearers A^6 A^6.

N is a pipe by which water is carried from the tank E to a feed-pump, N', from which it is forced through a feed-pipe, N^2, to the boiler. The said pipe N is provided with a vertical part, *n*, within the chamber tank E, said part *n* terminating near the bottom of the said tank. The feed-pump N' is made in the ordinary manner and is actuated from an eccentric, *h*, upon the shaft H of the driving-gear.

N^3 is a rod connected with a valve controling an air-inlet opening to the feed-pump, whereby air may be admitted to the said pump at the times when the pumping of the water is not required in a familiar manner. The said rod N^3 extends from the feed-pump to a point beneath the platform A^2, where it is connected with a hand-lever, N^4, extending upwardly through the said platform in position convenient for its manipulation by the driver.

The steam pipe or tube C^9, for allowing the escape of steam from the boiler, is connected with the exhaust-pipe N, as shown in Fig. 3^a, so that steam allowed to escape from the boiler will pass through the said exhaust-pipe into the tank E, where it is wholly or partially condensed, and thus disposed of without noise. Inasmuch as the tank E is in free communication with the open air, any uncondensed steam passing from the water will make its exit quietly and without noise from the top of the pipe E^3 either when the steam comes directly from the boiler or when it passes from the exhaust-ports of the cylinder.

Inasmuch as the engine-cylinders F F and other operative parts of the driving-gear are mounted upon the frame I, which is supported upon the wheel-axle in the manner before described, and the car-body is supported upon said axles through the medium of springs in the manner common heretofore, it is obviously necessary to provide for a movement of the parts of the several steam, feed-water, and exhaust pipes, which are attached to the car-body with relation to the portions of said pipes immediately connected with the driving-gear and supported upon the frame I. For this purpose I have herein shown each of the said several pipes as provided at points between the ends of the car and the said driving-gear with flexible sections O, formed by thick rubber tubes *o*, connected at their ends with the pipes and re-enforced by exterior spiral wrappings, *o'*, of wire.

The slide-valves of the steam-cylinders shown are provided with a common form of link-motion reversing-gear, P, the reversing-gear belonging to both cylinders being controlled by a single transverse rock-shaft, P', which is connected with the links by means of arms *p* and connecting-bars *p'*. Said shaft is provided with a rigid arm, p^2, to which is connected an actuating-rod, P^2, which extends to a reversing-lever, P^3, mounted upon the car-platform A^2. A single counterbalance-weight, p^3, for both reversing-gears is herein shown as applied to an arm, p^4, fixed upon the shaft P'.

To provide means for changing the speed at which the car is driven, and at the same time to increase or decrease the driving-power, I provide, for connecting the transverse driving-shaft H of the driving-gear with the axle B' of one of the car-wheels, two or more sets of gear-wheels, either of which may be thrown into action, as desired. For this purpose, in the device shown, the wheel-axle B' is provided with a spur-wheel, Q, adapted to intermesh with a spur-wheel, H', upon the said shaft H. The spur-wheel H^2 is considerably smaller than the spur-wheel H', and on the other hand the wheel Q is smaller than the wheel Q', so that when the wheels Q and H' are in position to intermesh with each other the car may be driven at the highest speed and with the least power, and when the wheels Q' and H^2 are in engagement the car will be moved more slowly, but with increased power. To provide a convenient means for shifting the gear-wheels to cause the engagement of one or the other pair thereof, the wheels Q and Q' are desirably attached to a sleeve, Q^2, splined to the wheel-axle B', so that it may slide freely longitudinally thereon, and the said wheels Q and Q' are placed at a less distance apart than the wheels H' and H^2, so that when the wheel Q is engaged with the wheel H' the wheel H' will be free from the wheel H^2. When the parts are thus constructed, it is entirely obvious that the shifting of the sleeve Q^2 a short distance in either direction will bring the wheel in either position for engagement with either one of the wheels upon the shaft H, as desired. For shifting the said wheels Q and Q', I have herein shown the sleeve Q^2 as provided with an annular groove, *q*, which is engaged by a ring, *q'*, to which is connected one arm of a bell-crank lever, Q^3, supported upon a vertical pivot, q^2,

and connected with an operating-rod, Q^4, which is extended to and connected with a hand lever, Q^5, upon the car-platform A^2.

To protect the several operative parts of the driving-gear from dust and dirt, I preferably surround the same by a casing, R, attached to the supporting-frame I in the manner shown. This casing I preferably provide with a removable top, R', by means of which access may be had to the driving-gear for the purpose of oiling the same or for making repairs.

The middle part of the car-floor is desirably cut away over the casing R, and the opening thus made is covered by a grating, R^2, sustained slightly above the top of the casing, so as to allow a vertical movement of the car-body in the yielding of the springs, said top being adapted for convenient removal to allow access to the interior of said casing.

The supporting-frame I may be constructed in any convenient or preferred manner; but, as herein shown, it consists of two longitudinal bars, I' I', to the ends of which the bearings *i i* are attached, said bars being extended beneath the several parts of the driving-gear and upturned at their ends for attachment to the said bearings *i i*, as clearly shown in Figs. 3 and 3^a. The said bars I' I' are rigidly connected by suitable cross-bars, I^2, upon which the cylinders F and bearings for the several shafts are attached or sustained.

One important feature of novelty in the driving-gear is embodied in the construction wherein motion is communicated from the piston-rod of each of the engine-cylinders to the driving-shaft G by means of a cross-head, F', and two connecting-rods, F^2 F^2, extending from the cross-head toward and past the cylinder at both sides of the latter. By this construction a desired length of connecting-rod may be provided, while at the same time the entire driving-gear may be easily placed within the space between the car-axles.

By the employment in a motor for street-cars of a steam-generator at one end of the car and a tank for feed-water at the opposite end of the car, in the manner shown, these parts are so placed as to occupy none of the space in the car-body, so that the space for passengers is not curtailed, while at the same time the weight of the boiler is counterbalanced by the feed-water tank, and an objectionable preponderance of weight at either end of the car is thereby avoided.

I claim as my invention—

1. The combination, with the supporting-wheels of a street-car and a car-body provided with platforms at both ends, of a steam driving-gear located beneath the car-body and between the axles, a steam-generator located upon the outer end of the platform at one end of the car, and a feed-water heater located upon the outer end of the platform at the opposite end of the car, substantially as described.

2. A device for heating feed-water and preventing the noise of escaping steam in a car-motor, consisting of a tank or receptacle, E, a chamber, E', the said tank E being constructed to hold the feed-water and communicating at its top with the open air, and a pipe, E^4, leading from the top of the chamber E' and opening into the lower part of the said tank E, substantially as described.

3. The combination, with a feed-water tank or receptacle, E, open at its top to the air, of a chamber, E', communicating with the exhaust-pipe of an engine, and a pipe, E^4, leading from the top of the chamber E' and discharging into the lower part of the said tank, said pipe E^4 being bent into tortuous or spiral form within the tank, substantially as described.

4. The combination, with a feed-water tank or receptacle, E, communicating at the top with the open air, of a chamber, E', communicating with the exhaust-passage of a steam-cylinder, and a pipe, E^4, leading from the top of the chamber E' and opening into the lower part of the tank E, said pipe E^4 being provided with a perforated head, *e'*, at its exit end, substantially as described.

5. The combination, with a feed-water tank or receptacle, E, and chamber E', located beneath the tank E and connected with an exhaust-steam pipe, of a pipe, E^4, leading from the top of the chamber E^3 and discharging into the tank, and a second pipe, E^5, leading from the bottom of the chamber E' and extending upwardly to a point above the water-level in the tank and discharging into said tank near the bottom thereof, said pipe E^5 being provided with a check-valve, substantially as described.

6. The combination, with a feed-water tank or receptacle, E, communicating at its top with the open air, and a chamber, E', connected with the exhaust-passage of a steam-cylinder, of a pipe, E^4, leading from the top of the chamber E' and opening into the lower part of the tank E, and a second pipe or tube, E^5, extending from the bottom of the chamber E' into the said tank E, substantially as described.

7. The combination, with the steam-generator and steam cylinders of a car-motor, of a feed-water tank, E, communicating at its top with the open air, a chamber, E', exhaust-pipes connecting the cylinders with the said chamber E', a pipe or tube, E^4, connecting the chamber E' with the tank E, and a passage connecting the steam-generator with the said chamber E, whereby steam allowed to escape from the generator will be delivered to said chamber E' and will make its escape through the pipe E^4 and the tank, substantially as described.

8. The combination, with the body and axles of a street-car, of a steam driving-gear located beneath the body between the axles and comprising a steam-cylinder and piston, a cross-head attached to the piston, a crank-shaft located between and parallel with the axles at that end of the cylinder opposite to the one at

which the cross-head is located, driving-connections between the crank-shaft and one of the axles, and two connecting-rods uniting the cross-head and crank-shaft, said connecting-rods being located at opposite sides of the cylinder, substantially as described.

9. The combination, with the supporting-wheels of a street-car and a car-body yieldingly supported thereon, of a steam driving-gear located beneath the car-body between the wheel-axles, a frame sustaining the said driving-gear, said frame being supported upon the axles independently of the car-body, and a casing surrounding and covering the driving-gear on all sides and supported solely by and upon the said frame independently of the car-body, substantially as described.

10. The combination, with the supporting-wheels of a street-car and a car-body yieldingly supported thereon, of a steam driving-gear located beneath the car-body between the wheel-axles, a frame sustaining the said driving-gear, said frame being supported upon the axles independently of the car-body, and a casing surrounding and covering the driving-gear on all sides and supported upon the said frame independently of the car-body, said casing being provided with a removable top, and the car-floor being provided with an opening to allow access to said top, and a removable floor-section or grating covering the said opening in the car-floor, substantially as described.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

WILLIAM VOGEL.

Witnesses:
C. CLARENCE POOLE,
W. ROOVAART.