No. 782,624. PATENTED FEB. 14, 1905.

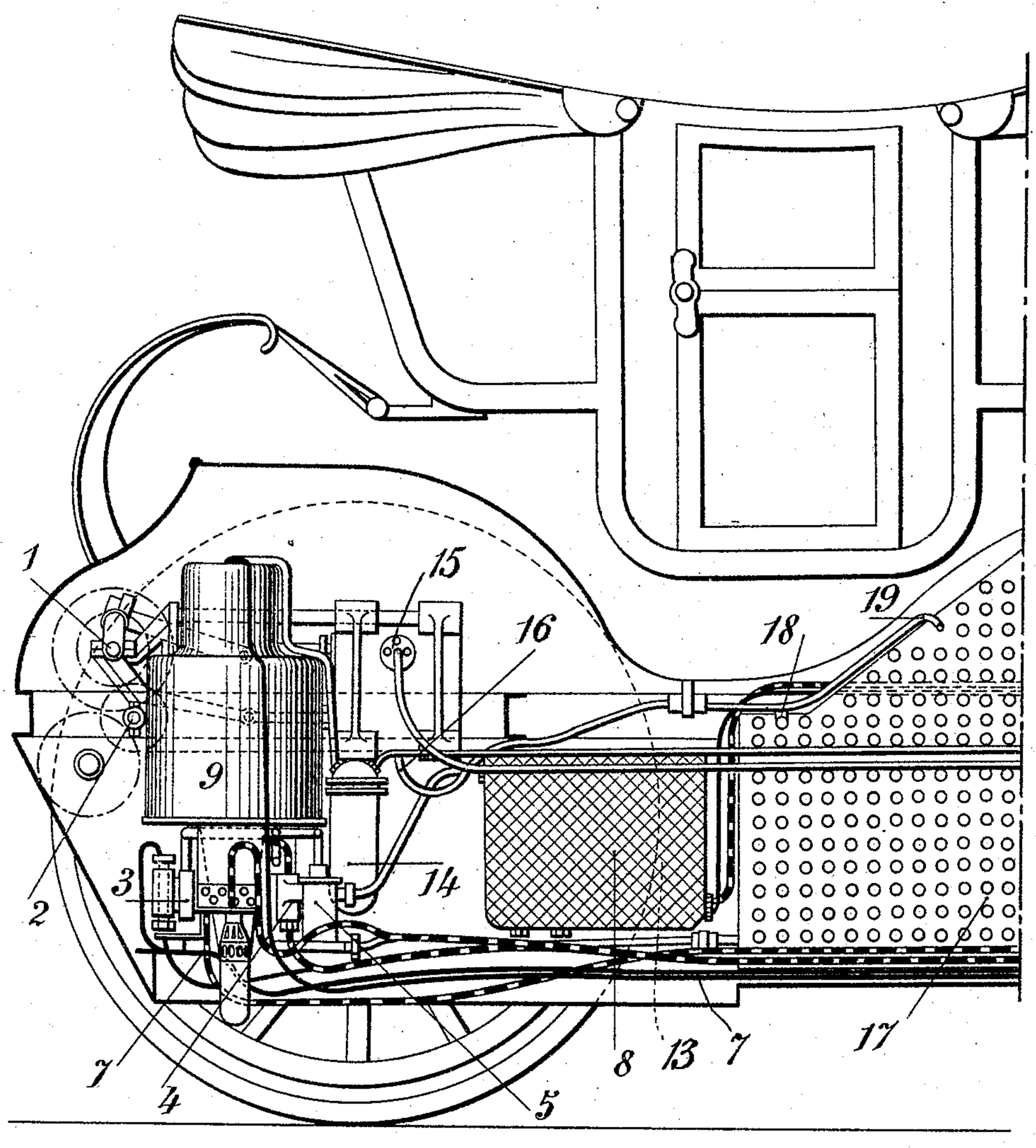
J. A. & J. M. B. REY.

STEAM MOTOR CAR.

APPLICATION FILED MAR. 24, 1903

5 SHEETS—SHEET 1.

Fig. 1.



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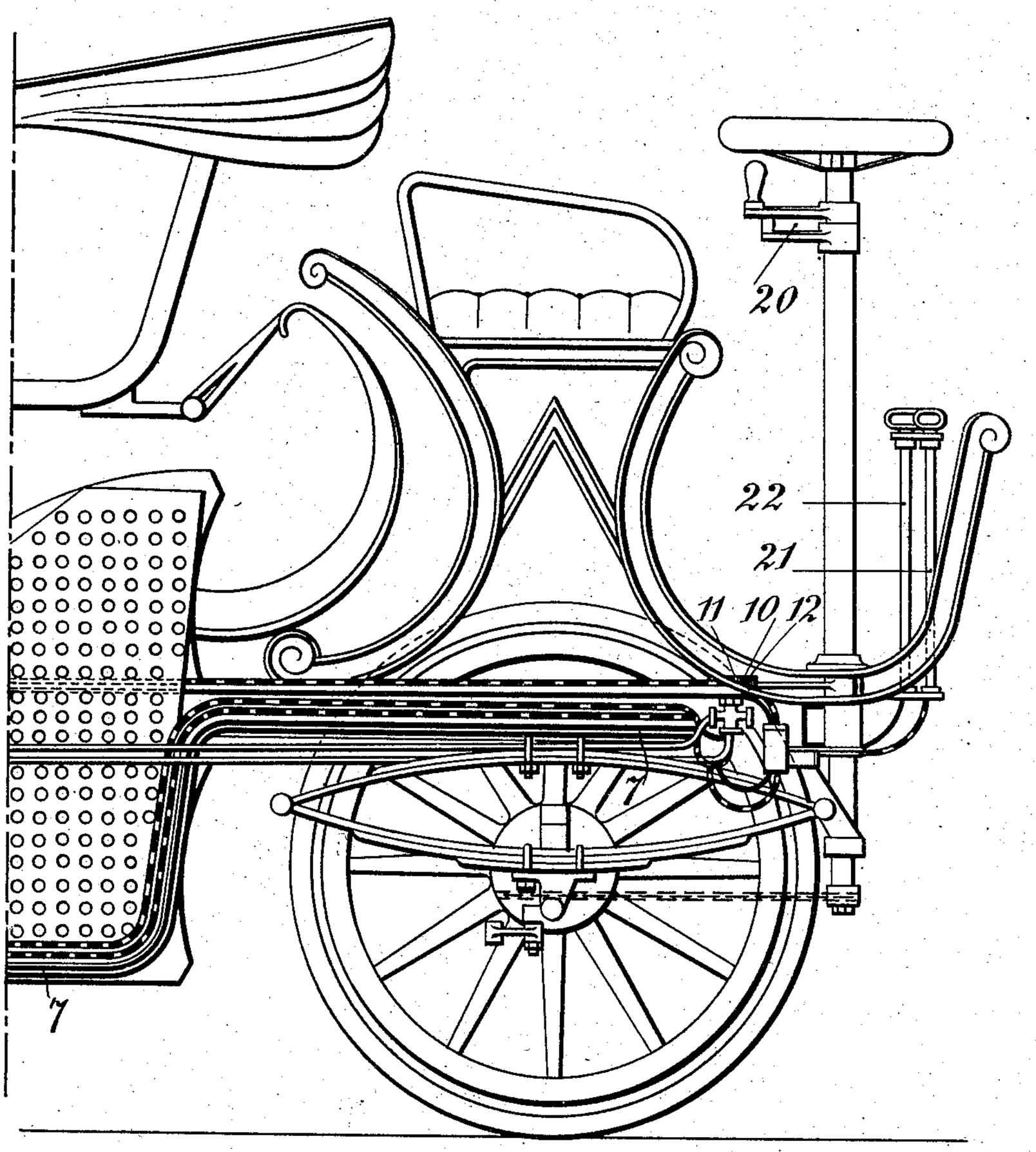
5 SHEETS—SHEET 2.

Fig. 1.ª



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5 SHEETS—SHEET 3.

Fig. 4.

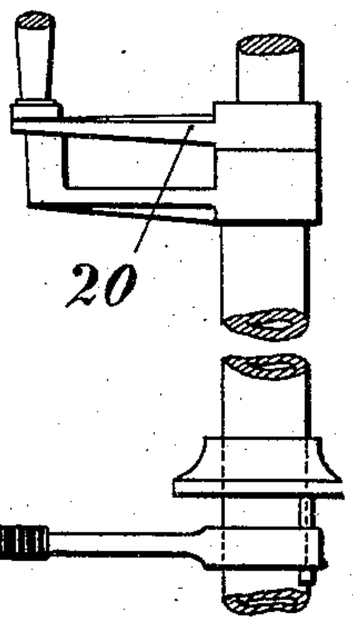


Fig. 5.

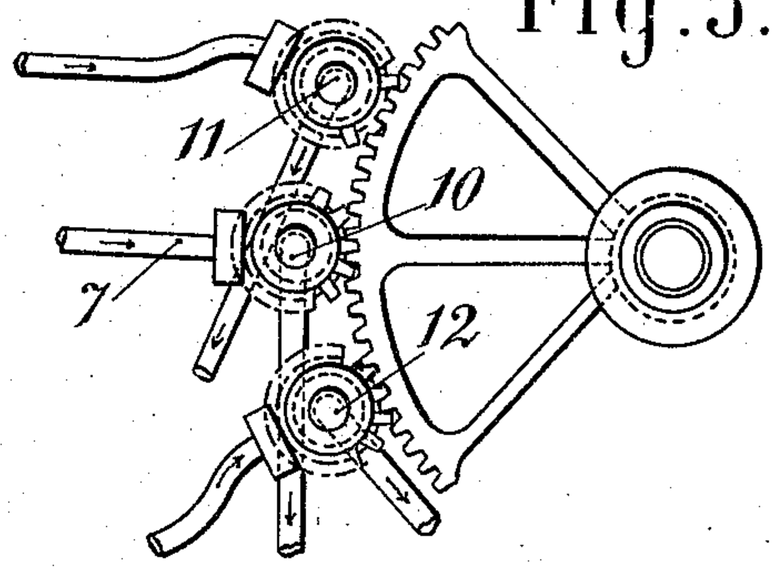
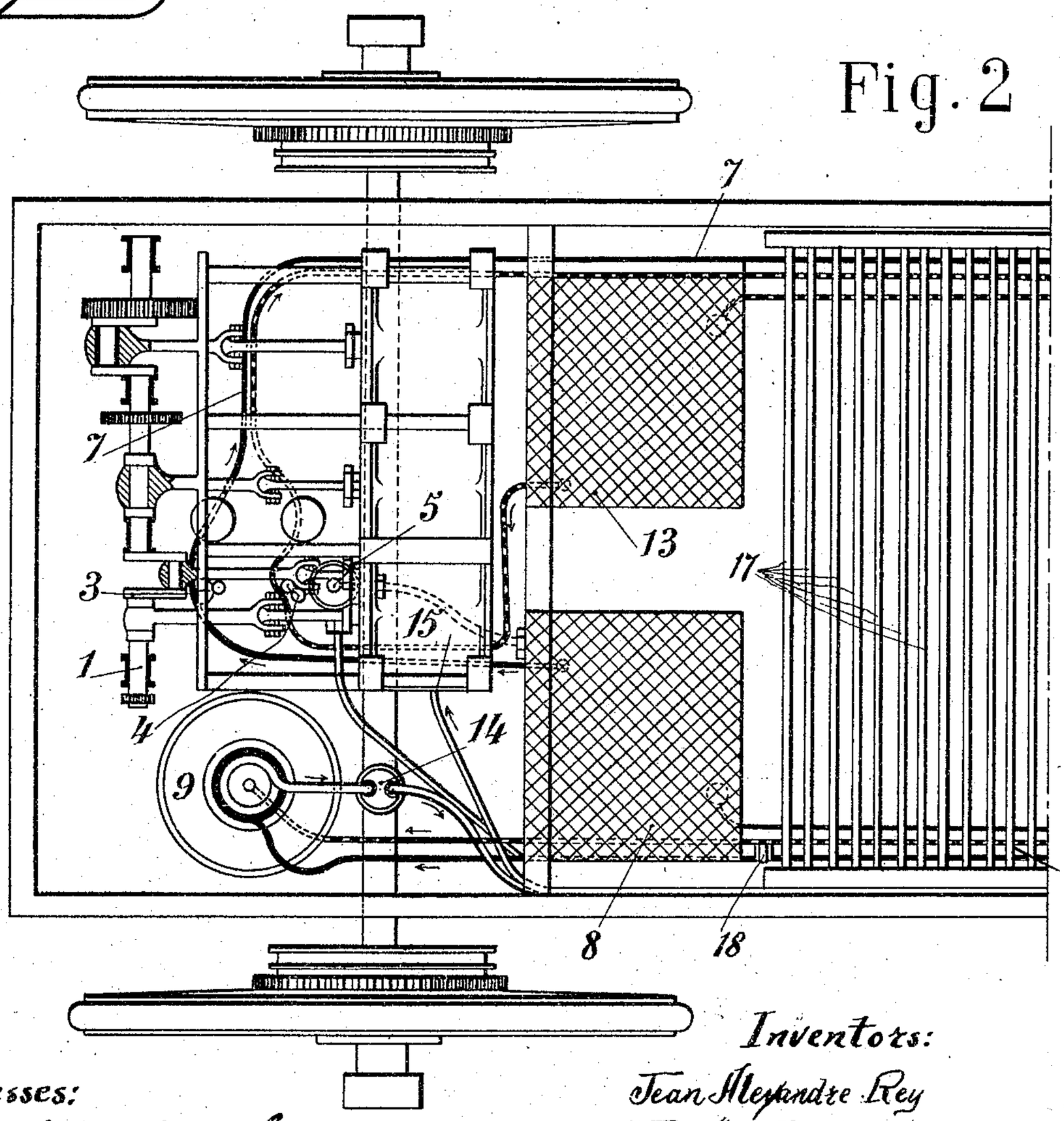


Fig. 2



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5 SHEETS—SHEET 4.

Fig. 3.

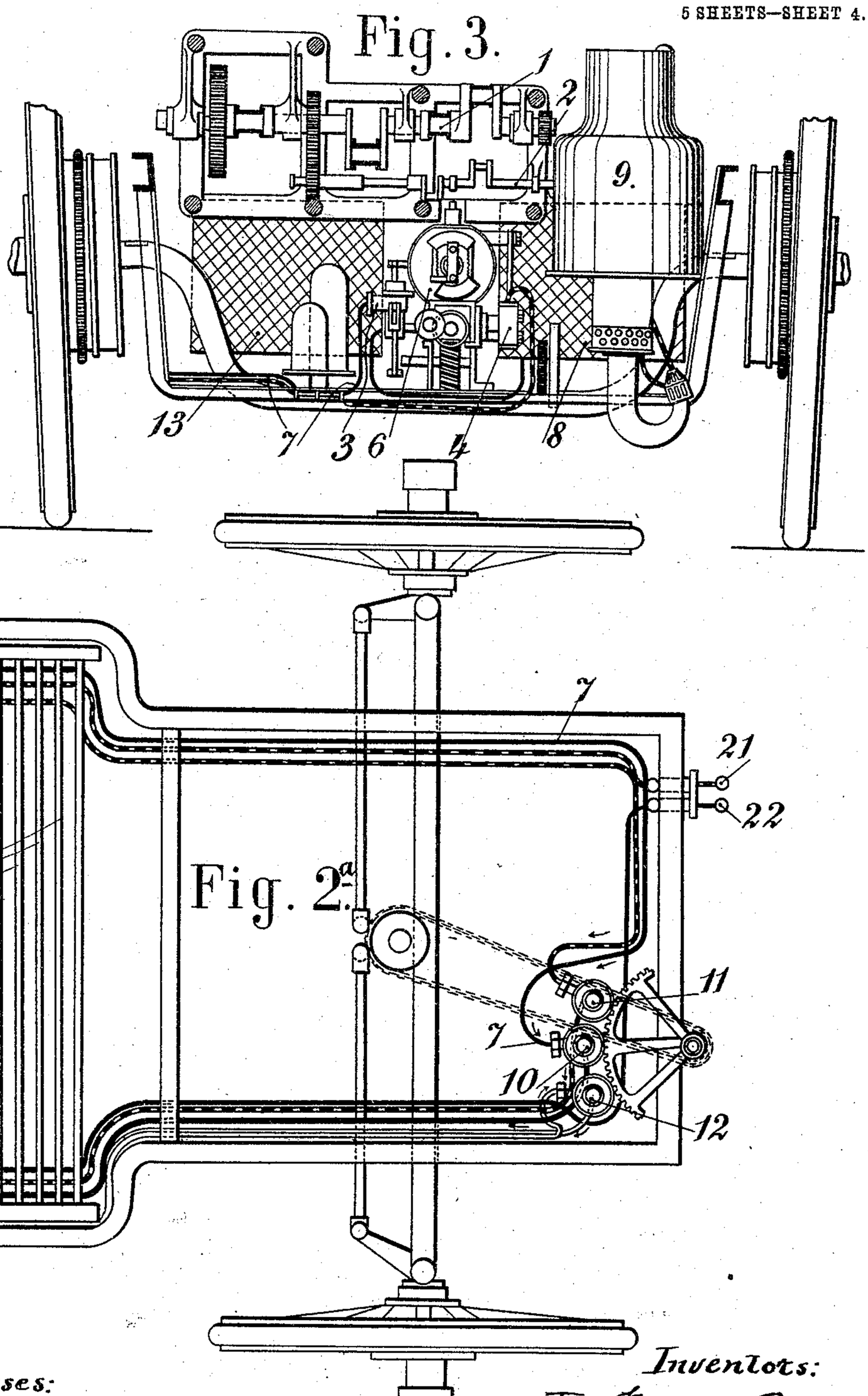

Fig. 2a.

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5 SHEETS—SHEET 5.

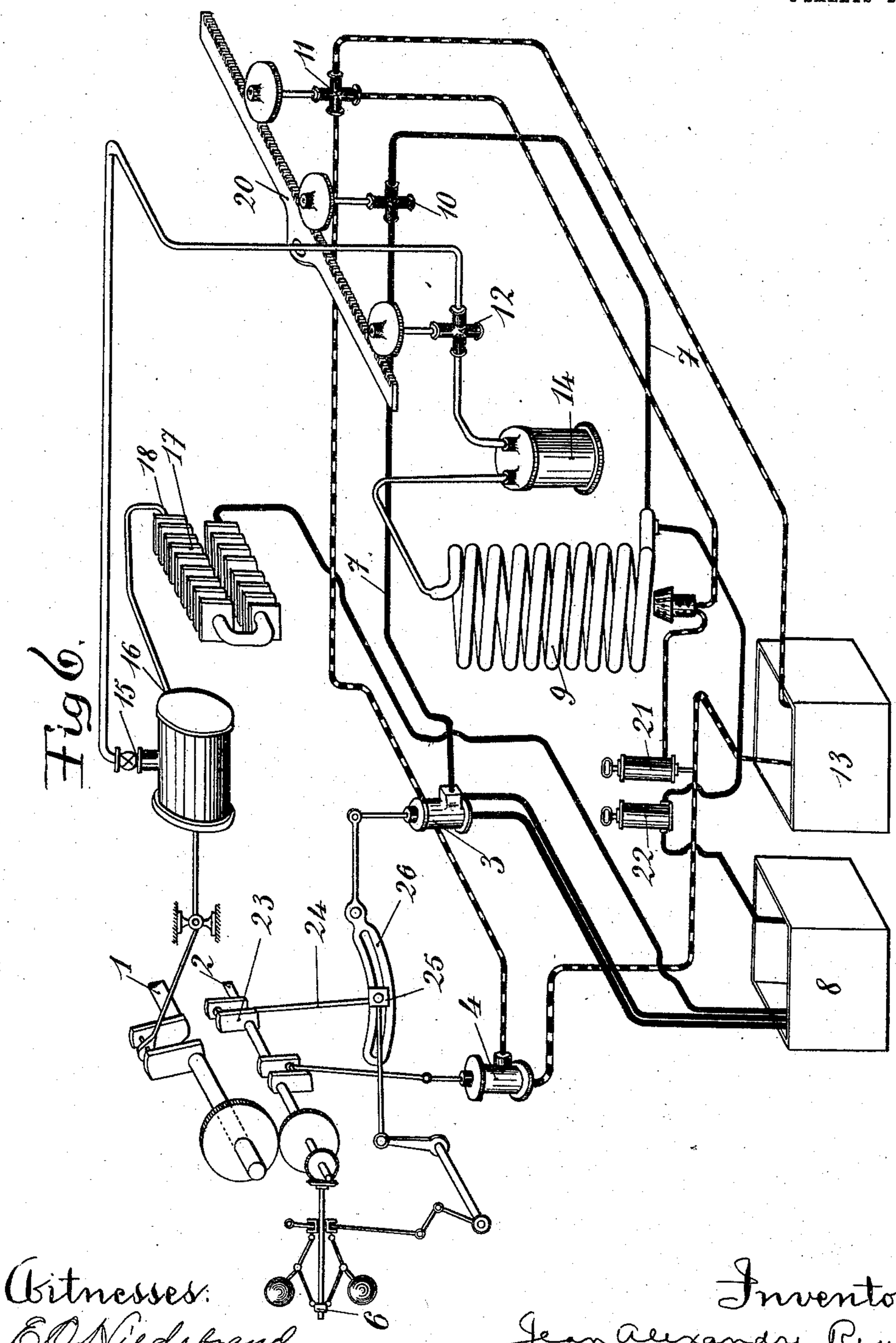

Fig 6.

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No. 782,624. Patented February 14, 1905.

UNITED STATES PATENT OFFICE.

JEAN ALEXANDRE REY AND JEAN MARC BARTHÉLEMY REY, OF PARIS, FRANCE.

STEAM-MOTOR CAR.

SPECIFICATION forming part of Letters Patent No. 782,624, dated February 14, 1905.

Application filed March 24, 1903. Serial No. 149,302.

To all whom it may concern:

Be it known that we, JEAN ALEXANDRE REY and JEAN MARC BARTHÉLEMY REY, residing at Paris, France, have invented a new and useful Improvement in Steam-Motor Cars in which the Motive Power is Automatically Controlled, which improvement is fully set forth in the following specification.

This invention relates to steam-motor cars, and particularly to the means for regulating the supply of fuel to the burner, water to the boiler, and steam to the motor. In motor-cars of this type it is of the greatest importance that the feed of the fuel, water, and steam shall be exactly proportioned to meet the varying demands upon the system due to differences in speed and in motive power required at varying speeds. In the first place it is necessary to avoid the introduction into the boiler of a volume of water greater or less than the evaporating power of the furnace. It is also important that the supply of fuel to the furnace shall be sufficient but no greater than is necessary to convert the water supplied to the boiler into the amount of steam consumed by the motor under these conditions. If the fuel and water feed pumps are directly driven by the vehicle, their speed will vary with the speed of the vehicle and the quantity of water injected into the furnace may exceed the demand for steam—as, for instance, in descending grades. On the other hand, in climbing hills, at which time the boiler should furnish the motor with the greatest amount of steam, the low speed of the vehicle would cause the fuel and water pumps to supply an insufficient quantity. While it has been attempted to overcome these difficulties by providing the pumps with mechanism permitting the driver to alter their speed independently of the vehicle, this arrangement is open to the objection that it requires the constant attention of the driver, and if he overlooks the adjustment of the pumps when the conditions vary the volume of water and fuel may become too large or too small, resulting in delay and damage. In order to overcome these objections, we have by the present invention made the control of the motive power in a sense automatic, a single movement being sufficient to alter the power of the generator and the motor, it not being necessary for the driver to occupy himself with the proportioning of the heat to the boiler-feed or the production of steam to the consumption of the motor. We accomplish this object by equipping the water-pump with a special centrifugal governor, which maintains its delivery constant whatever may be the speed of the vehicle, the travel of the pump-piston being rendered inversely proportional to the speed. Its delivery thus remains constant at all speeds and is adjusted to the maximum quantity which can be vaporized in the boiler. In the path of the water-pump to the boiler and of the fuel-pump to the burner and also of the steam from the boiler to the motor are arranged valves which limit the supply of each, respectively. The three valves—water, fuel, and steam—are operated by a single driving wheel or lever under the control of the driver. Their openings are such that by one adjustment the water, steam, and fuel are delivered in proper proportions under all conditions. Any excess of water or fuel not required by the boiler or burner is returned to the suction side of the respective pump.

In the accompanying drawings the improved system is shown as embodied in a motor-vehicle.

In the drawings, Figures 1 and 1ª together constitute a side elevation of the vehicle, partly in section. Figs. 2 and 2ª together constitute a plan of the same, showing the interior mechanism. Fig. 3 is a rear view of the vehicle. Figs. 4 and 5 are detail views showing the method of regulating the valves, and Fig. 6 is a diagrammatic view showing the relation of the various parts of the circulating system.

The operation under ordinary conditions is as follows: The main motor-shaft 1 through the intermediary of gearing shown in dotted lines in the drawings drives the shaft 2, which drives the three pumps—viz., the feed-water pump 3, the petrol-pump 4, and the vacuum-

pump 5. The feed-water pump 3 under the action of the governor 6 pumps a constant volume, whatever may be the speed, into pipe 7. In the body of the pump 3 is placed, in the delivery, a spring-valve. (Not shown in the drawings.) When the pressure generated by the pump is greater than the effect of the spring, the said valve is raised and a portion of the delivery-water returns to the hot-well 8 containing the feed-water. On the other hand, the pressure generated by the pump 3 is equal to the pressure in the boiler 9, increased by the loss of charge occasioned by the throttle-valve 10, placed at the entrance into the boiler. When the valve 10 is entirely open and the whole of the system is working with a full pressure in the boiler, the pressure generated by the pump 3 is substantially equal to that of the boiler. The spring-valve of the pump 3 therefore limits the pressure to a rate fixed beforehand. If the boiler exceeds the pressure limited by the valve, it opens and the water returns to the aspiration, proportionally lessening the volume introduced into the boiler 9. It will be seen, therefore, that the combination of the valve 10 and the pump 3, of constant delivery, provided with a delivery-valve, prevents the pressure in the boiler exceeding the limits fixed, and, moreover, the volume of water really introduced into the boiler varies, at the will of the driver, from zero to the total delivery furnished by the pump 3, whatever may be the speed of the vehicle. The petrol taken from the tank 13 by the pump 4 passes through the valve 11 and passes out directly into the furnace. The pump 4 has a delivery varying with the speed, there being no governor; but it possesses, as does the water-pump, a spring-valve placed on the delivery in communication with the aspiration. The size of the petrol-pump is such that at the lowest speed of the vehicle—for example, in ascending—it delivers a quantity of petrol greater than the furnace can consume under the limited pressure of the governing-valve. The said valve is therefore always open, and a portion of the petrol returns from the delivery to the aspiration. The volume really introduced into the burner is thus regulated by the opening of the valve 11, which is in accordance with the valve 10 for water, they being actuated in common. The steam at the outlet from the boiler passes into the purge 14, which is provided with a safety-valve. It then passes to the valve 12 in order to return to the motor, into which it passes at the point 15. It passes out through 16 and from thence to the condenser 17 through 18 and 19. At the same time that the driver varies the opening of the valve 12 for steam he also alters the orifice of the valve 11 for the petrol and of the valve 10 for water. The valves 12, actuated by a lever 20 common to the valve 10, allows the pressure of admission into the motor to be governed, and consequently the speed of the vehicle. When the driver wishes to slow down, he partially throttles the outlet of steam from the boiler by acting upon valve 12. The pressure in the boiler increases, while the volume of feed-water introduced, as well as the weight of fuel injected into the burner, diminishes. A new state of equilibrium is established which corresponds to a decreased motive power. On the contrary, if the driver increases the opening of the valve 12 the delivery of steam and the pressure of admission into the motor increases, the heat produced by the furnace and the volume of water increasing in the same proportion.

It should be remarked that the automatic control allows the maximum power to be obtained whatever may be the speed of the vehicle—that is to say, as well on a steep incline at a low speed as on the levels at great speed, and consequently at all intermediate speeds.

Whatever may be the speed of the vehicle, the drowning of the boiler is impossible, because the volume of water introduced is governed by the valve for the water, so worked that the heating power of the furnace shall not be exceeded, the weight of petrol consumed and that of water remaining always in the same ratio. The valves being open to their fullest extent at the maximum speed, the weight of water introduced into the boiler can never exceed the constant delivery furnished under the pump 3 by the action of its governor 6. The fuel consumed is then equal to the maximum weight of that which the furnace can burn under the limited pressure of the petrol-pump 4.

None of the above-mentioned evils can take place, and the control takes place automatically.

Lastly, it may be mentioned that the use of the condenser 17 of a suitable capacity, combined with an air-pump 5, allows all the vaporized water to be collected, and it may consequently be used for an indefinite time in the form of distilled water of perfect purity, which is an important condition when there is question of feeding a rapidly-evaporating boiler.

The vehicle is started by means of the hand-pumps 21 and 22, placed in the path of the petrol and the water. The furnace being first heated by means of a flame of alcohol, petrol is injected at 21. For this purpose the petrol-valve 11, placed in the zero position, is not entirely closed. It leaves a sufficiently large passage for the delivery of a quantity of petrol, under the pressure of several kilos, sufficient to maintain a small flame. If it be desired to start, water is injected into the boiler through 22, generating the required pressure. When once the vehicle has started, the pumps 3, 4, and 5 are in action and automatically distribute.

The arrangement above described may also

be applied to tramway or main-line locomotives heated by a liquid fuel. Their general conditions are, indeed, the same.

We claim—

1. In a power system, the combination, with a furnace, a boiler, a motor, and suitable connections, of a fuel-pump, a water-pump, valves located respectively between the fuel-pump and the furnace, between the water-pump and the boiler and between the boiler and the motor, and means for simultaneously operating said valves.

2. In a power system, the combination, with a furnace, a boiler, a motor, and suitable connections, of a fuel-pump driven by the motor and having a delivery varying therewith, a water-pump driven by the motor, means for maintaining a substantially uniform discharge from the water-pump at all speeds, valves located respectively between the fuel-pump and the furnace, between the water-pump and the boiler, and between the boiler and the motor, and the means for simultaneously operating said valves.

3. In a power system, the combination, with a furnace, a boiler, a motor, and suitable connections, of a fuel-pump, a water-pump, valved passages connecting the pressure and suction sides of the two pumps, valves located respectively between the fuel-pump and the furnace, between the water-pump and the boiler, and between the boiler and the motor, and means for simultaneously operating the three valves.

4. In a power system, the combination, with a furnace, a boiler, a motor, and suitable connections, of the fuel-pump driven by the motor and having a delivery varying therewith, a water-pump driven by the motor, means for maintaining a substantially uniform discharge from the water-pump, by-passes from the delivery to the suction side of the pumps, three valves located respectively between the fuel-pump and the furnace, between the water-pump and the boiler, and between the boiler and the motor, and means for simultaneously operating said valves.

5. In a power system, the combination, with a furnace, a boiler, a motor, and suitable connections, of a fuel-pump driven by the motor and having a delivery varying therewith, a water-pump driven by the motor, and means for varying the travel of the pump-piston inversely to the speed of the motor, by-passes from the delivery to the suction side of the two pumps, spring-pressed valves controlling said by-passes, three mechanically-operated valves located respectively between the fuel-pump and the furnace, between the water-pump and the boiler, and between the boiler and the motor, and means for simultaneously operating said valves.

6. In a power system, the combination, with a furnace, a boiler, a motor, and suitable connections, of a fuel-pump driven by the motor and having a delivery varying therewith, a water-pump driven by the motor, and means for varying the travel of the pump-piston inversely to the speed of the motor, by-passes from the delivery to the suction side of the two pumps, spring-pressed valves controlling said by-passes, three mechanically-operated valves located respectively between the fuel-pump and the furnace, between the water-pump and the boiler, and between the boiler and the motor, and means for simultaneously operating said valves, consisting of a toothed segment gearing therewith and provided with an operating-handle.

In testimony whereof we have signed this specification in the presence of two subscribing witnesses.

JEAN ALEXANDRE REY.
JEAN MARC BARTHÉLEMY REY.

Witnesses:
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AUGUSTUS E. INGRAM.