(No Model.) 3 Sheets—Sheet 1.

R. R. ZELL.

SODA MOTOR.

No. 457,831. Patented Aug. 18, 1891.

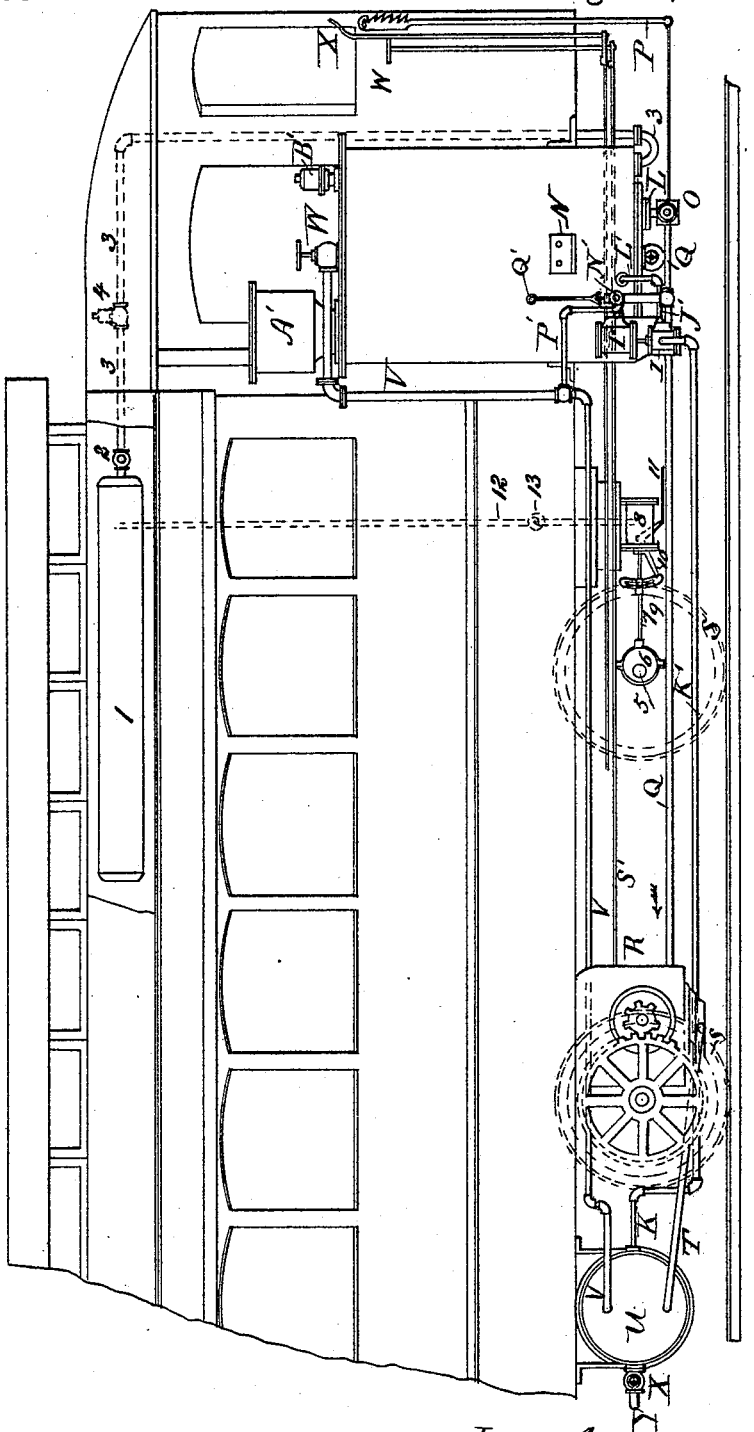

Fig. 1

Witnesses
J. B. Evans
Geo. P. Flenner

Inventor
Robert R. Zell
By J. Stuart Clark
Atty.

(No Model.) 3 Sheets—Sheet 2.

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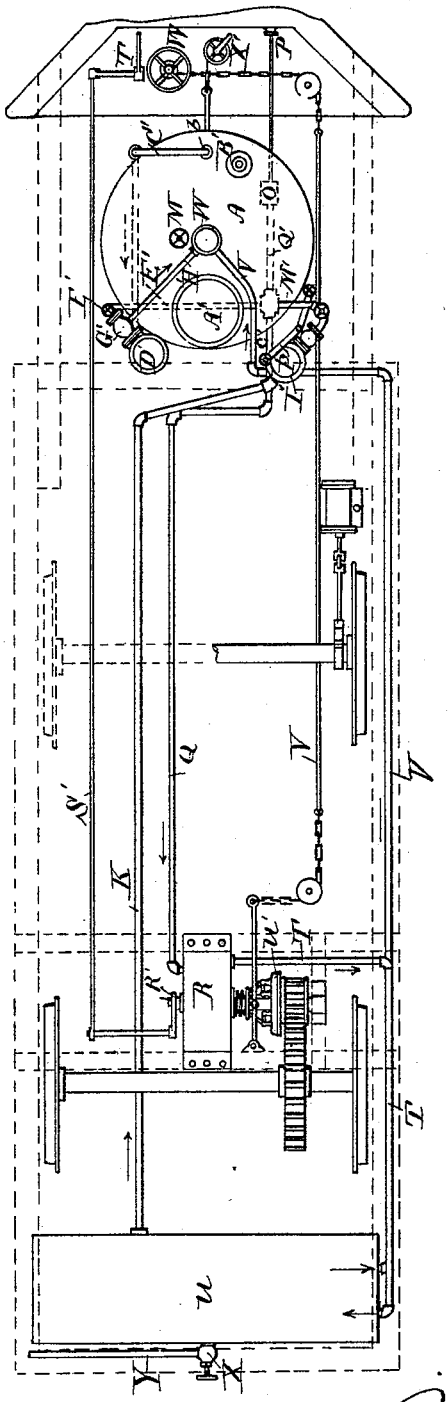


Fig. 2

Witnesses
I. B. Evans
Geo. P. Flinn.

Inventor
Robert R. Zell
By J. Stuart Black
Atty

(No Model.) 3 Sheets—Sheet 3.

R. R. ZELL.

SODA MOTOR.

No. 457,831. Patented Aug. 18, 1891.

Fig. 4

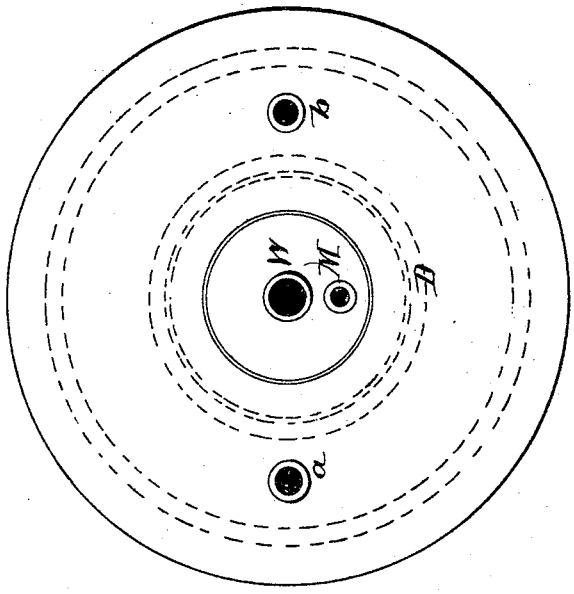
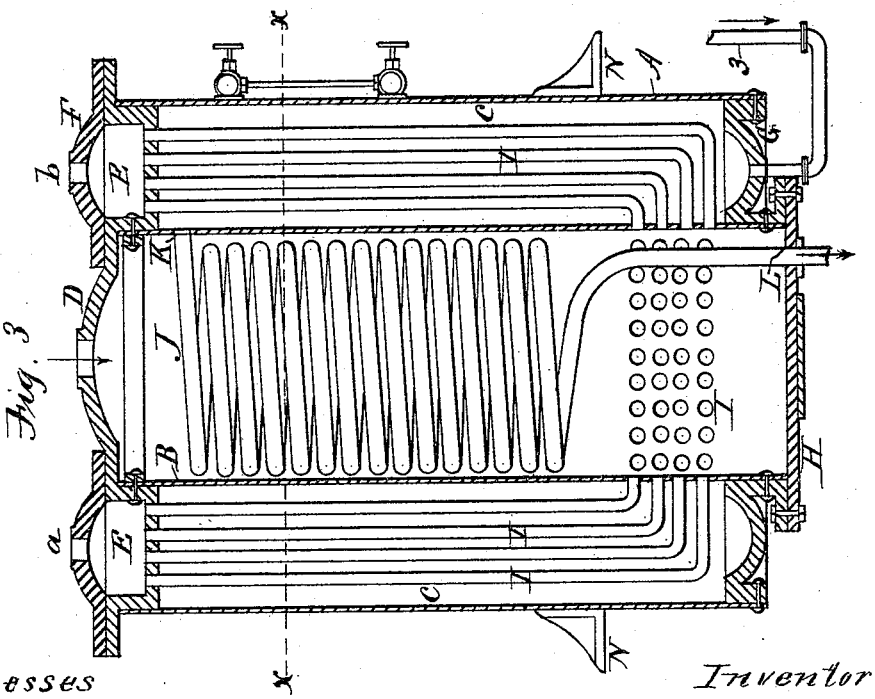


Fig. 3



Witnesses
J. B. Evans
Geo. P. Flinn.

Inventor
By Robert R. Zell
J. Stuart Rudy,
Atty

UNITED STATES PATENT OFFICE.

ROBERT R. ZELL, OF BALTIMORE, MARYLAND, ASSIGNOR TO THE ZELL STORED POWER COMPANY, OF SAME PLACE.

SODA-MOTOR.

SPECIFICATION forming part of Letters Patent No. 457,831, dated August 18, 1891.

Application filed February 20, 1891. Serial No. 382,269. (No model.)

To all whom it may concern:

Be it known that I, ROBERT R. ZELL, of Baltimore, in the State of Maryland, have invented a new and useful Improvement in Soda-Motors, of which the following, taken in connection with the accompanying drawings, is a specification.

My invention relates to improvements in soda-motors, and particularly in that class of soda-motors which are intended for use upon street-cars, such as have been fully described in my applications for Letters Patent filed November 6, 1890, Serial Nos. 370,512 and 370,513.

My invention consists in utilizing compressed air to mingle with the steam in the motor, this air serving as a carrier for the water of the partially cooled and condensed steam in the motor-exhaust on its way to the soda-generator. The air, also, in being heated by the steam is expanded and has its pressure raised, thus enabling it to act as an efficient motor-fluid in the engine, and the steam acting also as a lubricant for the air.

My invention also consists in the particular apparatus to be used in effecting the starting of the motor by means of compressed air, all of which will be disclosed in the following specification, and the accompanying drawings, forming part thereof, and in which—

Figure 1 is a vertical longitudinal section of a motor-car disclosing the apparatus employed. Fig. 2 is a plan of the apparatus as arranged beneath the car-platform. Fig. 3 is a vertical section of the motor-generator, and Fig. 4 is a plan of the same.

Referring to Figs. 3 and 4, A is the exterior shell of the generator, and B an interior shell, leaving an annular water-space C between the two shells.

G is an annular cover forming the bottom of the annular water-space, and D is the upper head of the generator, provided with the annular pocket E.

F is a cover over the circular pocket E.

I and I represent pipes leading from the space E downward through the water-space and then bending inwardly to connect with the interior of casing B.

H is the bottom for the soda-space contained within the shell B.

X X represent the water-line, and, also, the soda-line, when there is no pressure in the apparatus.

K is an opening to the steam-space, to which connects the steam-pipe J, which is in the form of a coil passing down through the soda and out through the bottom H at L.

N and N are the flanges or brackets by means of which the generator is secured in place upon the car.

O is a throttle-valve in the steam-pipe J, and it is operated by means of the handle P. From the throttle-valve O the pipe Q leads steam to a motor R.

R′ is the reversing-valve for the motor, and it is provided with the rod S′ and reversing-lever T′.

T is the exhaust-pipe of the motor, which leads through a condenser and feed-water heater U.

X and Y represent the valve and pipe by means of which the tank U is charged with water at the station.

V is the pipe leading the exhaust-steam, after having passed through the water-tank U, to the valve W, which permits it to enter into the space above the concentrated alkali, such as soda, potash, chloride of calcium, &c.

At *a* a gas-absorber A′ is attached, and at *b* there is a pipe C′ leading to a vacuum-pump whose steam-cylinder is at G′, steam coming from the main steam-pipe Q through the branch pipe E′ and valve F′. The exhaust-steam of this vacuum-pump passes to the valve W and to the soda-space. The heated feed-water from tank U passes by pipe K to a pump I, and then by pipe L′ into the water-space of the generator. The steam for the steam-cylinder I′ of the feed-pump comes from a branch pipe leading from the main Q, the branch pipe being provided with a throttle-valve N′ and handle Q′. The exhaust-pipe P′ from the feed-pump leads into the engine exhaust-pipe V, and thus the exhaust-steam of the pump also passes into the soda. The absorption of the exhaust-steam by the soda liberates heat, which generates steam in the water-space surrounding the soda. The steam operates the engine and the vacuum and feed pumps. The vacuum-pump acts to draw the steam downwardly through

the soda, thus making a more ready absorption and at the same time maintaining a better vacuum and reducing the back-pressure upon the various motor-pistons. In passing through the tank U, the feed-water is heated and the exhaust-steam is partially cooled and condensed, rendering it more readily absorbed by the soda.

So far the devices described are the same as those already described in my above-named applications, Serial Nos. 370,512 and 370,513, and I do not herein claim them *per se* in this application.

The devices constituting my present improvements as illustrating the methods of operation herein claimed are: the air-tank 1, conveniently located in the roof of the car. A stop-valve and branch pipe 2 are used for charging the tank with compressed air from the stationary compressors at the terminals and way-stations. 3 is a pipe leading from tank 1, and 4 is any desired form of pressure-regulator or "reducer." The pipe 3 leads to the bottom of the water-space, as shown in Fig. 3. A stop-valve may be inserted in the pipe 3, if found desirable. 5 is one of the car-axles, and to it is attached an eccentric 6, which operates the rod 7, through a link or other device 9 for throwing the eccentric into operation. This link may be shifted by means of the bell-crank 10 and the rod 11, which leads to the working platform. The mechanism just described operates, when thrown into gear, to compress air by means of the mechanism such as the compressor-cylinder 8 and to deliver it through pipe 12, by check-valve 13, to the tank 1.

At the station the water and soda spaces of the generator are filled, respectively, with highly-heated water and concentrated alkali. The water-tank is filled with cool water and the air-tank is filled with compressed air at any desired pressure, depending upon the size and strength of the tank. The pressure-regulator 4 is set to control the flow of air at a working-pressure of, say, seventy-five pounds to a square inch. The air flows from the regulator to the water-space of the generator and fills the steam-space with air at the working-pressure, so that instead of charging the generator with highly-heated water, which liberates steam under pressure, cold water even may be used, the air-pressure taking the place of the liberated steam until, through the action of absorption of the exhaust-steam from the motor, steam is generated in the soda-generator. The compressed air in passing through the body of the water becomes thoroughly saturated with moisture, so that on passing through the motor the exhaust contains sufficient water to lubricate the cylinder of the motor and thus prevents excessive friction. The compressed air thus acts as a carrier for the particles of water-vapor, both for use as a lubricant and for the generation of steam through absorption. After steam has been generated in the water-space the combined air and steam will pass to the motor, the compressed air being greatly increased in pressure by the addition of the heat of the steam and the exhaust-steam which is cooled by passing through the condenser feed-heater, and which assumes the "vesicular" state, is still more readily carried to the absorber-generator by the compressed air. Should the engine be stopped the back-pressure in the generator immediately rises, and as the working-pressure is exceeded the pressure-reducer valve 4 closes and retains the pressure in the air-tank. On operating the engine again this pressure will flow from the tank to the steam-space and thus to the motor. While going downgrade the momentum of the car is usually wasted by applying brakes. By throwing the air-pump 8 into operation a part of the energy of the car may be saved by compressing air into the tank 1, thus keeping it supplied with the maximum pressure. Proper pressure-gages (not shown) will indicate the safe pressures to be used. As in my former application, the vacuum-pump will reduce the back-pressure on the motor-pistons and cause the soda to be agitated as the exhaust is drawn through it, thus increasing the rapidity and effectiveness of the absorption.

It is obvious that my invention may be used for stationary purposes, as in machine-shop work or pumping, &c.

I do not herein claim the method of operation disclosed in this application, as I have applied for the same in application for Letters Patent filed March 18, 1891, Serial No. 385,506.

I am aware that it is not new to use compressed air carried in tanks to act as motive power upon a car, nor is it new to pass the air through a body of hot water carried by the car to increase its pressure; but I believe that I am the first to use these devices in connection with a soda-generator in the manner above described. I therefore believe the same to be new; and

What I desire to secure by Letters Patent of the United States is—

1. In an alkali-motor, the combination of the water and the alkali chambers, a pipe leading a mixture of compressed air and water-vapor into the alkali-chamber, and a vacuum-pump for drawing the mixture through the alkali, substantially as described.

2. In an alkali-motor, the combination of the water and the alkali chambers, a motor operated by a mixture of steam and air, an exhaust-pipe from the motor leading into the alkali-chamber, and a vacuum-pump for drawing the mixture through the alkali, substantially as described.

3. In an alkali-motor, the combination of the water and the alkali chambers, a motor operated by a mixture of steam and air, and an exhaust-pipe leading from the motor and

conducting the mixture to the alkali-chamber, the air acting as a carrier for the steam, substantially as described.

4. In an alkali-motor, the combination of the water-chamber and the alkali-chamber with a pipe for conveying the mixture of steam and air into the alkali-chamber, the air serving as a carrier for the water in the steam, substantially as described.

5. The combination of a closed water-chamber, a closed vessel containing caustic alkali in contact with the water-chamber, a pipe leading compressed air into the water-chamber, a pipe leading mixed steam and air to a motor, and a pipe leading the exhaust of the motor to the alkali-chamber, substantially as described.

6. The combination of a boiler, an alkali-chamber for heating the boiler, a compressed-air tank, a pipe, and a pressure-regulator conducting the air into the boiler, a motor operated by the mixture of air and steam from the boiler, and an exhaust-pipe from the motor to the alkali-chamber, substantially as described.

7. The combination of a boiler, an alkali-chamber for heating said boiler, a compressed-air tank, a pressure-reducer, and a pipe conducting the air to the boiler, a motor supplied from the boiler, an exhaust-pipe leading from the motor to the alkali-chamber, and a vacuum-pump for drawing the exhaust through the alkali, substantially as described.

8. The combination of a boiler, an alkali-chamber for heating the boiler, a source of compressed air, an air-pump and pressure-regulator conducting the air to the boiler, a motor supplied from the boiler, an exhaust-pipe from the motor, and a feed-water tank heated by said exhaust, the exhaust being cooled thereby and then passing into the alkali-chamber to generate the heat of absorption for evaporating the water in the boiler, substantially as described.

9. The combination of a boiler heated by an alkali-chamber, a compressed-air tank, a pipe and pressure-regulator leading the air into the boiler, a motor operated by mixed steam and air from the boiler, a water-tank for cooling the exhaust of the motor prior to its introduction into the alkali-chamber, and a vacuum-pump for drawing said exhaust through the alkali, substantially as described.

10. The combination of a boiler, an alkali-chamber for heating the same, a compressed-air tank and pipe leading into the boiler, a motor supplied with a mixture of air and steam from the boiler, all mounted upon a street-car, and an air-compressor operated by the motion of the car, substantially as described.

11. The combination of a boiler, an alkali-chamber for heating said boiler, a compressed-air tank, a pipe and pressure-regulator leading to the boiler, a motor operated from the boiler, an exhaust-pipe from the motor to the alkali-chamber, a vacuum-pump connected to the alkali-chamber, all mounted upon a car, and an air-pump operated by the movement of the car to supply said air-tank, substantially as described.

12. The combination of a boiler, an alkali-chamber for heating the boiler, a source of compressed air leading to the boiler, a motor supplied from the boiler, an exhaust-pipe leading from the motor through a water-tank, a vacuum-pump for drawing said exhaust through the alkali-chamber, all mounted upon a car, and an air-compressor operated by the motion of the car to sustain the said air-supply, substantially as described.

In testimony whereof I, ROBERT R. ZELL, have signed my name to this specification in the presence of two subscribing witnesses.

ROBERT R. ZELL.

Witnesses:
I. B. EVANS,
GEO. P. FLINN.