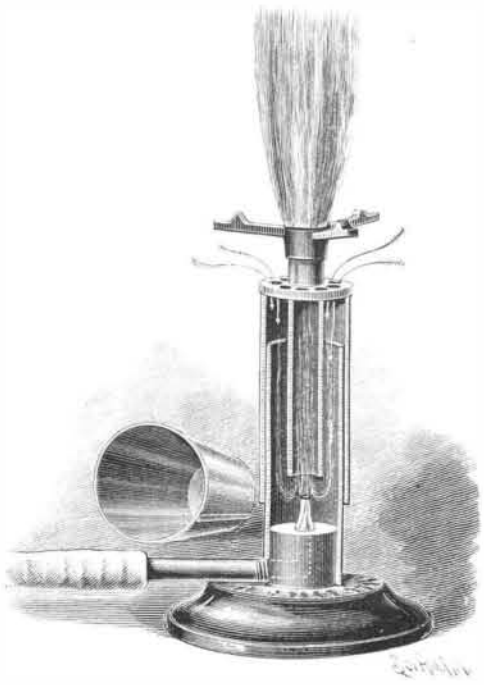
FRIEDBURG'S BUNSEN BURNER.

The Bunsen burner illustrated in the cut is the invention of Prof. L. H. Friedburg, of this city, and is designed for chemical laboratories. It disposes of the troubles incident to the ordinary type of construction, such as the jumping down of the flame and smokiness at the tip. It consists of a base with the usual nipple for attachment of the rubber supply tube, and with a tube terminating in a gas orifice in the center of the base. This orifice is of approximately rectangu-

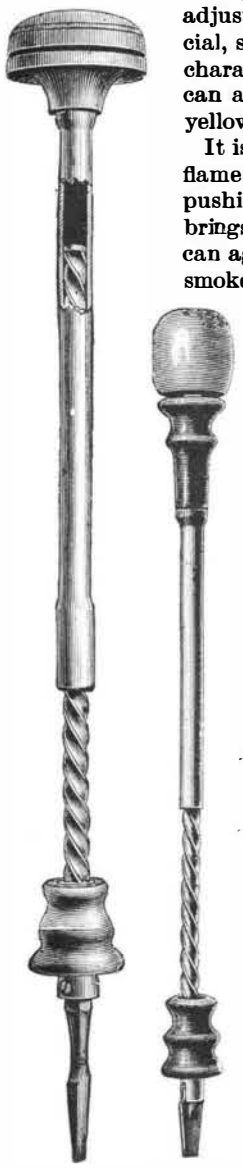


FRIEDBURG'S BUNSEN BURNER.

lar or slot-like form, one easy to clean and which has proved adapted to secure the mixture of air and gas. The base supports a brass tube, about an inch in internal diameter, which surrounds the gas jet like a chimney. A second brass tube telescopes over this one. The top of the telescoping tube is covered with a diaphragm. A circle of holes are drilled in the diaphragm near its periphery, through which the air for mixing with the gas enters. The combustion tube passes through the center of the diaphragm.

In operation the gas is turned on, and entering by the central jet, rises into the central combustion tube, and as it does so draws in air which mixes with it. It is lighted at the top of the combustion tube. A very perfect flame results—showing not the least particle of yellow, provided the telescoping tube is rightly set. It is here that one of its best features appears. By raising the telescoping tube more air is admitted to mix with the flame, and by lowering it the supply can be cut off almost completely. Thus the burner can be adjusted for any gas, natural or artificial, so as to give a proper flame. The character of the flame for a given gas can also be made to vary from a full yellow to a blue superoxidized one.

It is almost impossible to make the flame jump down, but if it should, the pushing down of the telescoping tube brings the flame back, when the tube can again be raised to give the desired smokeless flame. The burner will work in any position. It is proposed to mount some on universal joints, so that they can be inclined in any desired direction. The burner may fairly be said to represent an important advance in laboratory appliances.



REID'S "LIGHTNING" BRACE.

This improved brace is especially designed for light boring and screw driving. It is very quick in its work, and as the power is applied on the top, it may be usedwith great force. It may be used automatically, running the bit both back and forward, or to turn the bit one way only, as is necessary to drive a screw or bore a hole with an auger bit. This is done by means of the divided head, which acts as a fast and loose pulley, there being no ratchet about it to get out of order. It is made strong and durable, the metal part finely polished and nickel plated, and the trimmings of lignum vitæ and rosewood. This brace is manufactured by A. H. Reid, No. 3000 Market Street, Philadelphia, Pa.

STEAM TRAMCARS WITH SERPOLLET'S BOILER.

Mr. Serpollet's generators for the instantaneous production of steam, to which we have several times called the attention of our readers, have, up to the present, been limited to a power of from five to six horses, in consequence of the spiral form given the tubes constituting the element of the boiler. In order to reach a power of from 15 to 20 or more horses, it was necessary to multiply the elements and to substitute for them straight bars grouped quincunxially and mounted in tension, with tubes supporting the high pressures without strain or distortion. This result is now obtained by the use of U tubes that permit of effecting a saving in the weight of the apparatus, of increasing their specific power of vaporization and of thus applying them to locomotion with certain advantages that we shall set forth in taking as an example the application that has just been made of them in the propulsion of tramway cars upon one of the best patronized Parisian lines. The vehicle that is now running in Paris, from the Madeleine to Clichy Place, is an ordinary type of the car of the Tramway Company of Paris and of the Department of the Seine.

The system, as a whole, adapted to the car, in order to render it automobile, motors, generator, accessories, water and fuel, weighs about 1,500 kilogrammes, the car weighing 3,500. The car, empty, in running order, therefore, weighs five tons. With forty passengers of 70 kilogrammes each, the total weight reaches 7,800 kilogrammes.

When the automobile car hauls another weighing, when empty, 3,200 kilogrammes and carrying thirty-two passengers, which represents 5,440 kilogrammes, we reach a total weight of 13,240 kilogrammes.

It is this heavy load that the motive system combined by Mr. Serpollet permits of hauling, with a mechanical part whose weight scarcely exceeds a tenth of the total weight.

The steam generator and the driving apparatus are installed in the front of the car (Fig. 3). These apparatus, few in number, comprise a starting pump, a regulator of speed through a return of feed water to the tank, and a reversing lever.

The motor is fixed beneath the platform, with its axis in the same plane as that of the axles. It consists of two steam cylinders of 13 centimeters internal diameter and 13 centimeters stroke, arranged at each extremity of the car and acting upon the axis through two cranks keyed at right angles.

The entire mechanism is hermetically inclosed in two iron plate boxes, in which are disengaged the vapors of the lubricating oils eventually produced in the running at a high temperature. These two boxes debouch in the ash box through a wide conduit, and it is through the latter that the air enters that supplies the firebox (Figs. 1 and 2). The vapors of oil carried along by the air are consumed on the grate before reaching the chimney. The noise that might be produced by the exhaust is suppressed by the use of a deadening reservoir interposed between the chimney and the exhaust. The cloud of steam is suppressed by the very fact of the use of superheated steam as soon as the system of tubing has reached the normal temperature. The cloud of smoke likewise is suppressed through the use of coke as fuel.

The boiler consists of eighteen elements, each comprising two straight tubes connected by an elbow. These tubes, which are 45 centimeters in length, have the form of an inverted U, and are 12 millimeters in thickness. These eighteen elements, connected in series, are arranged horizontally, and so distributed as to break the ascending column of hot gases. A gutter shape has been adopted in order to increase the rigidity and permit of reaching high pressures without distortion. Instead of working by flexion, the sides work one by traction and the other by compression.

The injection of cold water is effected through the lower part, while the steam at 250 or 300 degrees escapes from the last element in order to reach the valve box. The tubes being arranged at the lower part of the boiler, nearest the firebox, thus always preserve a relatively low temperature, and run no risk of being burned.

Such a boiler weighs only 600 kilogrammes. With a total external surface of tubes of 4 square meters and a grate surface of 26 square decimeters, it produces sufficient steam to develop a power of 20 horses at a pressure of 5 kilogrammes per square centimeter—a power that may reach that of 40 to 50 horses on allowing the pressure to reach from 10 to 15 kilogrammes per square centimeter.

A boiler is heated with coke, which is packed in small boxes each containing a supply sufficient for a run of from 10 to 12 kilometers, and that are put in at the terminus. The quantity of water carried is

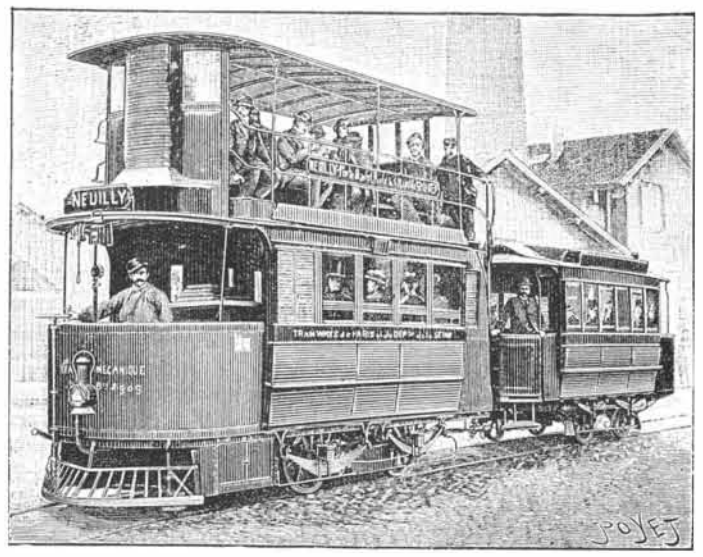


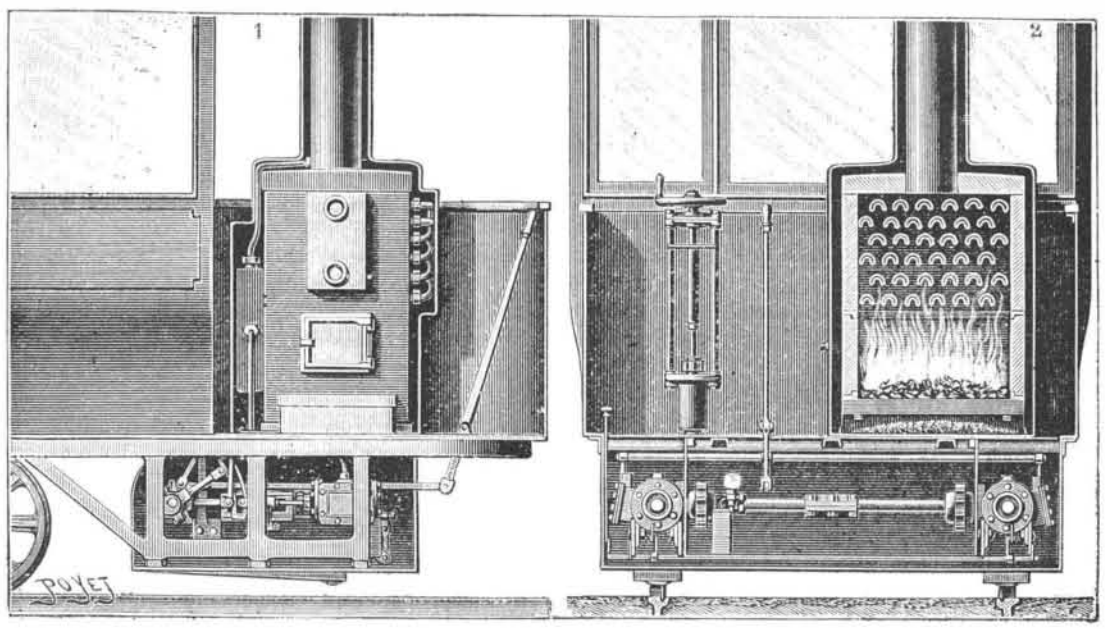
Fig. 3.—GENERAL VIEW OF A SERPOLLET TRAMCAR HAULING ANOTHER CAR.

likewise renewed at the terminus at the rate of about 12 liters per kilometer traversed. The consumption of coke is about 1·7 kilogrammes per kilometer on a level for the automobile car alone.

Incrustation of the boiler can never occur, for every time that the production of steam is arrested, either for the stoppage of the car or descending a declivity, the generator is emptied by a return to the tank. The steam contained in the valve boxes, tubing and generator takes a direction backward in sweeping the sides of the tubes with great force: so, in this sort of application, no other preventive measure is taken against incrustation than that resulting from the very operation of the system.

The order of the products of combustion is itself annulled through an ingenious artifice that we shall describe.

The steam generator is provided, in addition to its masonry, which is insulating from a thermic point of view, with an iron plate jacket between which and the generator there is an annular space for the circulation of a stratum of air. This jacket also surrounds the chimney up to the top of the roof of the imperial; but the real chimney of the generator debouches in this external chimney at a level of 1·5 meters below the upper orifice. The exhaustion of the gases of combustion and of the steam that has



Figs. 1 & 2.—DETAILS OF THE MECHANISM OF SERPOLLET'S STEAM TRAMCAR.