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TRANSFORMATION OF PHYSICAL FORCES.

One of our readers communicates to us an arrangement of the Bunsen battery by means of which he performs a very curious experiment on the transformation of physical forces. The annexed figure shows the general arrangement. The pile is constructed as follows:

The zinc, instead of being tubular and surrounding the porous cup, is a solid cylinder, and is suspended beneath a bell glass, which is itself fixed to a wooden cover that hermetically closes the vessel through the intermedium of wax or cement. The bell glass is closed by a rubber stopper provided with two tubulures. One of these latter gives passage to the copper rod which supports the zinc, and which serves as an electrode, while the other is provided with a tube and cock that gives exit to the hydrogen gas formed. The cock, when opened or closed, opens or closes the circuit. In effect, in the first case, the hydrogen escapes, and, in the second, having no exit, it accumulates in the bell and expels the liquid. The pile then ceases to work, as the zinc is no longer immersed. The carbon and the porous cup containing the acid are arranged alongside of the bell in the usual manner.

The experiment that this pile permits of performing is as follows: The metallic conductors fixed to the two poles are connected with a small electric motor, which operates as soon as a contact is established. The disengaged hydrogen is led by means of a rubber tube beneath the boiler of a small steam engine, and, when lighted, soon boils the water and sets the engine running.

We thus have at the same time a generator of heat and electricity. This is a pretty lecture experiment, and we recommend it to physicists.—*La Nature*.

ESTRADE'S HIGH SPEED LOCOMOTIVE.

Our collaborator Mr. Audra has already described* Mr. Estrade's conception of a type of railway rolling

* See SUPPLEMENT, p. 5556.

stock of a speed such as has never as yet been attained. Such conception is at length a reality, and there may now be seen in the shops of Messrs. J. Boulet & Co., of Paris, the locomotive and its tender entirely mounted and ready to operate. It is impossible not to be struck by the character of grandeur and power

already arisen. It is to be wished that some experiments shall soon be performed, either upon the lines of our large companies or upon those of the State. They will be deeply interesting and instructive. It does not appear doubtful that it will be possible to reach the high speeds of from 72 to 78

miles, for which this locomotive has been constructed. The equal size of the locomotive wheels, and of those of the cars, will, doubtless, in a great measure diminish the resistances of friction, and permit of gaining in speed.

It must be noted that the fore axle of the locomotive, although coupled with the others, is provided with hinged grease boxes. On properly slowing up, then, it does not seem that it will be impossible to turn curves of the usual radius.

This granted, we can appreciate what peculiar services will be rendered by rolling stock of this kind in the India mail service and on the great rectilinear lines of Russia, Asia, and the New World, and everywhere, in fact, where it is desirable to cross with exceeding rapidity great desert

TRANSFORMATION OF PHYSICAL FORCES.

of this beautiful engine, with its six driving wheels, of one diameter in common of $8\frac{1}{4}$ feet, mounted upon three coupled axles.

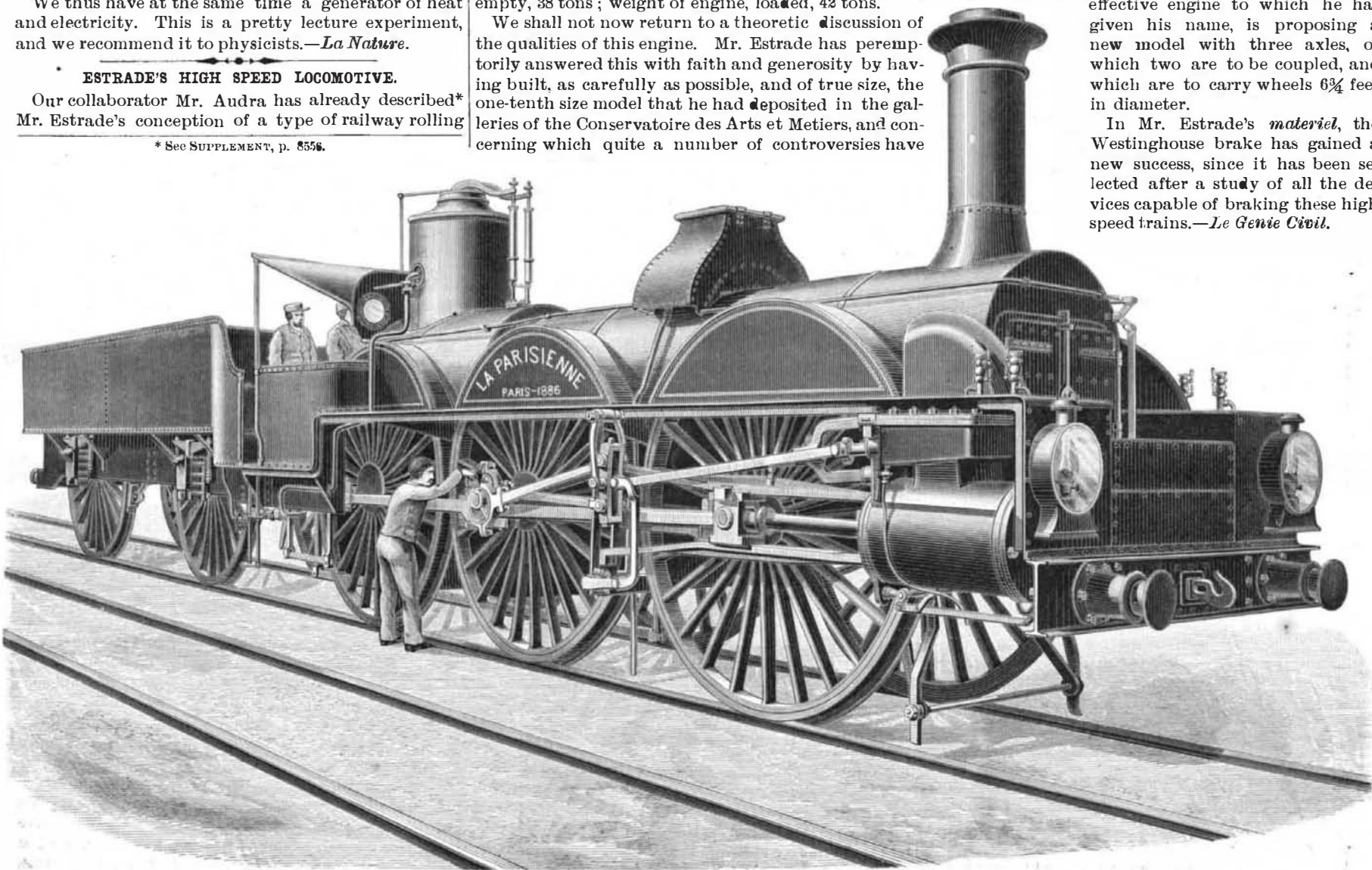
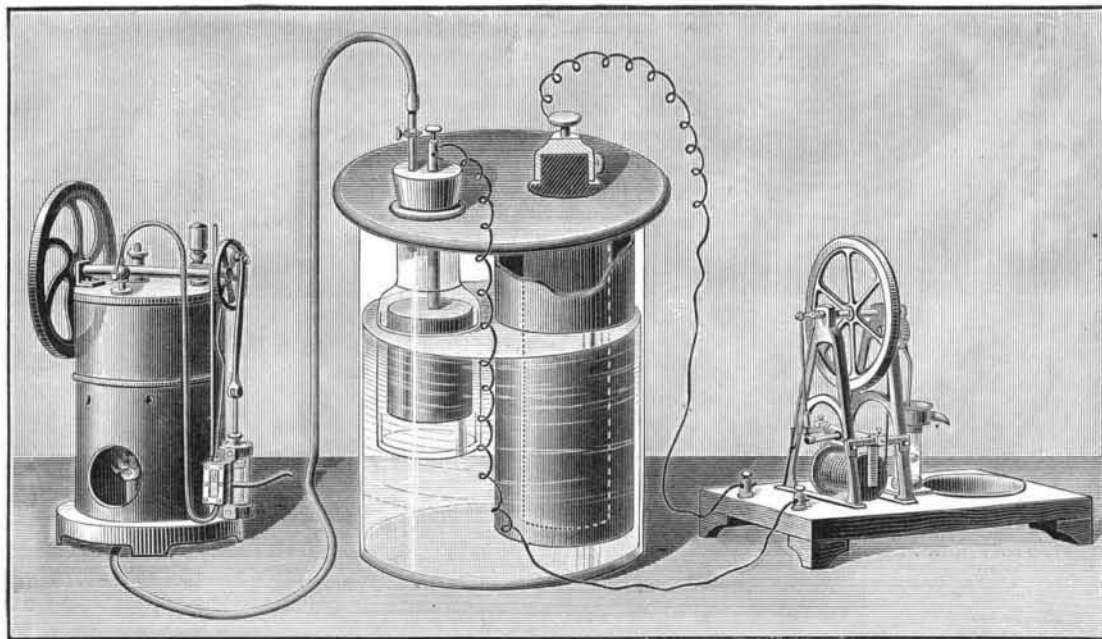
The inventor's idea, it will be remembered, consists in generalizing the use of wheels of large diameter, in the extension, to high speeds, of the coupling of the axles of the motor, and in the adoption of a new and well studied style of double suspension.

The principal dimensions are as follows: Total length, 33 feet; width between longitudinals, 4 feet; diameter of the wheels, $8\frac{1}{4}$ feet; weight of engine, empty, 38 tons; weight of engine, loaded, 42 tons.

We shall not now return to a theoretic discussion of the qualities of this engine. Mr. Estrade has peremptorily answered this with faith and generosity by having built, as carefully as possible, and of true size, the one-tenth size model that he had deposited in the galleries of the Conservatoire des Arts et Metiers, and concerning which quite a number of controversies have

spaces between centers of population. Were it from but this standpoint, Mr. Estrade's rolling stock would merit being taken into serious consideration; and it is very desirable that the experiment shall be performed in France, since it is a question of a French idea, all the expenses attending the carrying out of which have been liberally defrayed by one of our compatriots. These experiments will give us new hints, and will permit of passing a definite opinion very opportunely at the moment when Mr. Crampton, the eminent English engineer, improving upon the beautiful and effective engine to which he has given his name, is proposing a new model with three axles, of which two are to be coupled, and which are to carry wheels $6\frac{3}{4}$ feet in diameter.

In Mr. Estrade's *materiel*, the Westinghouse brake has gained a new success, since it has been selected after a study of all the devices capable of braking these high speed trains.—*Le Genie Civil*.



ESTRADE'S HIGH SPEED LOCOMOTIVE LA PARISIENNE.