THE HEILMANN ELECTRIC LOCOMOTIVE.

It is now some three years since Mr. J. J. Heilmann, of Paris, designed and placed in operation his first standard gage electric locomotive, which was known as La Fusee Electrique and was tested upon the lines of the Compagnie des Chemins de Fer de l'Ouest, of France. The Fusee was of 600 horse power and 120 tons weight and it was designed for hauling the ordinary class of passenger trains. The novelty of this locomotive consisted in the fact that it did not take its current from a feeder connecting with a distant power station, but carried its power station with it—the boiler, engine, generators, and motors being all combined in one machine upon one set of wheels and comprising an absolutely self-contained electric locomotive.

In spite of a vast amount of adverse criticism based on theoretical à priori grounds the builders of the Fusee were so well satisfied with its performance that they have constructed two more locomotives of the same type, but having much greater power and embodying the improvements suggested by the trials above referred to. By the courtesy of the builders we present a series of views of the first of these engines taken during its construction at the shops.

The designs of the Heilmann locomotive have been subjected to considerable criticism, mainly on the ground that it is at an evident disadvantage compared with the ordinary steam locomotive, because it necessitates an extra conversion of power, with its inevitable attendant loss. But while the loss in conversion is admitted, it is claimed by Mr. Heilmann that there are valuable compensations to be realized. In the first place, the absence of reciprocating parts and counterbalance weights secures a perfectly balanced engine which is easy upon the track and bridges. There is a further economy, it is contended, in the use of a many-cylindered high speed engine, and although considered as an electric motor, there is a greater weight of machinery to be carried than in a motor driven from a central station, this is offset by the absence of any loss by transmission over a line of greater or less length.

Regarding the first claim that this type of locomotive is perfectly balanced there can be no dispute, and the designer is entitled to full credit for having solved one of the most difficult problems connected with high speed locomotives. In the ordinary type the evil effects of "excess balance" are met or mitigated by the use of large driving wheels. This, however, necessitates a slow piston speed and a corresponding reduction of the indicated horse power. In the Heilmann machine the main engine is completely balanced by the arrangement of the six cranks, and the tests which have taken place show that there is a complete absence of the well known hammering and plunging effects noticeable in the ordinary locomotive.

It will be argued that the ordinary electric motor is also balanced, and that the extra load of boiler, engines and generator are a distinct handicap to this engine. To this it must be answered that in a locomotive of 1,350 horse power, which it is claimed the new machines will develop, the load of boiler, engines, etc., is almost necessary to give the requisite adhesion when the locomotive is working up to full power, as in starting or on a steep grade. It is evident that in proportion as the weight of the steam boiler, engines and generators become necessary for adhesion, the advantages of their installation in a separate power house disappear.

The above facts show that the design is per se not so altogether indefensible as many of its critics have roundly declared; and the aims of its designers appear yet more reasonable when they state that in building the Heilmann locomotive an effort is being made to make it possible to equip the trunk railroads electrically, without making any radical changes in the road itself. With this fact in view, it must be admitted that whether the arguments above given are sound or not, this machine will enable the railroad companies to experiment with electric traction on a limited scale without undertaking the great expense which will be entailed in the use of the central station system.

The machine is built upon a pair of deep plate girders and carried by a couple of eight-wheel trucks, one under each end. The total length of the engine over all is 61 feet and the rigid wheel base measures 37 feet 3 inches. The front of the engine is not, as one would suppose from looking at the engraving, the end occupied by the boiler, the latter being placed over the rear trucks, the forward half of the platform carrying the engines, generators, exciters, etc. Water is carried in two tanks, one on each side of the boiler, and the coal bunkers are situated just ahead of the tanks and on each side of the fire box. The engines, generators, etc., are completely housed in by a large plate steel cab or casing which is given a sharp plow-like form at its forward end with a view to reducing the air resistance.

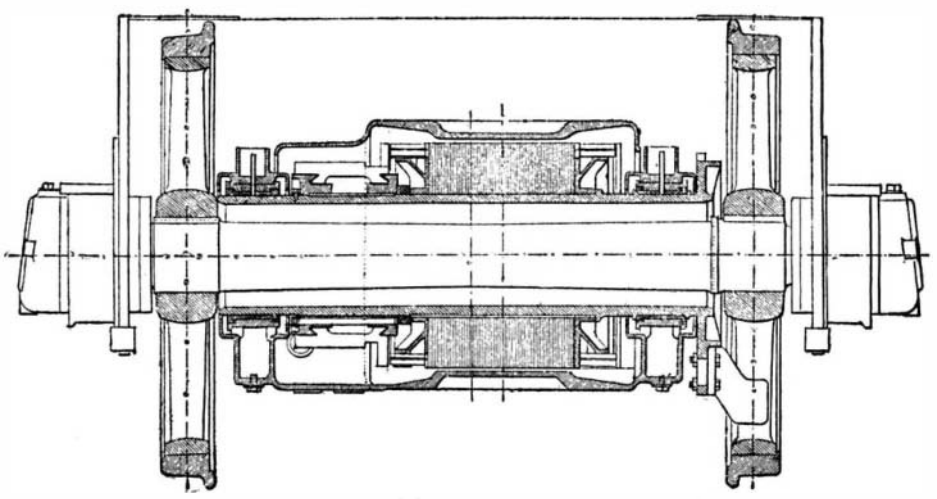

Fig. 5.—CROSS SECTION THROUGH MOTOR—HEILMANN LOCOMOTIVE.

The boiler of the first experimental locomotive was of the Lentz type, with corrugated fire box and combustion chambers, but in the present type the designer has returned to the ordinary locomotive style of boiler, the fire boxes being, however, of copper and built on the Belpaire pattern. There are 351 tubes 1·77 inch in diameter and 12·5 feet long, and there are 35·95 square feet of grate surface, the total heating surface of the whole boiler being 1,996·5 square feet. The boiler pressure is 200 pounds to the square inch. The generators are driven by a Willans compound six-crank vertical engine, the cranks being set at 0°, 120°, 240°, 240°, 120° and 0°, by which arrangement the difficulties of counterbalancing are completely overcome. In spite of its high speed, the engine runs in perfect equilibrium. As we have said, this is one respect in which Mr. Heilmann claims a distinct advantage over the ordinary form of locomotive, in which the well known counterbalance problem is causing no end of trouble and expense.

There are two continuous current generators directly connected to the main shaft, one at each end of the engine. The generators, which were built by Messrs. Brown, Boderi & Company, are continuous machines coupled in parallel, and each has a capacity of about 1,000 amperes at 450 volts. They are excited by a small four-pole self-exciting dynamo which is driven by a simple Willans engine of about 28 horse power. The current is led to eight motors, one for each axle of the trucks. The motors have four poles, with two field cores placed horizontally. The field winding is an insulated copper strip and the armature is a toothed drum wound in series and mounted on a hollow steel shaft which carries at one end a disk. This disk transfers the motion to the axle by means of three powerful links which are carried upon three corresponding pairs of springs secured between the arms of one wheel. The arrangement is shown in Figs. 3 and 5 in the accompanying illustrations. The axle passes with sufficient clearance through the hollow shaft, and the springs have sufficient flexibility, even under the full power of the motor, to allow free movement of the hollow shaft. The motors are all connected in parallel and each motor is fed by a special circuit from the switchboard and has its own switch and automatic cut-out. For low speed and under heavy loads the motors may be grouped in a series of four by means of a controller. There is an eight-way switch for reversing the current in the armatures of the motors and for instantaneously changing their direction. The speed may be varied by means of a rheostat placed in the exciting circuit of the generators.

The controlling gear is arranged in duplicate, one set being placed at the forward end of the locomotive and the other near the boiler in the position usually occupied by the throttle and reversing lever in an ordinary locomotive. This is done to enable the engine to run in either direction. It is claimed by the makers that these locomotives will take a train of nearly 400 tons at a speed of 62 miles an hour. We are informed that the preliminary trials, of which we do not as yet possess the details, give reason to expect that when they are in active service these locomotives will be capable of performing the full duty for which they are designed.

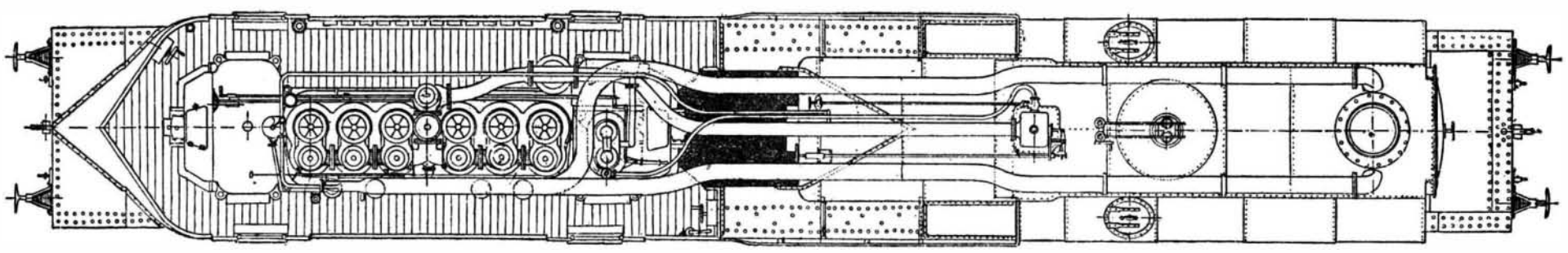

Fig. 6.—PLAN OF THE HEILMANN LOCOMOTIVE SHOWING ARRANGEMENT OF BOILER ENGINES AND GENERATORS.

The Scientific American in Russia.

The following is a letter of G. Wilfred Pearce to the editor of the New York Sun. It gives some interesting particulars about the state of trade in Russia and incidentally bears witness to the appreciation of the SCIENTIFIC AMERICAN in that country:

Sir: Several mechanical engineers and manufacturers of machinery which find markets in Europe, Asia and Africa, who have had opportunities for conversing with Major Moses P. Handy, commissioner to the Paris Exposition of 1900, are of the opinion that the 500,000 square feet of space which Major Handy has applied for will be quickly taken up by American manufacturers, who are keenly alive to the fact that the exposition will be open sesame to a large and profitable trade in certain lines of manufactures in metals in which we can control the markets of the world.

Russian merchants who do business in our city [New York] are saying that nearly every merchant, engineer and manufacturer in Russia will visit Paris during the exposition year, by which time business will be lively all along the line of the great Transsiberian Railway, which is destined to play a great part in the commerce of Europe and Asia. At the present time the European and Asiatic demand for American machinery and agricultural implements is very great. In electrical and steam apparatus our makers are driving a lively trade with Russia.

During this week I have seen a letter from a large firm having warehouses in St. Petersburg and Moscow, inquiring as to the reliability of the Richmond Locomotive Works, whose advertisement the Russian says he saw in the Sun. The concern wants about $100,000 worth of apparatus, which it could not get at the Samavar Locomotive Works, owing to the rush of orders at that new plant, equipped with American machinery. St. Petersburg is in the market for more than $1,000,000 worth of apparatus. The imperial engineer, who gave me the data for the proposed electric lighting plant at St. Petersburg, informs me that he reads the Sun and SCIENTIFIC AMERICAN, in order to "keep up with the march of Father Time."

Electrical Cabs in London.

In London a company has placed a dozen electrical cabs in the streets. They resemble coupes, and the accumulators consist of forty cells, capable of propelling them over fifty miles, at a cost of fifty cents. The rear wheels do the driving and the front wheels do the steering. They have heavy rubber tires and upholstered spring cushions, are lighted by electricity, are speedy, and almost noiseless. They appear to be giving every satisfaction. The machines seem under perfect control, and thread their way wonderfully through the traffic. The tariff is the same as that of the cabs. They look like a cross between a brougham and a four-wheeler, with accumulators underneath.

THE French used the bicycle in 1871, during the siege of Belfort, for carrying dispatches. The wheel adopted at that time was of course the "ordinary" or high wheel. This was the earliest introduction of the cycle in the army.—Stahl und Eisen.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1897, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES

Vol. LXXVII.—No. 10. ESTABLISHED 1845. NEW YORK, SEPTEMBER 4, 1897. [$3.00 A YEAR. WEEKLY.

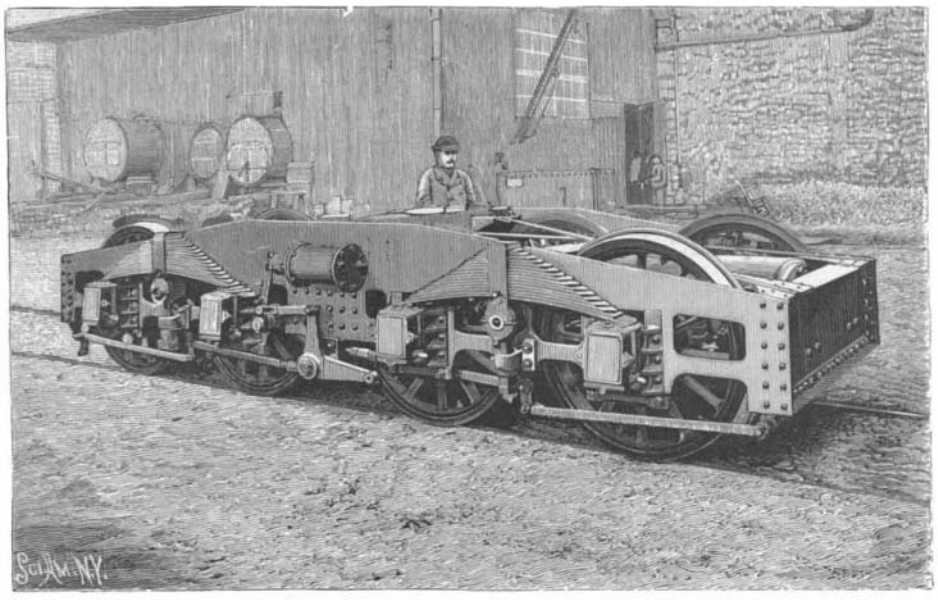

Fig. 1.—AN EIGHT WHEELED TRUCK.

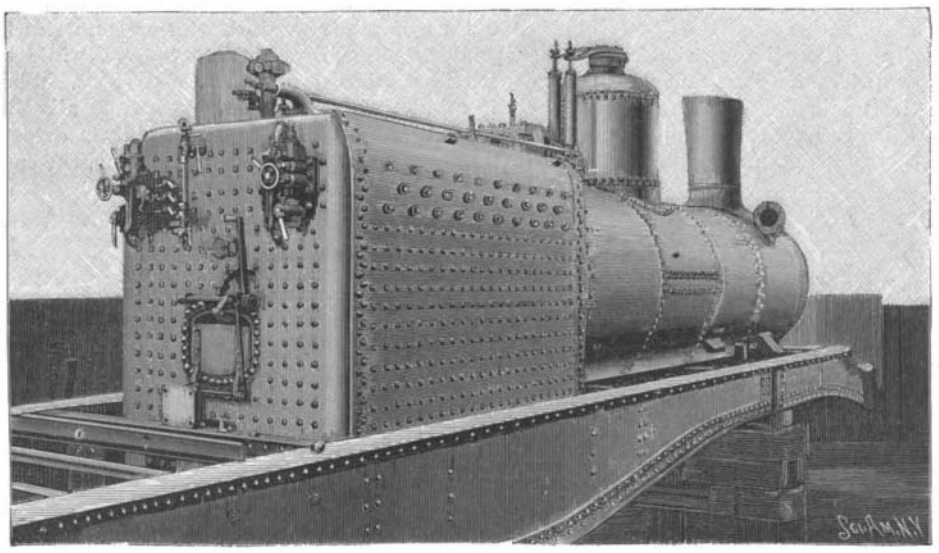

Fig. 2.—THE BELPAIRE BOILER.

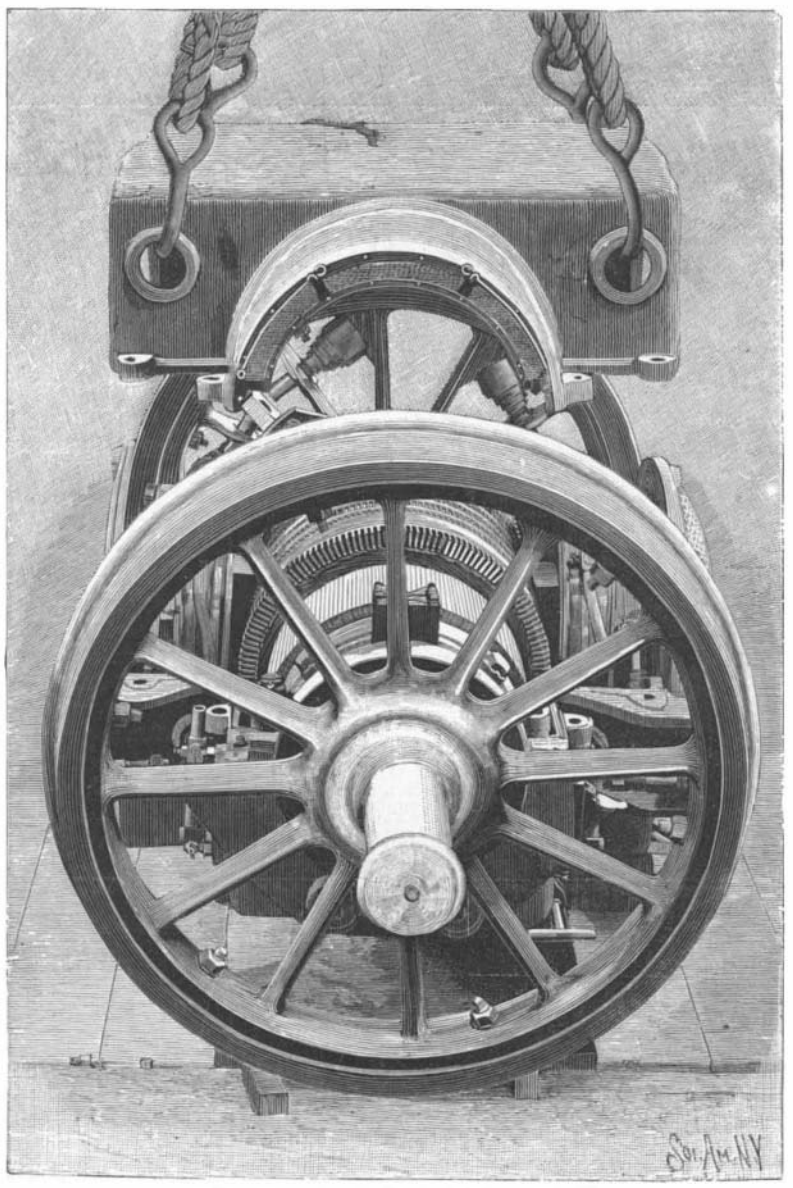

Fig. 3.—ONE OF THE EIGHT MOTORS.

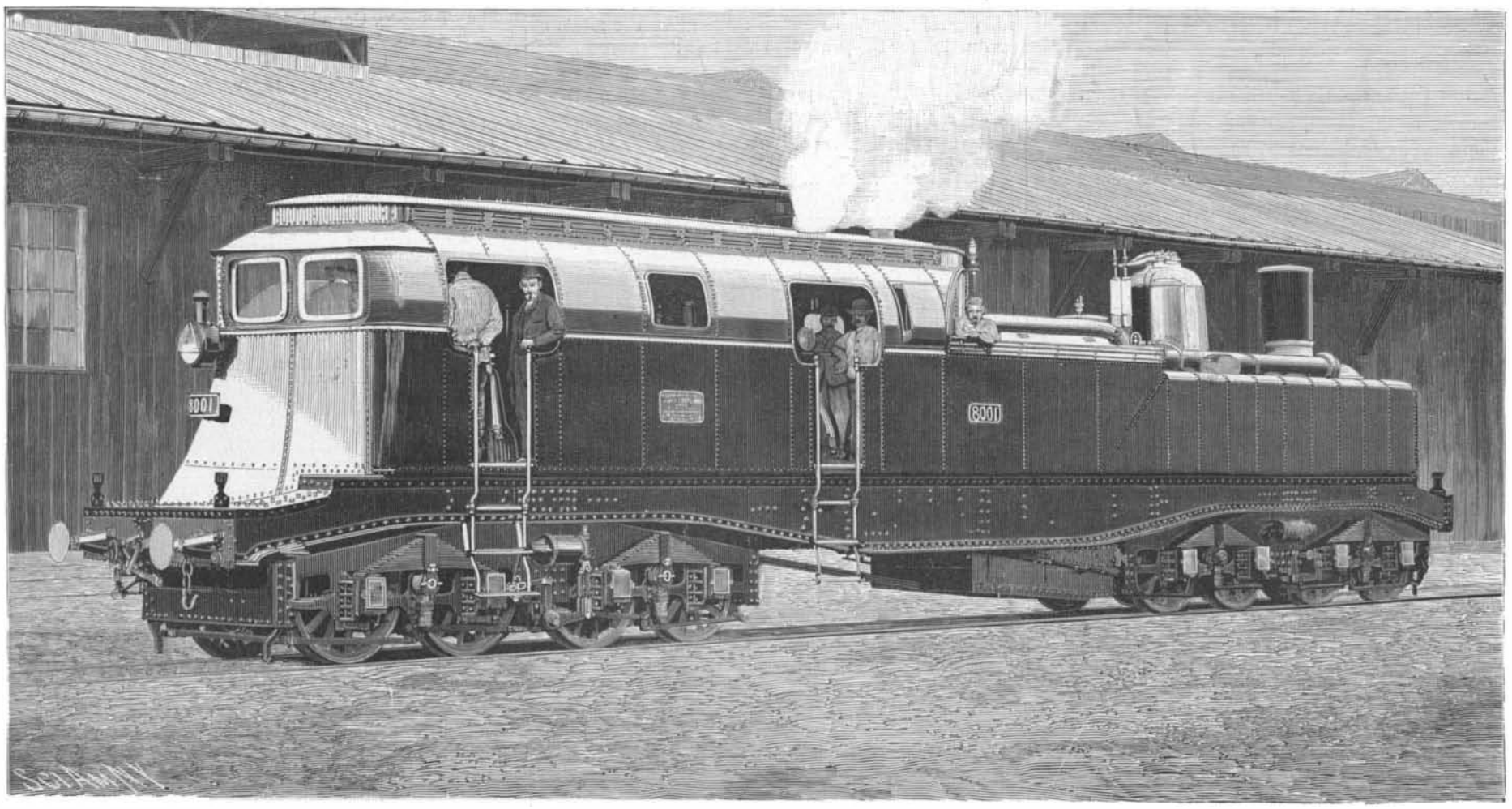

Fig. 4.—THE HEILMANN ELECTRIC LOCOMOTIVE.—[See page 152.]