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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

A REVERSION TO TYPE.

The old American eight-wheel passenger locomotive, with its flexible wheel base and comparatively high center of gravity, was admirably adapted to the tracks on which it ran. When, a few years ago, electric traction was applied to our steam railroads, the designers of the electric motors made the mistake of ignoring altogether the steam locomotive, and basing their designs upon electric street car practice. Consequently, the first electric locomotives for this work were, in respect of their driving mechanism, nothing more nor less than exaggerated trolley cars, with the characteristic rigid wheel base and a low center of gravity.

When the plans of the electric locomotives for the New York Central and New Haven railroads were made public, the SCIENTIFIC AMERICAN criticised these features, and predicted that they would prove very destructive to the track, particularly in their tendency to throw it out of alignment. The wreck at Woodlawn, followed later by another at Greenwich, established the truth of these criticisms, and both locomotives have subsequently been modified, with a view to eliminating as far as possible the defects referred to.

In designing the powerful electric locomotives for the Pennsylvania tunnels, which are illustrated elsewhere in the present issue, the defects of rigid wheel base and low center of gravity were avoided by removing the motor from the axle and placing it above the frames, and by reverting to the wheel plan of the American eight-wheel type, in which there are four coupled drivers and a leading four-wheel truck. It will be seen that if a pair of cylinders were placed above the truck, and the jack-shaft cranks and the coupling rods to the motor were replaced by a crosshead and piston, we would have the familiar steam locomotive arrangement.

It will thus be seen that the locomotives are a compromise between the existing steam and electric locomotives, with the best features of each included. They will combine the even turning effort and absence of unbalanced weights of the electric, with the high center of gravity and flexible wheel base of the steam locomotive. Whether this is destined to be the enduring type, is a matter for the future to determine.

NAVY DEPARTMENT REORGANIZATION.

Since the new plan for the reorganization of the administration of the navy is described by its sponsors as "tentative," they evidently expect that experience will suggest some modifications. This being the case, we have no wish to indulge in what might seem to be captious criticism; for we believe that the Secretary has given his indorsement to the present plan only after a very serious consideration of its utility. Furthermore, we have personal reasons for believing that many of the naval officials who have taken an active part in the recent criticisms and discussions are weary of the protracted controversy, and are anxious to welcome any plan which gives promise of harmonious and economical administration.

Surely, if special boards have done anything to solve the problem we ought by this time to have reached a clear road. The Sperry board, the Leutze board, and lastly the Swift board, were appointed, made their investigations, and duly reported to the Secretary. The present scheme may, therefore, be taken to represent the combined wisdom of the many selected experts who have passed upon the subject.

On one point, however, we do doubt most strongly the wisdom of Secretary Meyer's proposed scheme. We refer to the proposal to take the administration of the navy yards out of the hands of the naval constructors and put the seagoing officers in control. Look at the matter whatever way we will, this move seems about as unreasonable as to take the captains and executive officers of the transatlantic liners from their ships, and place them in full control of the yards in which their ships were built. Our seagoing officers have not the experience or the special technical and mechanical knowledge to qualify them for the position of "works managers." An officer may have a perfect genius for naval strategy and tactics; he may have the most intimate knowledge of seamanship in its broadest sense, of navigation, and, in short, of everything that has to do with the management of a warship when she is in commission, and yet be a very poor mechanic, and have only a very hazy idea of shop and yard management.

If it be necessary—and we believe it is—for the present scheme of reorganization to receive the sanction of Congress, we trust that body will make a very exhaustive investigation of this phase of the question. The Newberry scheme, which has now been for about a year in successful operation, established the naval constructors in practical charge of the administration of the yards, subject to a commandant; it created a single payroll, and placed the care of buildings and grounds, and of all the work coming under the head of civil engineering, under a single manager. The number of separate shops was greatly reduced, and the officers in charge of the various shops were practically inspectors of the work done for their several bureaus. The work of the yards was greatly simplified, expenses were reduced, and there was a greater all-round efficiency. We trust that Congress will modify the proposals of the present scheme as far as they affect the navy yards, and permit them to be run under the present admirable plan. If this modification be made, we believe that Secretary Meyer's reforms will prove to be of lasting benefit to the navy.

THE VALUE OF EXHAUST STEAM.

Apart from its own inherent excellence as a prime mover the steam turbine has been teaching us many valuable lessons about the steam engine; or, to speak more correctly, has been bringing into prominence many facts regarding the steam engine which were known, but whose great importance was being overlooked or neglected. We have all of us known in a general way, for instance, that a high-pressure engine exhausting directly into the atmosphere was extravagant; but it remained for the low-pressure steam turbine to teach us how much power was being lost, and what a large proportion of that power could be recovered by expanding the steam down in a suitable auxiliary chamber. It has already been established that when an exhaust steam turbine is installed as an auxiliary to a non-condensing engine, it can develop from the exhaust steam even more useful work than the engine does from the live steam. Proportionate economies also are realized where an exhaust steam turbine is interposed between the low-pressure cylinder of a compound or triple-expansion engine and the condenser. A notable instance of this is found in the 59th Street power station of the New York Subway, which was originally equipped with the well-known Allis-Chalmers cross-compound engine.

The maximum economical rated power of these engines, as contracted for, was 6,000 kilowatts, with an overload capacity of about 8000 kilowatts. At their normal rating, the engines showed a water rate of about 18 pounds of steam per kilowatt hour, and at maximum overload the consumption ran up to about 22 pounds. By interposing a low-pressure turbine between the low-pressure cylinder and the condenser, it has become possible not only to run the engines with an economical water rate at their full overload, but the total kilowatt output is about doubled, the combined unit developing about 16,000 kilowatts on a water rate of 14 pounds per kilowatt hour. The steam enters the high-pressure cylinders at a gage pressure of from 190 to 195 pounds, the low pressure at from 45 to 48 pounds, the turbine at about one pound, and the condenser is maintained at about 28.8 inches of vacuum. In the expansion from 195 pounds gage to atmospheric pressure 8000 horsepower is developed; and by the interposition of the steam turbine another 8000 horse-power is recovered between the atmospheric pressure and 28.8 inches of vacuum. This is a wonderful advance in steam-engine practice; but that we are still far removed from theoretical perfection is proved by the fact that, even with this successful combination, 60 per cent of the heat units is being carried away by the condenser water into the North River.

A STEAM-TURBINE ELECTRIC LOCOMOTIVE.

Considerable interest has been aroused in British railroad circles by the announcement that the foremost locomotive construction company have perfected a new type of railroad engine, particulars of which were recently given to a Scottish university engineering society by the president of the company in question. It is described as a "steam-turbine electric locomotive;" and as a turbo-electric combination. The first engine of this type, which is approaching completion in the company's shops, possesses many new and ingenious features.

In general design the engine will not differ very materially from the ordinary locomotive now in use. Steam is raised in a boiler of the usual locomotive type, fitted with a superheater, the supplies of water being drawn from tanks disposed on either side of the boiler, and the coal is carried in side bunkers. The steam is led from the boiler to a high-speed impulse turbine running at 3000 revolutions per minute, to which is directly coupled a continuous-current, variable-voltage dynamo. With this generator electrical energy ranging from 200 to 600 volts is supplied to four series-wound traction motors, the armatures of which are built on the four main or driving axles of the locomotive.

The exhaust steam from the turbine is passed into an ejector condenser, and is finally, with the circulating condensing water, discharged into the hot well. Owing to the steam turbine requiring no internal lubrication, the water of condensation is free from oil, and can consequently be discharged from the hot well direct into the boiler by means of a feed pump. In this manner the water can be used over and over again, and the water carried in the supply tanks actually serves as circulating water in the condensing operations. Circulation is effected in a closed cycle by means of small centrifugal pumps, driven by auxiliary steam turbines, placed alongside the main turbine and dynamo. The water thus flows from the tanks through the first pump, by means of which it is forced through the condenser, where it serves to condense the exhaust steam from the turbine, then to the hot well, from which it is pumped to a cooler at the front of the engine, where it comes into contact with a blast of cold air caused by the movement of the locomotive and a fan which serves to cool it, and then it returns to the tank for further use.

In so cooling the water, however, the usual exhaust blast which induces the draft through the furnace and boiler tubes is lost. To remedy this deficiency, a forced draft is supplied by means of a small turbine-driven fan, placed within the radiator or cooler, so that while it serves to cool the circulating water it also induces a blast of hot air to the fire. The cab of the locomotive carries a small switchboard, on which are mounted the controller for grouping the four motors, according to what draw-bar pull is required, in series or parallel, as well as the regulator for controlling the electrical circuit voltage, and consequently the speed of the train.

The whole of this main and auxiliary machinery is mounted upon a strong underframe, carried on two eight-wheeled compound bogies, to facilitate negotiation of curves at high speed. Each bogie carries two of the four driving motors, as already mentioned. It will thus be seen that in reality an articulated system is adopted.

The first engine to be built on these lines is approaching completion, and its performances are awaited with great interest. The experiments which have already been made by the company upon an extensive scale lead them to believe that such a locomotive as this would possess great possibilities and offer a complete solution to the traction question of to-day. In any large well-equipped locomotive establishment an engine can be produced for a low figure in comparison with the electric locomotive, and by the adoption of the new combination they do not anticipate that the prime cost will be very appreciably enhanced.

The Transvaal government have set aside a fairly large sum for the erection of an experimental scrap iron smelting works. Possibly, says Engineering, the movement may eventually extend so that larger works may be built to deal with the native ore. This ore has already been employed with good results in the manufacture of different articles. Speaking of Pretoria ore, the foreman of the railroad workshops says that it is easily fluxed and good iron obtained free of sulphur and phosphorus. A test of local hematite was recently carried out and 633 pounds of iron was obtained from 1,100 pounds of ore used. The Transvaal mines' consumption of iron and steel is estimated at 50,000 tons yearly, valued at £900,000; of this £600,600 consists of rails, sleepers, pipes and pipe fittings, rock drills, and spares. The railroad also purchases about 32,000 tons of rails and sleepers annually. There is therefore scope for the opening of works, but the government mining engineer considers that the provision of blast furnaces must be a matter for private enterprise. Perhaps some day South Africa may take its place among the great manufacturing countries of the world, but that state of affairs is a long way off at present, and for many years that country will have to depend on its gold and diamonds, and in a lesser degree on its agricultural productions.