electrification, however, has been abandoned. It is estimated that to convert the section in question to electricity over $9,000,000 would have to be expended. The existing railroad would have to be torn up, heavier rails laid down, and the conduit for the accommodation of the current cable and collecting shoe installed, while special vehicles would have to be constructed.

Instead it is resolved to allow the existing rails to remain and to supersede the present horse-drawn vehicles by cars equipped with oil or gasoline motors. By this decision the expense will be simply confined to the purchase of the motor vehicles, which will cost approximately from $4,000 to $5,000 each. No expensive generating plant, stations, and transformers or cable will have to be laid down, such as would be the case were electricity adopted.

The electric conversion of street railroads in London especially is being brought to a stop owing to the rapid strides of the motor-propelled vehicle. The majority of engineers interested in the project are realizing the fact that as electricity has superseded steam so the internal combustion motor system of propulsion is rivaling electric motive power, and there is no doubt that within a very short time the motor vehicle for all-round street service will largely replace the electric trolley car.

While the gasoline omnibus may prove to be even more economical than the electric trolley car, there is little doubt that a large number of these machines running in the city streets would greatly vitiate the atmosphere, owing to incomplete combustion and the burning of lubricating oil. That this will eventually become a problem with private automobiles may be appreciated by any one who sees a high-powered machine emitting clouds of smoke as it moves through the streets. Therefore it would seem as though the New York Transportation Company was taking the right course in adopting electricity as the motive power of the new thirty-passenger 'buses it expects to be operating soon on Fifth Avenue. In this city most of the commercial vehicles are electric, even to the heaviest trucks; and in the present state of the storage battery, these are operated at a saving over horse-drawn trucks. Therefore the new electric autobuses will doubtless prove profitable, besides giving New Yorkers clean. cheap, and rapid transit on one of the principal avenues in which the transportation facilities have always been wofully poor.

AN ANTITOXIN FOR LAZINESS.

BY HUGO ERICHSEN.

If the conclusions drawn from experiments detailed in a recent issue of the Muenchener Medicinische Wochenschrift (No. 48, vol. 51) are substantiated, fatigue and exhaustion will be a thing of the past. To banish sleepiness, it will only be necessary to drink an antitoxin (a substance that renders a toxin or poison inactive), which will invigorate you, no matter how jaded you may be. Henceforth such a thing as a somnolent policeman will be unknown on the force, and the speed of the messenger boys will only be comparable to that of the winged Mercury himself. Women who are fond of talking will be able to enjoy their gossiping proclivity to the full, and renew the flagging interest of their victims with an occasional hypodermic injection of the new stimulant. Factory and office employes will lead a strenuous life indeed when the vigilant inspector makes the rounds with a syringe full of the new serum, so called after one of the fluid constituents of the blood from which it is derived. Indeed, when one comes to think of it, the application of this marvelous discovery would be almost illimitable. Race horses, sustained by the antitoxin, would be sure to win, armies enabled to endure forced marches in order to snatch victory from the jaws of defeat, and worshipers prevented from falling asleep in church during a dry sermon and suffering the consequent disgrace. Possibly at some time in the remote future, it will become customary to politely offer a fellow mortal a dose of antitoxin, whenever he yawns or exhibits any other sign of weariness, much as a pinch of snuff was proffered, as a matter of course, in centuries past.

But, seriously, if we believe the eminent authority mentioned, Dr. Wolfgang Weichardt, of Berlin, has made a very important contribution to the science of physiology, a discovery that is destined not only to be of service to acrobats but in the treatment of neurasthenia, better known as nervous exhaustion, and the convalescence from acute diseases. Briefly, his experiments may be described as follows: A guinea-pig was drawn backward, on a rough carpet, by means of a string, until it no longer resisted interference with its motion and was totally exhausted. Stimulation was continued, by means of electricity, until the animal was in a state of autointoxication, that is to say, a condition of infection from the toxin or poison generated by itself. During the experiment, the temperature of the guinea-pig fell from 39.2 to 34.8 deg. Celsius. When exhaustion could be carried no further, the animal was killed. Immediately after death, the toxin (or poison) was obtained from the crushed muscles of the animal. When dried in a space exhausted of air, the toxin was found to consist of yellowish-brown scales, that were not very stable and had to be kept in sealed glass tubes, preferably in liquid air. This toxin or poison, injected into other guinea-pigs, produced symptoms of exhaustion followed by death within twenty-four hours. The same poison could not be obtained from the muscles of non-exhausted animals.

Weichardt's antitoxin is produced very much like that of diphtheria, by injecting the toxin into the circulation of horses. When dried in a vacuum, the resulting scales—unlike those of the toxin—are permanent; in fact, the substance retains its activity even after months. It is readily taken up by the stomach, but generally injected under the skin by means of a hypodermic syringe. It was determined that ten milligrammes of the toxin are neutralized (or rendered inactive) by one-tenth of a milligramme of the antitoxin. Small animals, into which the toxin was injected, remained in a perfectly normal condition when treated with the antitoxin, but succumbed to the poison when the antitoxin was not administered. After taking four doses of a quarter of a gramme of the antitoxin, in pastilles, a young lady was able to lift two kilogrammes 2,478 meters with the middle finger of her right hand, whereas she had only been able to lift the same weight 1,533 meters alone. The ingestion of the antitoxin did not produce any disturbance whatsoever; on the contrary, it was followed by increased vigor and energy. Dr. Weichardt's findings are based upon a large number of experiments.

TURBINES VS. RECIPROCATING ENGINES IN MARINE SERVICE.

BY OUR ENGLISH CORRESPONDENT.

Although the Parsons marine steam turbine is being extensively adopted in Great Britain for the propulsion of vessels, yet for the most part this application has been based upon the theoretical advantages of this system over the ordinary reciprocating engines. Now, however, actual comparative results of the two methods of propulsion are available, since statistics and data have been gathered during the day-by-day commercial use of the marine turbine in competition with the older form. These results abundantly justify the confidence entertained by the inventor in this system.

In June, 1901, the first turbine-propelled vessel intended for commercial traffic made her trial trips. This was the vessel "King Edward," which was built for the service between Greenock and Campbelltown on the River Clyde, and was maintained in service by the syndicate especially formed to prove the efficiency of the Parsons turbine for such work. This syndicate comprises the Parsons Marine Steam Turbine Company, of Wallsend-on-Tyne, Messrs. W. Denny & Sons, the well-known shipbuilders of Dumbarton, and Capt. John Williamson, to whom we are indebted for much of the information contained in this article. The "King Edward" was duly described, together with the results of the trial trips, in the Scientific American at the time. In general design the "King Edward" is similar to the existing vessels engaged in this class of traffic, being 250 feet in length by 30 feet beam, and depth to promenade deck of 17 feet 9 inches. The vessel is equipped with three sets of Parsons turbines—two low-pressure and one high-pressure—capable of developing a speed of 20 knots per hour. So satisfactory were the results with this vessel, that another ship of somewhat larger dimensions—"Queen Alexandra"—was built for the same service.

These two vessels have now been running for four and three seasons respectively. Recently the turbines of each vessel were opened, and no perceptible wear and tear on the machinery was found. The turbines were as bright and as clean as the day when they left the builders' shops. There is so little oil used in connection with the turbines that the boilers are kept thoroughly clean, and consequently this adds considerably to their life. The total amount of oil used per month is the low average of about one gallon. Of course, oil is employed for the auxiliary engines, but this factor is not considered in the present calculations.

In some quarters it is maintained that owing to the high speed at which the turbines revolve, the repair bill must be unduly heavy. But this contention is not supported by actual work. So far as the "King Edward" is concerned, the extent of repairs is so trifling as not to be worth consideration, being confined to the refilling of the bushes once or twice.

It is also urged against the turbine that there is an abnormally heavy consumption of coal involved in maintaining the high speed developed as compared with the amount required to develop the maximum power with a reciprocating engine. On this point there is a great diversity of opinion, but Capt. Williamson, who superintended the operation of these two turbine vessels, has prepared some interesting tables on this point, which are rendered additionally valuable since he is able to offer comparative data concerning this problem. The vessel which he has utilized for comparative purposes is a vessel in every respect similar to the "King Edward." The dimensions and tonnage are identical; the boat is quite modern, and is fitted with the most up-to-date type of reciprocating engines. The vessel furthermore is employed in similar traffic to that in which the turbine vessels are engaged. These comparisons are as follows:

	Turbine steamer.	Steamer with reciprocating engines.	Turbine steamer.	Steamer with reciprocating engines.
	1901.	1901.	1902.	1902.
Speed on trial trip	20½ knots	18 knots.	20½ knots.	18 knots.
Mileage........	12,116	15 604	15,605	14,850
Coal consumption...	1,429 tons.	1,758 tons.	1,897 tons.	1,744 tons.
Days sailing	79	111	110	105
Mileage per ton....	8.47	8 87	8.37	8.51
Average coal per day...	18.2 tons.	15.17 tons.	17.5 tons.	16.6 tons.
Working average per hour.........	8½ knots.	16 knots.	18½ knots.	16 knots.

From this it will be observed that there is very little difference between the mileage per ton of the two types of vessels. But at the same time, the fact must not be overlooked that the difference in speed is 2½ knots per hour in favor of the turbine boat, which represents a considerable increase. Further comparison on this point is afforded by comparison with another river steamer of a similar type and driven at the same average speed, fitted with reciprocating engines. The results are as follows:

	Steamer with reciprocating engines.	Turbine steamer.
Distance steamed......	12,106 knots.	12,116 knots.
Days sailing..........	80	79
Daily average speed...	18½ knots.	18½ knots.
Coal consumption......	1,909 tons.	1,429 tons.

The efficiency and economy of the turbine vessel are even more decisive in this case. Not only did it cover a greater distance, by 10 knots, than that recorded by the other vessel, but the coal consumption, even including the slightly increased mileage, shows a balance of 480 tons in its favor. It may be pointed out that the above service speed of the "King Edward" represents about two-thirds of full power on trial. For the past two seasons the economy of the two turbine vessels is equally well marked, though in the case of the "Queen Alexandra," which is of greater dimensions and speed than her consort, the results show an even better record.

An exception may be taken to the comparison of the above-mentioned steamer fitted with the ordinary reciprocating machinery; it may be explained that she is fitted with compound engines. The builders state, however, that if she were equipped with triple-expansion engines, the coal consumption could be reduced; but even under these advantageous conditions, to maintain an average speed of 18½ knots per hour would involve a coal consumption of 22 tons per day, which is four tons in excess of that required by the turbine steamer to maintain the same average speed, corresponding to an economy of 20 per cent in favor of the turbine steamer.

In connection with the foregoing results, however, there is one prominent fact that must not be overlooked. To obtain the maximum efficiency and economy of the turbines, they must be driven at full pressure. The maximum speed of these Clyde vessels is 20½ knots, while in the above comparison their speed is only 18½ knots. At the latter speed, therefore, they are less economical than they otherwise would be. With these particular vessels, however, this difference is not so very marked. The deficiency in economy when running at a lower speed than that for which they are designed is more emphasized in the case of war vessels, where for the greater part of the time a cruising speed only is required. In strictly commercial vessels, the opposite is invariably the practice—full speed, that is, running at the designed power of the turbines, with a minimum of reduced speed. In the aggregate, therefore, the loss in economy is very slight. In the case of the "King Edward," practice has demonstrated that it is necessary to reduce the speed of the vessel to between 17 and 18 knots before ordinary engines under similar conditions and at the same speed show a less fuel consumption per knot of speed. This 17 or 18 knots speed corresponds to about 50 per cent of the total maximum power of the turbine engines of the "King Edward." Up to the highest speed at which this vessel has been driven, an always increasingly favorable consumption of coal in proportion to the speed of the vessel has been found.

One noticeable feature in connection with these two turbine vessels is the regularity of their running. In no instance has the daily service of either craft been interrupted. No breakdowns have ever occurred, nor has there ever been the slightest hitch. In fact, it has been possible to maintain a better daily service on the River Clyde than has hitherto been possible.