SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States. Canada. or Mexico $3.00
One copy, one year. to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845)	$3.00 a year
Scientific American Supplement (Established 1876)	5.00 "
Scientific American Building Monthly (Established 1885)	2.50 "
Scientific American Export Edition (Established 1878)	3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.

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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, AUGUST 30, 1902.

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.

EXPRESS TRAINS OF THE FUTURE.

That the express train of the near future will not necessarily be hauled by electric locomotives is evidently the belief of the German Society of Mechanical Engineers, who have offered a series of prizes for the best-designed high-speed express train capable of carrying 100 passengers and their baggage, with every modern convenience of travel, at an average speed of 75 miles an hour for a continuous run of three hours' duration. There is no question that this competition was prompted by the disappointing results of the experiments in high-speed electrical traction, carried out last year on the stretch of military railway between Berlin and Zossen. It will be remembered that the failure of these trials, or rather their somewhat sudden termination, was due, not to the inability of the electrical equipment to drive the train at the high speeds contemplated, but to the unexpected weakness displayed by the track and roadbed, which, under the heavy concentrated and rigid loads of the motor trucks, yielded so seriously as to produce dangerous oscillation of the car. The object of the express train competition is to provide a train suitable for greatly accelerated railway travel, whose steam locomotive shall be able to exert the necessary power without imposing greater strains than the comparatively light track of the present state railways of Russia can endure. The Berlin-Zossen trials proved that the track of the state railways, as at present laid, is altogether too light for high-speed electric travel, and the German Society of Mechanical Engineers believe that it is possible to design a high-speed, steam locomotive train that would accomplish the desired result without damage to the track and roadbed. The trials demonstrated practically the fact, which might very well have been foreseen, that the steam locomotive with its high center of gravity and its spring-supported load, is far less severe upon a track than the electric locomotive with its low center of gravity, and its large proportion of non-spring-supported load. The effect of a low center of gravity is felt in rounding curves, and when the engine or cars begin to oscillate laterally from one rail to the other. With a high center of gravity the lateral blow against the rail is considerably cushioned and the lower the center of gravity, the more direct and hammer-like is the impact. This is a point that has been well understood by steam locomotive builders and engineers, and when the first of our American express engines with boilers placed above the drivers were introduced, it was found that, despite their great weight, they were actually easier on track, at least as regards lateral displacement, than the old type of locomotive with low boiler and low center of gravity. Of course, in the very nature of things, an electric locomotive carries its weights low, and hence at very high speed loads particular attention will have to be given to the lateral strength of the track and roadbed.

During the electrical experiments of last year an endeavor was made to gather data regarding the air resistance at varying rates of speed, and it was shown that the head-on pressure increased at a much more rapid ratio than the speed, though apparently not as fast as the square of the speed. As a result of the data so gathered, an endeavor is to be made to reduce air resistance by clothing the whole train from pilot of engine to the rear platform of the last car in sheet steel, with suitable sliding joints between the cars to give the necessary flexibility in rounding curves. This sheeting is to finish at the engine in a wedge-shaped front. Our readers will here be reminded of the experimental train designed by Adams and tested in some high-speed runs. The train in question made a good speed record, considering the moderate power of the engine that hauled it; and we think the probabilities are that if good results are secured with the proposed experimental train in Germany not a little of its success will be due to this special feature of its construction. According to the German technical publications, care will be taken in the construction of the locomotive to minimize the racking effect of the engine on the track, by carrying the weight upon a large number of wheels, twelve in all being used. There will be a four-wheeled truck at the front, followed by a pair of coupled drivers and a four-wheeled trailing truck beneath the firebox. The engine will be a three-cylinder compound, with the cranks arranged so as to secure a perfectly even turning movement.

LIGHT ON THE LIQUID FUEL QUESTION.

In a paper recently read by Mr. Edwin L. Orde before the Institution of Mechanical Engineers, at Newcastle-on-Tyne, on the subject of liquid fuel, the author stated that close examination of the literature which has appeared on the subject, seems to show that from some cause or another, many undoubted advantages which liquid fuel offers have either not been fully appreciated, or if appreciated, not pursued with sufficient determination to insure their realization in actual practice. In explanation it has been suggested that the reason why liquid fuel has a higher calorific value than solid fuel of the same chemical composition is, that some of the heat has been rendered latent in passing it from the solid to the liquid form; but the author points out on the other hand that experiments fail to show the existence of this latent heat, quoting as an authority Dr. Paul, who holds that the best results that can be obtained from liquid fuel are an evaporation of 16 pounds of water at 212 deg. F., which is about 50 per cent more than any good coal will give in an efficient boiler. The most important point made in the paper was the explanation as to why liquid fuel does not give evaporative results in actual practice corresponding to those obtained in laboratory tests. Mr. Orde attributes the difference to the fact that crude oil exclusively is used in boiler furnaces, and that this oil contains a great amount of water. Ten per cent is the proportion quoted in the paper, although, as a matter of fact, many oils contain a higher percentage than this. The presence of this water destroys the conditions necessary for perfect combustion. Its first effect is to reduce the temperature of the flames and increase their length, thus moving the point of highest combustion further into the furnace, with the result, first, that a large portion of the heating surface of the furnace is rendered useless; secondly, that the temperature of the combustion chamber may be raised to a higher point than is good for its material; and thirdly, that the last stage of combustion takes place in the smokebox and uptake. The existence of a low furnace temperature is suggested, furthermore, by the fact that in cases where no smoke was being formed and the air supply was not more than 20 per cent above the amount that was chemically necessary for the combustion of the fuel, the evaporative work of the boiler was poor.

In commenting editorially upon Mr. Orde's paper The Engineer states that it has authentic evidence of oil being shipped from oil wells which contained as high as 40 per cent of water, this large amount having been added, not fraudulently, but having flowed naturally into the wells, which are usually driven through water-bearing strata. As crude oil is nearly as heavy as water, and only separates from the latter after a long rest in the tanks, it follows that on shipboard, where the bunkers are in constant motion, separation is impossible and the water is carried with the oil into the furnaces. In concluding his paper Mr. Orde quotes actual results obtained by successful installations of burning apparatus on the steamers of three different companies, which show the difference in consumption of liquid fuel as compared with coal. In the case of the four steamers quoted, there is an advantage in favor of liquid fuel of 27 per cent, 28.6 per cent, 35.5 per cent and 36 per cent. The conclusion arrived at is that except in the case of steamers which are engaged in carrying oil as cargo, or those which are employed in the oil-producing region, liquid fuel cannot show sufficient pecuniary advantage over coal to render its entire adoption advisable.

THE RECENT "BELLEISLE" EXPERIMENTS.

In a characteristic discussion of the recent "Belleisle" experiments, Mr. F. T. Jane, the well-known author of "All the World's Fighting Ships," sums up the experiments as having two main objects: First, to ascertain the effect of lyddite on a conning tower, and, second, to ascertain the effect of shells on torpedo nets. After a careful analysis of the results, he points out the main lessons that are to be learned and presents his own suggestions as to how far they should modify future battleship design. The whole article as given in The Engineer will be found in full in the current issue of the SUPPLEMENT, and it will be sufficient to give here a brief review of Mr. Jane's analysis of this interesting trial. It is pointed out that in the first case the experiment was invalid because the conning tower of the "Belleisle" was not of a modern pattern, being entered from below instead of, as is now the practice, from the rear. Attention is drawn to the fact that the gas from the exploding lyddite shells was only able to act upon the top of the tower, whereas in the modern type of conning tower, which has a doorway through the rear wall with a curved screen to partially cover it, the blast of an exploding shell would be able, if the latter came from a wide arc on either beam, to enter between the screen and tower and find its way, with deadly impact, throughout the whole of the interior of the tower. In the "Belleisle" tower the gas could only enter through the peep-hole slot at the top, and hence there would be something of an air-cushion effect before the pressure reached the floor of the conning tower, on which, before the firing, a live rat had been placed to test the effect upon a living being. As we take it, Mr. Jane's argument is that though the modern conning tower with open rear entrance and so-called protecting screens may keep out shells, it will not prevent destruction of the inmates by the shock of the shell gases. He suggests the construction of a double-deck conning tower, to accommodate a steersman in the upper compartment, and a reserve steersman below. He would place the commander of the ship on the roof of the turret, this roof to be extended to form a wide, circular platform, around which platform would be hung a wall of splinter nets, the idea of this arrangement being that the splinter nets would catch the lighter flying fragments, but would not present sufficient resistance to burst the storm of explosive shells, to which the captain himself would offer but a small target. He suggests that the best position for the captain in the heat of action would be prone upon this upper roof with his mouth above the speaking tubes, etc., which would lead down into the conning tower below. The suggestion that the captain should fight his ship practically in the open is warranted by the fact that in the Spanish-American war the commanders of our vessels preferred, like Admiral Dewey, to carry on the action from the bridge, where they could obtain a clear view, rather than be cooped up within the restricted outlook of the conning tower.

Early in the action the bridge of the "Belleisle" was struck and completely wrecked, the mass of wreckage being swept away and carried overboard. From this it is argued that it would be folly to support the conning tower or fighting position on a bridge. The tower should carry its full diameter well down into the body of the vessel, and have its base thoroughly protected by the side armor. There can be no question as to the necessity, as above pointed out, for giving most thorough protection both to the steersman and the reserve steersman; for should the former be killed or disabled at a critical moment in battle it is easily conceivable that the delay in sending for a "replace-man" might have most serious consequences, and, possibly, be fatal to the ship. By building the conning tower in two stories, and having the "replace-man" in the story below, the risk of the ship running wild is reduced to a minimum.

The awful destruction wrought by the lyddite shells and the dense clouds of dust and fragments produced by the explosion indicate that there are two other most important accessories that demand attention; the first, the important matter of placing the range-finder, and the second, signaling. Ordinarily the range-finder is carried on the bridge, but the short work made of this structure on the "Belleisle" shows that some other position must be found, and the writer suggests that the range-finder tripod should be carried on a light grating, upon which the operator would lie prone and communicate the ranges by a transmitter. As to signaling, the "Belleisle" experiment confirms the experience gained at the battle of the Yalu, where the signal halyards were entirely swept away; for the bombardment gave little promise of the survival of even the light masts. There are two methods of signaling suggested, one a small captive balloon carrying flags which may be hoisted and cut away and sacrificed when done with, and the other suggestion is the use of colored shell for simple signals.

When the writer comes to the question of the effect of high-explosive shell fire on the personnel of the ship, we think that he is dealing with what, after all, is the most vulnerable point of attack in the modern warship. We are satisfied that in a battle carried out at moderate ranges between ships whose crews are fairly proficient marksmen the fight will be determined by the decimation of the crews, rather than by the destruction of the ships. Unquestionably many will be placed hors de combat by mere concussion, whether by the impact of shells on the outside of the turrets and casemates, or by the atmospheric shock and asphyxiation due to the bursting of high-explosive shells within the inclosed spaces of the ships. It is true, as Mr. Jane points out, that the actual effects of gun fire on the personnel is a matter of conjecture, and unless volunteers can be found who will place themselves within such a vessel as the