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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.

THE TRUTH ABOUT THE BELLEVILLE BOILER.

Why is it that the French engineers of the Messageries Maritimes have pronounced the Belleville boiler an unqualified success, and Englishmen condemn it as a costly failure? The boiler, it is true, is a French invention; but patriotism alone never persuaded Frenchmen to introduce it in the navy. Moreover, the Independent Boiler Committee, whose recommendations the British Admiralty largely followed in adopting the boiler, had decided in no uncertain terms that the Belleville was the best boiler on the market. And yet, despite this strong praise from an unbiased jury, the boiler has sometimes failed in a way that could not but occasion uneasiness.

In the current issue of the SUPPLEMENT, Mr. Archibald S. Hurd very carefully analyzes the problem which has confronted the British Admiralty, and has proven quite conclusively that the varying success which has attended the use of the Belleville boiler in France and in England is to be attributed to two causes—the one British variations from the inventor's designs, the other British unfamiliarity with the working of the boiler.

It might be supposed that, having decided to adopt the Belleville boiler, the experience of the inventor would have been drawn upon by the Admiralty. Moved largely by Parliamentary objections to the use of a French invention in a British warship, however, the Admiralty thought it expedient to modify the plans to suit the British ideas. Workmen, utterly ignorant of the niceties of construction learned by the French makers, blindly began the building of the boilers for the navy. In France welded tubes had been employed. In England solid-drawn tubes were substituted. Other alterations were made of questionable merit, all of which increased the cost of the boiler at least one-third.

Ships equipped with boilers made after a pattern which was probably unsanctioned by the inventor, were placed in commission with an engine-room staff that knew little or nothing of the practical working of the new steam generator, except that it required more nursing than the Scotch boiler and that it needed more careful stoking. The older men, in particular, looked askance at the innovation. Even if they knew enough about the boiler, they were little disposed to give it a fair trial. It happens frequently enough in the British navy, not only that engineer officers are placed in charge of boilers and engines about which they are technically ill informed, but also that the number of these officers is wofully insufficient for the task assigned to them. Is it any wonder that breakdowns occurred?

The more intimate the engineer's acquaintance with the machinery which is intrusted to his care, the greater will be the efficiency of that machinery as time passes. In a fighting-ship perhaps more depends upon the man who gets up steam than upon the much-praised man behind the gun. And yet a few months ago the military prestige of Great Britain depended upon warships with men in the engine room who were anything but familiar with the boilers they were called upon to supervise.

That the chief reasons for most failures of the Belleville boilers in British ships are to be found in the uncalled-for modifications of the French type and in the lack of skill of British engineers, Mr. Hurd has shown by many a striking example. After much delay and at no small cost, the British authorities learned how to make the boiler, and trained a large number of officers and men in its use. The result was magical.

Within the last few months ships which have been fitted with the Belleville boiler have more than justified the expectations of its most ardent advocates. Of the twenty-six battleships and forty-three cruisers which took part in the recent naval maneuvers, but one vessel broke down, and that was the "Blake," fitted with Scotch and not with Belleville boilers. Twenty-one of the ships had been equipped with the French steam generator. Each of the vessels during the preliminary operations was made to cover a distance of from 2,000 to 2,500 miles. And yet in no instance were the boilers found wanting. Perhaps the most striking illustration of the efficiency of the boiler was afforded by the remarkable run of the cruiser "Good Hope" during the maneuvers. She took on coal at Portland, and steamed for the Azores at a speed of eighteen knots. There she received orders to chase one of the cruisers of the opposite side. She had slowed down to nine knots for over half an hour to communicate with the senior Admiral, Sir Arthur Wilson, but in seven minutes she was traveling through the water at nineteen knots, and in half an hour she was speeding at twenty-two and one-half knots, with still enough steam to enable her to move even faster. For three hours and a half and more, she kept up this speed. Then the quarry, which had a start of ten miles, was overtaken. The vessel then proceeded to Lagos on the Portuguese coast. She arrived in good order for the series of tactical exercises which had been planned for the combined British fleets.

Still another remarkable example is afforded by the cruiser "Spartiate," whose reputation as a ship is anything but enviable. For six years her construction had been delayed. When she was at last completed, her trials proved her a most unsatisfactory vessel. On March 17 last, she left England for Hong Kong with a relief crew for the battleship "Ocean." Although two of her engineer officers were familiar with the working of her Belleville boilers, only about twenty of the stokers and artificers had had previous experience with the new generator. Nevertheless, the run of 9,600 miles to the far East was creditably covered at an average speed of thirteen knots with a coal consumption of but 3,000 tons. The best previous records for the same trip in coal consumption were those of the cruiser "Amphitrite," which burnt 4,200 tons, and of the "Blenheim," fitted with cylindrical boilers and displacing 2,000 tons less, which burnt 4,000 tons, although the average daily speed was only eleven and one-half knots.

Some time must necessarily lapse before the true history of the Belleville boiler is written. The experience gained within recent months proves, however, that the introduction of the boiler will be attended with the same success which marked its use in the Messageries Maritimes. Too much haste has been shown in condemning a system only too imperfectly understood in England. Whether the Belleville boiler or one of its half dozen rivals will ultimately be selected by naval engineers, no one can tell. This much at least is certain—the water-tube boiler as an adjunct to a fighting-ship has come to stay.

FIREPROOF METALLIC CARS AND A PROTECTED THIRD RAIL URGENTLY NEEDED ON ELECTRIC ELEVATED AND TUNNEL RAILWAYS.

The collision which occurred on the Fifth Avenue line of the Brooklyn Elevated Railway early in the evening of November 19, by which a motorman and a conductor were killed and some half dozen passengers were seriously injured, should sound a note of warning to the management of the new Rapid Transit tunnel road, and cause the operating company to pause before equipping the road with cars that are not surely incombustible, even in the intense heat of electric arcs that generally occur when there is a collision.

In the accident referred to, an empty train was proceeding toward New York, when a fuse blew out, extinguishing the lights and bringing the train to a standstill. Whether oil danger lights were burning on the rear end of the train or not, is not definitely known; but the action of the conductor in immediately attempting to reach its rear end with a red lantern (as a result of which he lost his life) would perhaps indicate that the lights were not in place. Otherwise, it seems improbable that the motorman of the following train, which was well filled with passengers, would not have seen the lights in time to stop, as this train crashed into the empty one on a straight track and under perfectly clear weather conditions. At the same instant that the collision occurred, there was a loud explosion, and flames shot up from beneath the car at its forward end, setting it ablaze almost before the badly shaken-up and injured passengers had time to crowd back into the rear cars. Although thrown from the track, and telescoped into the two rear cars of the forward train, the head car fortunately did not fall from the elevated structure. Firemen were called, and they rescued four trainmen from the burning rear car of the forward train by means of ladders, which they put up from the street to the track. The passengers of the second train made their way back with difficulty to the Thirty-sixth Street station, in constant danger of stepping on the live third rail. The collision occurred alongside of Greenwood Cemetery, and two passengers and a guard jumped to the ground to escape from the burning train. The inefficiency of the railway company in case of accident is shown by the fact that it was an hour and a half before a rescue train arrived. The motorman was found dead at his post, his body being badly charred; and the conductor of the forward train was found in the rear car, lantern in hand.

The accident is a forcible reminder of the dangers of third rail electric traction as carried on to-day in many of our leading cities; and it has again demonstrated that, despite signals, automatic devices, and all precautions, the failure of one individual to perform his duty, either from neglect or accident, may precipitate a disaster of the most terrible kind. When one thinks of the lives that would have been lost had the collision occurred between two of the many densely-packed trains that return from New York daily in the early evening hours, a shudder involuntarily goes through one at the thought of the havoc that would have been wrought, and that is now constantly menacing.

It is evident the time has now arrived for some legislative enactment compelling the use of fireproof metallic cars, proved by an actual fire test to be incombustible, and substantially constructed to withstand the shock of a collision in a far greater degree than is ordinarily possible, as well as of protected third rails, which, if they will not cease arcing in case of short circuits, will, at least, be incapable of setting anything afire, or of giving to escaping passengers death-dealing shocks. Such a law could doubtless be applied with benefit to the rolling stock of all electric street car lines, but in the case of elevated and tunnel roads, it seems an absolute necessity for the proper protection of the public.

GOVERNMENT TESTS OF THE LAKE SUBMARINE BOAT.

The government tests of the Lake submarine boat are being held at Newport, R. I., during the last two weeks in November. An outline of the programme for these tests was given in our November 14 issue, where it was stated that a competitive trial between the Lake boat "Protector" and the Holland boat "Fulton" would be held. The Holland boat failed to put in an appearance, and so there will not be an opportunity of comparing the two leading types of American submarine boats as to their ability to maneuver in the open sea, as was hoped. The "Protector" demonstrated her seaworthiness in a run from Bridgeport, Conn., to Newport, R. I., where she went to report for the trials, as she covered the distance at an average speed of nearly 7 miles an hour, with a sloop and a launch in tow, and during rough weather. We are not aware that any boat of the Holland, or diving, type has ever been run outside of land-locked waters, and incapability of negotiating heavy seas may therefore be one of the reasons for the non-appearance of the "Fulton." The Lake boat is an improvement in this respect at least over the half-dozen odd submarines now owned by our government, and it is to be hoped that the test will result in showing other improvements of secondary importance that the inventor claims are incorporated in the "Protector."

PHOTOGRAPHIC PRINTS WITHOUT LIGHT.

"Katatypes" is the name given by the inventors, Ostwald and Gros, of Leipzig, to prints made from photographic negatives without the aid of light. The process is based on the properties of peroxide of hydrogen and on the formerly mysterious chemical phenomenon which is known as katalysis. By katalysis is meant the production of a chemical reaction by means of a substance which itself undergoes no chemical change. The first known instance is the conversion of starch into sugar by treatment with acids, the latter being found unchanged, and undiminished in quantity in the final mixture.

Another case is the explosion of mixed hydrogen and oxygen in the presence of finely divided platinum.

Recent experiments on the speed of chemical reactions have thrown a little light into the darkness of this mysterious katalysis, and it is now believed that all such reactions would take place of themselves but with almost infinite slowness, and that the function of the katalyzer is to make the reaction rapid enough to be perceptible to our senses. Possibly, it overcomes some unknown resistance to the reaction, thus acting as a sort of chemical unguent. Now most of the chemical changes which are apparently wrought by light are of this sort. They take place, though slowly, in the dark. Every photographer knows this from experience. His bichromated paper becomes useless in a few days, his plates in a few months or years.

The function of light in photography, then, is simply that of an accelerator, a katalyzer, and it may be replaced by other katalyzers. Now there are few better katalyzers than the layer of finely divided silver which forms a photographic negative picture, and there are few substances more susceptible of katalytic action than peroxide of hydrogen, which, despite its excess of oxygen, and its resultant tendency to split up into oxygen and water, is entirely permanent under normal conditions.