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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 ELECTRIC RAILROAD WRECK AT ATLANTIC CITY.

It is a most unhappy coincidence that on the same date on which we publish in the SUPPLEMENT a description of the very fine work of electrifying the West Jersey and Sea Shore Branch of the Pennsylvania Railroad, we should have to comment in the SCIENTIFIC AMERICAN upon a tragic accident which occurred soon after the opening of that road, whereby between fifty and sixty people lost their lives. As we go to press, the coroner's jury is at work upon the investigation of the wreck, which occurred on October 28, and it is too early to give any definite opinion as to the cause of the derailment, by which a whole train was thrown from the drawbridge into the water, and three-fourths of its passengers drowned in over 20 feet of water. Pending the findings of the jury and the report of other investigations which will be undertaken by experts who are qualified to judge of the conditions, it is only an act of common fairness to the company to state that this work of electrification, as described in the SUPPLEMENT, seems to have been carried out with that thoroughness and disregard of cost which characterizes first-class work. Shortly before reaching the "Thoroughfare"—a tidal estuary which flows beneath the railroad at a point about two miles from Atlantic City—the tracks of the new electric road are carried by an elevated viaduct over the tracks of the Pennsylvania and Reading line, and this work is thoroughly up-to-date, consisting of a steel superstructure carried on concrete piers. Other evidences of the high character of the work are that over a considerable part of the 65 miles from Camden, N. J., to Atlantic City, the tracks are laid with 100-pound steel, which is the heaviest weight used on any steam railroad to-day, while over the rest of the distance 85-pound rail is used. The rolling stock is also of the most modern type, and broadly similar to that which will be used on the Pennsylvania Railroad main line improvements.

The cause of this terrible accident, then, is to be sought for, not in poor construction, but in certain accidental conditions which developed at the drawbridge at the time the fatal train was crossing. The track, the bridge, and the car would seem to have been of first-class construction, and the accident would seem to have been due to some misplacement, either of the draw or the rails, or possibly to the slipping of one of the wheels on its axle—the cause to which a recent derailment in the New York Subway was attributed.

As far as one can glean the truth from the confused and contradictory statements of railway employees, passengers, and onlookers, and from the incomplete evidence at the inquest, we are inclined to think that the draw, which had been opened for the passage of a small yacht shortly before the train approached, was not perfectly aligned when the wheels of the first trucks passed from the approach on to the draw itself. That these were the conditions is strongly suggested by the reported testimony of the bridge tender at the inquest, who stated, according to press accounts, that the rails at the drawbridge buckled at times; that he had to hammer them back into place, and that he had received instructions to saw them shorter if they buckled again. This would indicate that the rails on the downgrade of the overhead crossing over the Pennsylvania and Reading Railroad track had been creeping toward the draw, and that possibly on this Sunday morning there was interference trouble between the rail ends, which prevented a proper closure of the draw and alignment of the track. In the interests of future railroad operations, particularly at drawbridges, it is to be hoped that the underlying causes of this disaster will be accurately determined.

SINGLE-PHASE ELECTRIC ROAD BETWEEN BALTIMORE AND THE NATIONAL CAPITAL.

Single-phase electric traction has come to stay. The latest evidence of this is shown in the announcement that a single-phase electric road is about to be built connecting Baltimore and Washington, D. C. Some three years ago a company was formed to carry out this project; but after the contract had been let for the equipment the plans were abandoned. Owing to the failure of the first single-phase project, a most careful engineering study was made of the conditions; and the final solution of the problem, and the construction of the road by an entirely new company, are proof of the merit of the present single-phase system. The contract for the entire electrical equipment of the rejuvenated road has been let to the General Electric Company.

The total length of the new road is about 60 miles, double-tracked throughout. The main line will connect Baltimore and Washington, and there will be a branch line, from a point on the main line near Odenton, extending to Annapolis. A very complete rolling-stock equipment will be provided for both express and local service between the cities mentioned. Nineteen express cars will be operated, each capable of making 60 miles an hour on a level track; and two heavy construction cars will be equipped, each powerful enough to haul a train of five ordinary passenger coaches at 45 miles an hour. Four of the new type General Electric single-phase railway motors will be installed to drive each of these cars. These motors will each have a capacity of 125 horse-power, and as in the case of the New Haven equipment, they can be operated not only on the single-phase electric trolley of the main line, but also on the direct-current trolley sections within the city limits of Baltimore and Washington.

Two motors of this same size will be used on the local service cars. All the cars will be equipped with the multiple-unit system of control, by means of which the cars can be operated singly or in trains, on direct current or alternating current, by one motorman. Express cars will run every 15 minutes between Baltimore and Washington, the total time being 72 minutes. Power for the new road will be purchased from the Potomac Electric Company at Washington, D. C., and will be delivered by that company to suitable substations located along the line, which will supply single-phase current to the trolley at a potential of 6,600 volts. As this is one of the largest installations of exclusively single-phase railway equipment, the construction and operation of this road will be watched with great interest in railway and engineering circles.

NEW RATING OF THE WORLD'S FLEETS.

If the system of rating the fighting values of the world's fleets adopted in the latest issue of "Fighting Ships" be correct, we must entirely revise our estimate of the relative power of some of the leading navies. France yields second place to the United States, and Germany, which before the Japanese war was considered to be at least equal if not superior to the United States, moves down to fifth position with Japan ahead of her, Russia being sixth, Italy seventh, and Austria in the eighth position. The placing of the German navy below that of Japan in an estimate of relative fighting power would seem, at the first blush, to savor of absurdity; but when we begin to examine into the basis of comparison adopted in "Fighting Ships," we find that the change has been made on grounds which are at least plausible.

This startling advancement of some of the navies and depreciation of others is due to the fact that the new system of rating is based strictly upon the stern lessons of the Japanese war, in which, during a few short months, the third greatest navy of the world was practically swept out of existence. Outside of its reassertion of the value of a trained personnel, that war emphasized the importance of the big, heavily armed, and heavily armored battleship. Furthermore, it is the unanimous opinion of naval experts that the war established the overwhelming value of the heavy, long-range gun. It proved, once more, that the final command of the sea, other things being equal, will lie with the navy which can bring the largest number of big guns to bear, when the rival fleets are facing each other in line of battle. This fact has been so far accepted that the building programmes of all navies for the present year are based entirely upon its recognition.

In the new rearrangement of the navies of the world in the order of their fighting importance, above referred to, the ships are set down in parallels of fighting value, with the battleship "Dreadnought" taken as the unit. In the estimate are included all the warships of the various fleets that are built, building, or proposed. The high position given to the United States and to Japan is due mainly to the fact that fortunately neither of these powers was affected by the agitation of a few years ago in favor of installing guns of medium caliber in the main batteries

of warships, and abolishing the 12-inch gun. As a consequence, not one of the first-class battleships of either navy carries, as its main armament, anything lighter than the 12-inch gun, while eight of our own ships mount a 13-inch piece of great power and accuracy. The German designers, however, in the ten years from 1890 to 1900, were leading exponents of the school which advocated the substitution of a lighter and handier gun in place of the then cumbersome, and comparatively slow-firing, 12-inch gun. As a consequence, every one of her battleships built during that late carries, in its main battery, a weapon which most of the leading powers to-day consider to be not even sufficiently powerful for use in the intermediate battery of battleships or the main battery of cruisers. The "Kaiser Friedrich III." class of five ships, and even the "Wittelsbach" class of five ships launched as late as 1901, mount nothing heavier than the Krupp 9.4-inch gun. Even the ten latest ships of the "Braunschweig" and "Deutschland" classes carry only a 40-caliber 11-inch piece, and there is not a battleship afloat in the whole German navy to-day that mounts a 12-inch gun.

In the "Fighting Ships" comparison the warships are rated under fourteen classes, with the "Dreadnought" as the unit; and it must be borne in mind that her high efficiency is due not alone to her ten well-protected 12-inch guns, but also very largely to her abnormally high speed. In the *First Class* the British have the "Dreadnought" completed and two new "Dreadnoughts" proposed. The United States has the "South Carolina" and "Michigan" and the new proposed 20,000-ton ship. France has nothing proposed of equal efficiency to the "Dreadnought." Japan has two new vessels proposed, and Germany none, of the same power as the unit ship.

In the *Second Class*, the British have two ships of the "Lord Nelson" type, carrying four 12-inch and ten 9.2-inch guns, and two so-called armored cruisers which will probably be an improved "Inflexible" type, carrying eight or more 12-inch guns. The United States has nothing in this class. The French have six of the "Danton" type carrying four 12's and twelve 9.4's. The Japanese have two "Akis," mounting four 12's and several 10's; the Germans two of the "Ersatz Sachsen" type, mounting fourteen 11-inch guns. In the *Third Class* the British have eight of the "King Edward" type carrying four 12's and four 9.2's, and three of the "Inflexible" type mounting eight 12's. In this class we have a very strong representation consisting of six of the "Kansas" and "Louisiana" type mounting four 12's and eight 8's; five "New Jerseys" of the same battery power, and two "Idahos," also carrying four 12's and eight 8's. France has six ships of the "Liberté" and "Republique" types carrying four 12's, and a numerous battery of 6.4's or 7.6's. Japan has two "Kashimas" carrying four 12's and four 10's. Germany has nothing in this class. In the *Fourth Class* Great Britain has twenty-five ships of the "London," "Duncan," "Warrior," and "Black Prince" types, the two last-named being cruisers. We have three of the "Maine" type and four of the cruiser "Washington" type, the latter mounting each four 10-inch in the main battery. The French have the "Suffren" and "Iena"; the Japanese nine ships, including those that were engaged in the war, two the former Russian battleships, the "Orel" and "Czarevitch," and four new cruisers, now under construction in Japan, which will carry 10-inch or 12-inch guns in the main battery. In this class Germany has a strong showing, including five "Deutschlands" and five "Braunschweigs," each carrying four 11-inch guns, besides two new cruisers each mounting eight 8.2's. In the *Fifth Class* Great Britain has fifteen battleships of the "Majestic" and "Canopus" types. We have three "Alabamas"; the French seven battleships and three powerful cruisers, and Japan three battleships, namely, the "Fuji" and two that were captured from Russia. Germany has no ship in this class. In the *Sixth Class* the British have twenty ships, including seven "Royal Sovereigns," the "Hood," two "Trafalgars," and ten armored cruisers of the "Drake" and "Cressy" types, the latter carrying 9.2's in their main battery. In this class also the United States is strong, having twelve ships, including two of the "Kearsarge" type, three "Indianas," one "Iowa," and the six armored cruisers of the "California" type. France has seven ships; Japan one; and it is to this class that, because of the light character of their armament, ten of the latest battleships of the German navy, launched between 1896 and 1901, are relegated.

It is not necessary to pursue the comparison further, but attention should be drawn to the new value assumed by that most efficient type of ship, the armored cruiser. The placing of some of these ships in the same class with the battleships is justified by the fact that in the engagements of the late war Togo did not hesitate to put his armored cruisers in the front line of battle. Under this method of rating, the author of "Fighting Ships" has placed those fine armored cruisers of our navy, the "Washington," and "Tennessee," and their sisters, in the same class with

the British battleships "Duncan" and "Formidable," the Japanese battleship "Mikasa," and the German battleships of the "Deutschland" class. In the same class also he places the British cruisers of the "Warrior" type. The compiler of these tables even prefers the "Washington," with its high velocity 10-inch armor-piercing rifle, high speed, and great coal endurance, to our own three "Alabamas," which are placed in a class below it. The high position given to our navy in this table, which has been drawn by the man who in all Great Britain has probably given the greatest amount of attention and thought to this particular phase of the subject, is an indorsement of that traditional policy of the United States navy, dating from its earliest days, which has insisted that our ships must carry the heaviest possible battery of long-range guns.

A FRENCH "JUNGLE."

The few Americans to whom European opinion concedes the possession of a sense of shame and a liking for decency, and who are supposed to have been sitting with bowed heads and tightly-clamped nostrils ever since the horrors of Packingtown were exposed, may stiffen their spines a bit—without, however, relaxing the death grip on their noses. They are beginning to learn that "there are others." All sorts of horrible stories have come from England, and now M. Martel (appropriate name!), chief of the animal inspection service of Paris, is hammering French butchers and telling them to go to Germany, regardless of Sedan and the lost provinces, and learn that the Middle Ages no longer exist beyond the French frontier. In an article in a French scientific journal (*La Science au XXme Siècle*) M. Martel, who surely ought to know what he is writing about, describes a state of affairs so primitive and repugnant, that its toleration in the twentieth century in the enlightened city of Paris seems absolutely incredible. For, singularly enough, conditions are even worse in Paris than elsewhere in France.

M. Martel impartially distributes the blame for the rudimentary equipment and exceeding filthiness of the 918 public abattoirs of France among ignorant architects, routine-enraptured butchers, careless municipal authorities, and indifferent consumers. French designers of abattoirs, he says, know nothing of the needs of the business or the importance of sanitary inspection, and are the laughing stock of the designers of foreign establishments. The French idea of a public abattoir has not changed in a century because the powerful butchers' syndicates have always maintained the principle that the butcher is master in his own shop, and may defy the inspectors.

The old provincial establishments, built long before there were any public abattoirs in Paris, are better planned than the newest Parisian abattoirs, for at first the advantage of working together was recognized. But the Parisian butcher would not abandon his private killing room, connected with his shop, except upon condition of finding precisely similar accommodations at the public abattoir. Consequently, the abattoirs have become agglomerations of private slaughter houses, in which everything is done in the most primitive fashion, and sanitary supervision is very difficult.

Many French cities, in order to avoid the expense of erecting public abattoirs, have conceded the privilege of building and managing them to individuals and corporations—most of the contracts being very disadvantageous to the city, and so drawn as to block all progress, for, as in Paris, the butchers use all their influence in favor of the system of many small killing rooms.

In France, as elsewhere, the public has remained indifferent to the cause of reform—especially the poorer classes, which are most exposed to the dangers of unwholesome meat. Last year a deputy, in proposing a law (which did not pass) for the extension of the system of public abattoirs, gave utterance to the following naïve confession of impotence: "We must content ourselves with the hope that small municipalities may recognize their duty, and invite the veterinary to inspect the private slaughter houses at the first suspicion of disease."

The average French abattoir consists of a series of stone-walled killing cells, about fifteen feet wide and thirty feet long, alternating with larger and more open halls or courts, which are used for the reception of cattle and for work of various sorts, including slaughtering when the adjacent cells are filled with carcasses. None of the great abattoirs of Paris possesses the modern appliances which are used in Germany and elsewhere for the slaughtering of animals and the dressing, hoisting, and aerial transport of carcasses. Many of the killing cells are poorly lighted, and in some of them lamps and candles must be used when artificial light is needed on winter mornings! The courts are exceedingly filthy. Here stomachs and intestines are cleaned, and their contents, with miscellaneous offal and embryos in every stage of development, are thrown pell mell on the blood-soaked soil. The drovers' dogs are allowed to feast on this

carion, through which the sanitary inspectors must pick their way to the dimly-lighted killing cells.

This appetizing picture is hardly more astounding than the information that no abattoirs in Paris, and only two in France, possess cooling or cold storage rooms.

On the other hand, the public abattoirs of Germany are, in M. Martel's opinion, models of construction, equipment, operation, and inspection. Twenty-five years ago Germany possessed few public abattoirs, but now there are more than four hundred in Prussia alone. The importance of cold storage was recognized fifteen years ago. Many of the German public abattoirs are controlled by syndicates of butchers, who appreciate the advantages of refrigeration, general killing rooms, and machine hoists and carriers. On these points, however, America has little to learn from Germany. The special merits of the German establishments consist in cleanliness and vigorous sanitary inspection.

A peculiar German institution, which has been introduced into some other countries, appears at first sight anything but attractive to American eyes. The *freibank* is a shop devoted to the public and official sale of condemned meat which has, theoretically, been made wholesome by sterilization. Sometimes the *freibank* is attached to the sanitary department of the abattoir, and is under the control both of the police and of the inspection service of the abattoir; sometimes it is in the city, in which case the supervision of the inspectors is less strict. But in every case the meat is sterilized in the sanitary department of the abattoir by methods which involve as little loss of weight and food value, and as little alteration in appearance and flavor, as possible. For example, meat which contains tapeworm larvæ is submitted to prolonged refrigeration, while tuberculous meat is simply heated to a high temperature in closed vessels.

The prices of meats sold at the *freibank* are fixed by the local authorities, and the quantity sold to a single purchaser is limited—usually to about six pounds. This restriction makes it impossible for keepers of hotels, restaurants, and boarding houses to feed their unsuspecting "paying guests" on this officially "cured" meat.

The *freibank* is rapidly becoming common in Germany, especially in the north. It is compulsory in Prussia and Saxony. In Saxony it has been gravely proposed to establish *freibänke* in the fire-engine houses in small towns. Austria, Belgium, and Switzerland are adopting the *freibank*, and it is making progress in Italy, in the face of violent opposition. In Saxony, in 1902, of each one hundred beeves slaughtered, ninety-three were admitted to unrestricted sale, and five and a half were sold at the *freibank*—the remaining one and a half, presumably, having been condemned beyond redemption. More than three million pounds of meat are sold each year in the *freibänke* of Berlin.

The *freibank* does not exist in France, and M. Martel thinks that the French idea of equality will prevent its establishment there. But he points out that the law of supply and demand creates *freibänke* of a very different sort, in which meat unfit for food is sold to customers who can not afford to buy any other. Probably we free and equal—and free and easy—Americans prefer the same system.

TULARE LAKE BASIN AGAIN FILLING UP.

Tulare Lake, once a prominent feature on all old maps of California, and at the time enjoying the distinction of being the largest body of fresh water west of the Mississippi River, is located in the extreme southern part of San Joaquin County, at an altitude of about 200 feet above tidewater. In the forties its superficial area is said to have exceeded 1,200 square miles, but in 1868 its dimensions had shrunk to 760 square miles, and twenty years later to less than 200. Occasional floods have raised the level of the lake, but the general tendency has been toward obliteration.

Originally the lake, by a well-defined outlet, emptied into the San Joaquin River, but sedimentary deposits have gradually built up a dike which obstructed the flow of waters and made of the Tulare basin an independent system of its own. The lake receives the waters of Kings, Tule, White, Waweah, Kern, and other rivers, each draining large sections of country, and in periods of flood carrying immense volumes of water. Though of great superficial dimensions the lake is extremely shallow, the deepest part being only 30 feet in depth, while evaporation exceeds 8 feet annually. Tulare Lake has for ages been the depository of all the sediment brought down from the Sierra Nevada Mountains by the rivers of the basin, which formed a soil of the greatest fertility and, but for a liability to flood, the wide plain constituting the basin would have been the site of extensive agricultural development and great productiveness.

Private enterprise aided by the State has made several ineffective attempts to re-open the barrier which prevents the surplus waters from flowing back through the old channel, and thus draining the whole basin,

but the undertaking involved dredging a channel 30 miles long and, in places, 30 feet in depth, and required an outlay of capital beyond the ability of the district to raise, though it is estimated some three-quarters of a million acres would be reclaimed and made fit for cultivation if the project were carried out.

Within the last ten years Tulare Lake has been visibly growing less in dimensions, and the belief in its permanent disappearance has become settled in the minds of those who were interested in the land once covered by its waters. Several reclamation districts were organized, appropriating 150,000 acres of the old lake bed, and a large area put under cultivation. The fertility of the land was demonstrated and immense crops were raised, the land being protected by levees and carefully drained at an expense of several millions. Faith in the future was stimulated by absence of floods, and the ease with which the surplus waters of the rivers were disposed of through the customary channels, and by the belief in the capacity of the numerous irrigating districts to consume all the waters of all the rivers which normally discharge into the lake; moreover, the rainfall of the region for over ten years had been light, and the change in the seasons seemed to have become permanent.

The present year opened with less than the usual rainfall, and more land was put under cultivation in Tulare basin than ever before. Thousands of acres which no plow had ever touched were planted to grain and fruit, and up to the first of February the outlook of the lake dwellers was most alluring. A vast amount had been laid out in permanent improvements and farming machinery, and appearance flattered the most exalted hopes of abundant crops of every description. These would have been fulfilled had not the early months of 1906 violated all precedent, and proved the most extraordinary in point of rainfall in the history of the State. Conditions were reversed. All the region included in the upper part of San Joaquin Valley was drenched with continuous rains for two months, and every watercourse emptied unprecedented floods and, having no outlet, covered the bed of Tulare Lake to a depth which submerged every acre of cultivated land within its boundaries, swallowing up all crops and improvements and utterly destroying the results of ten years of unremitting work expended by the industrious colonists. Where were once wide-spreading tracts of highly-cultivated farms there is now but a waste of waters, above which rise the ruins of great harvesters and the wrecks of homes. The loss cannot yet be estimated, but is widespread and will run into millions. There is no prospect of the lake resuming its level of the early part of the year, when not over ten square miles of land was submerged, for the rivers are still pouring great floods into the basin, and will continue to do so for the next six months, as the present high stages will be succeeded by the usual summer flood arising from melting snows from the Sierras, and is sure to be of unexampled magnitude. Observers report a depth of snow on the summit of the eastern ranges of 22 to 30 feet, extending to low altitudes, and as this will not begin melting before the month of June, the outlook for Tulare is ominous.

The general belief is that no farther attempt to reclaim the vast basin will again be tried until the old outlet into the San Joaquin River is opened, and a sufficient channel to carry any possible flood dredged.

THE CURRENT SUPPLEMENT.

The current SUPPLEMENT, No. 1610, contains an unusual number of valuable technical articles. A Koerting 200-horse-power valveless two-cycle petroleum engine for submarine boats is described and illustrated by the English correspondent of the SCIENTIFIC AMERICAN. The Editor has made arrangements to publish a series of articles on soldiers. The first of these appears in the current number of the SUPPLEMENT. W. B. Gump writes on the properties of the series transformer. Most valuable is Dr. Eugene Haanel's discussion of the electric smelting of Canadian iron ores. The electric railway on which the unfortunate accident at Atlantic City recently occurred is described in full, and its rolling stock illustrated. How hot-air balloons are inflated is told in a clear and well-illustrated article. Dr. Theodor Koller gives some very good suggestions on the utilization of waste materials. The Editor hopes to publish a series of articles on this subject. In the present installment the utilization of wood waste and horn shavings is discussed.

The proposal to transmit electricity generated at the Victoria Falls to Pretoria and Johannesburg is taking shape, and a first issue of capital will, it is said, be announced within the next few weeks. The distance from the Falls to the Rand as the crow flies is 600 miles, but it will be necessary to make deviations that will increase the distance to be covered to nearly 700 miles. The extraordinary pressure of 150,000 volts is proposed. At the outset provision is to be made for 30,000 horse-power, but this may be increased as necessity arises.