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NEW YORK, SATURDAY, FEBRUARY 25, 1905.

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.

TURBINES FOR TRAMP STEAMERS.

The subject of the unsuitability of the turbine as a drive for ships of slow speed, that is, of speeds of about 9 or 10 knots an hour, at which the average tramp steamer travels, was recently discussed in the course of his presidential address before the Institute of Marine Engineers, by the Hon. C. A. Parsons, the man who, better than anyone else, is qualified to speak on this subject. The problem of turbine propulsion of ships at low speed presents the following dilemma: In a slow vessel the revolutions must be low, because a certain disk area and a certain blade area are necessary in the propeller if we are to avoid too great a slip ratio; but the pitch ratio cannot be reduced much below 0.8 without incurring excessive skin friction of the blades. This makes it necessary to use the highest revolutions possible under the circumstances, and these, in a 10-knot vessel, are necessarily very low. On the other hand, a certain surface speed of the turbine blades and a certain number of rows of blades are necessary to obtain a reasonable economy from a turbine; and if the revolutions are low, the diameter, and the number of rows must be increased. The result is that, for a speed of 10 knots, the diameter and the number of rows become inordinately great; the weight and the cost become excessive; and, of course, the efficiency of the turbine is somewhat impaired by the use of such extravagant dimensions in proportion to the power realized.

It will be news to the marine engineering world, and extremely interesting news at that, that Mr. Parsons says there is a way out of the difficulty, by which there can be obtained in a low-speed turbine the full measure of expansion essential to economy—an economy better than that of the best set of tramp engines of which he knows. He has found it possible to build a turbine that will operate economically under very low-pressure steam, even when it is running under slow revolutions. He states that the engines of a tramp steamer expand the steam down to about 7 pounds absolute pressure, when it is discharged to the condenser. The remaining energy, represented between the pressure of 7 pounds and that of say 1½ pounds, is practically lost. The new type of turbine is able to save about 70 per cent of this wasted energy; and the additional power due to the use of this low-pressure turbine is estimated at between 15 and 20 per cent of the whole power now realized—a gain which Mr. Parsons likens to that which was obtained in the advance from the compound to the simple reciprocating engine.

In referring to the possibility of the marine gas or oil engine becoming the extensive competitor of the steam engine, Mr. Parsons holds the same view which we have frequently expressed in this journal, that although such engines have realized a horse-power on a consumption from half to two-thirds of that of the best condensing steam engine, "it cannot yet be said that they can generally subsist on ordinary bunker coal. If, in the future, some form of gas producer using ordinary coal is successfully applied for use on board ship, and if the mechanical details of reversing can be satisfactorily arranged, then the steam engine or steam turbine will have to give place to the gas engine." That is exactly where we stand to-day, and as soon as our inventors and engineers can build a gas-producer that can take the ordinary "run of the mine," the application of the gas engine will become general in almost every branch of engineering. We do not know of a field of investigation or invention that holds out a richer prize than this.

THREE MONTHS OF RAILROAD SLAUGHTER.

The death roll of the railroads of this country continues to lengthen, and the number of casualties in any given period steadily increases. Accident Bulletin No. 13 of the Interstate Commerce Commission tells us that the number of persons killed in train accidents during the months of July, August, and September last year, as shown in reports made by the railroad companies to the commission, was 411, and that the number of injured was 3,747. Accidents of other kinds, including those sustained by employes while at work and by passengers in getting on and off cars, etc., brought the total number of casualties for that quarter of the year up to 14,239, of which 1,032 were killed, and 13,207 were injured. These figures mean that in the course of a single year, were this rate of maiming and killing sustained, our railroad system would be directly or indirectly accountable for the death of 4,128, and the more or less serious injury of 52,828 people. The Bulletin of the Commission says that the quarter under review may, as a whole, be termed the most disastrous on record. Of the 228 passengers and 183 employes killed in train accidents, 217 cases are accounted for by six accidents, and these 217 were nearly all passengers. In one case of derailment, 88 people were killed. In one collision 63 were killed; in another, 24; and two other collisions accounted respectively for 18 and 16 deaths.

The true measure of the blameworthiness of the railroad systems, in this matter of injury and death, is not so much the total number of victims as it is the total number of accidents. There is no strict relation between the number of people killed in a particular accident and the amount of carelessness, or poor management, or neglect, that brought about that particular accident. A very slight defect, not easily detected, might result in the killing of a hundred people, whereas some glaring instance of neglect might cause an accident in which the casualties were extremely small. Therefore, the true test of the ability of our railroads to take proper care of the passengers who commit themselves to their care, is the list showing the total number of accidents in a given period, and more particularly the total number of collisions and derailments, the one indicating faults of operation, and the other faults of construction and upkeep. Tested even on this basis, the records of these three months are very damaging to the reputation of our railroad systems. For the three months there were 1,439 collisions and 1,321 derailments, of which 232 collisions and 137 derailments affected passenger trains.

The technical journals which are devoted particularly to the affairs of the railroads, have complained of such reiterated and bald statements of the totals in the Accident Bulletins, as we have been in the habit of presenting in the columns of the SCIENTIFIC AMERICAN. It is claimed that careful analysis of these returns would show that the condition of affairs is not nearly so bad as the simple statement of these figures would seem to imply. It is further objected that the frequent reference we have made to the fact that in a recent year the railroads of Great Britain were operated without the loss of the life of a single passenger is also misleading, for the reason that while it may be literally true, there are unrecorded considerations which considerably mitigate the force of the comparison. We have carefully read these articles, with an honest endeavor to see the drift of the arguments set forth; but we have to confess that we have found nothing to lessen the significance of the fact that, while we have been killing people at a rate which has risen for one quarter to over 4,000 a year, a great railroad system in another country, on which the traffic is far more dense, and therefore more difficult to handle than ours, was actually able to prosecute that traffic, day in and day out, without the loss of a single passenger.

There are several conditions peculiar to American railroads which account for our large casualty list. The chief among these, undoubtedly, is the inherent restlessness of a not inconsiderable section of our railroad employes, which shows itself in the chronic disposition to move on and try some new field of work. This results in a continual change of the personnel, with the result that at any given time, on any given road, there will be found a large number of employes who are entirely new to, or but little familiar with, the special local conditions surrounding their work. Now, it is this familiarity with the local conditions, over and above the general knowledge which any engineer, conductor, brakeman, signalman, switchman, must have of his duties in the abstract—it is this familiarity we say, that is the very best safeguard against railroad accidents, or at least against those that have to do with the running of the trains.

Second only in importance as a contributory cause to railroad accidents is the continual change which is taking place in the management and official staff of our railroads, and in their ownership. As a result of the mad whirl of organization and reorganization, combinations, receiverships, and what not, there is a continual change of management from president to roadmaster. Well-established organizations and systems of management, that have gained that smoothness and accuracy of working and that mutual confidence and sense of interdependence, which can only come from long and successful association in the operation of a particular system, are suddenly broken up by the sale of the road or its combination with some other system; new men are introduced into high offices; and they, in turn, have their own particular friends or well-tried assistants whom they naturally wish to introduce; heart-burnings, jealousies, and disappointments ensue; and the whole operative system of the road is shaken from summit to foundation; for the general unrest invariably distributes itself throughout the whole working force of the road, with a consequent lowering of discipline and more or less careless performance of duties.

If the time shall ever come when the various railroads will be content to recognize each other's spheres of influence and control; if a day is ever reached when this perpetual reorganization, this turning upside down of railroad management, shall cease, we may look for a return of that sense of stability and permanence which formerly made the average period of employment by any particular company much longer than it is to-day. Then, only, will there be a return of that personal interest and pride in one's work, and that sense of security as regards the permanence of one's job, which will do more than anything else to promote careful work, whether in the construction, the maintenance, or the operation of our steam railroads. Then, and not till then, shall we see a diminution in the disgraceful record of deaths and injuries which appears with painful regularity in the reports of the Interstate Commerce Commission.

FUTURE WATER SUPPLY OF NEW YORK CITY.

If anyone doubt the possibility of New York city's having to face a water famine within the next two or three years, he should read the report recently made to the Mayor of this city by the Commission on Additional Water Supply, from which he will learn that the average rate of consumption of Croton water during the past year has exceeded the amount which all of the present reservoirs in the Croton watershed, together with the great reservoir now being formed above the new Croton dam, can supply in a year of small rainfall. This emergency has been obscured by the fact that the rainfall and stream flow for the past two or three years have been larger than the average, as shown by the records of the Croton reservoir flow, which have been carefully kept for many years. No one can predict the year of the next severe drought; but the facts that the rainfall has been above the average for the past few years, and that periods of large and small rainfall follow in cycles, make it very likely that we shall have to face some years of small rainfall in the near future. Emergency work is being done in the Croton watershed by the construction, which is immediately to be undertaken, of two dams above the new Croton dam, which together will impound an additional twenty billion gallons, to be held in reserve against a dry season; but it will take at least two years and probably longer to complete these. That we are running perilously close to the margin is shown by the following figures: During the quarter ending September 30, 1904, the average daily use of water from the Croton basin was 290 million gallons, whereas the records show that the average annual daily fall of the Croton River fell to 209 million gallons in 1880, and to 222 million gallons in 1883.

Admitting then, as we must, that it is necessary at once, and with all speed, to provide additional water supply, the question becomes one of where to get it, how to store it, and how best to conduct it to the city. These are questions of engineering pure and simple, and as such they should be judged and determined. But, alas! there has fallen upon this problem, as upon every other big engineering question affecting the interests of this city, the pernicious blight of politics. The problem is so vast, it involves such big expenditures of money, such possibilities of patronage, to say nothing of "graft," that the political harpy is watching it with a hungry eye. The Ramapo scandal is fresh in the public memory; but the snake though scotched is not yet killed. The air is full of propositions, from Engineer Birdsall's $90,000,000 tunnel aqueduct to the ex-governor's bill for State control of water rights. Meanwhile, the population of New York is growing by leaps and bounds, water consumption is increasing, and nothing is being done to adequately meet the crisis.

The agitation of this question is much older than the general public might suppose; for as far back as the year 1886, a study of the problem was made by Mr. R. D. A. Parrott, who pointed out the advantages presented by the Esopus and Schoharie creeks as a future source of water supply for this city. The results of his investigation were published in the SCIENTIFIC AMERICAN SUPPLEMENT of September 4, 1886; and it is an interesting fact that the scheme outlined at that time is practically identical, as far as the location of the reservoirs is concerned, with the Ashokan reservoir suggested by Mr. Birdsall, the present Acting Chief Engineer of the Department of Water Supply, Gas, and Electricity, and indorsed, after very considerable modifications, by the Burr-Freeman Commission in the report above referred to.

The report of the Chief Engineer calls for the construction of a dam across Esopus Creek, near Olive Bridge, and of a deep-tunnel aqueduct, 97 miles in length, from the dam to New York city. The magnitude of this part of the work will be realized more clearly when we bear in mind that the total length of deep-tunnel construction of the present new Croton aqueduct is 29.85 miles, or less than one-third that called for in the Chief Engineer's plans. In detail, the plan proposed is to construct a single deep tunnel from Astoria, under the East River, to a point in Morrisania, whence there would be two deep tunnels to Rye Pond in the Bronx basin, a distance of 23 miles from Astoria, the two tunnels to be each 10 feet 6 inches circular aqueducts. Rye Pond reservoir, when full, would be 355 feet above mean tide. From this reservoir the plan calls for a single deep-tunnel aqueduct, 12 feet in diameter, extending by way of the east branch reservoir in the Croton basin to a point west of North Paterson, and thence due west to the Hudson River, and northwesterly to the Olive Bridge dam on Esopus Creek, which would have an elevation above mean tide of 555 feet. This 97 miles of deep aqueduct tunnel is expected to deliver 300 million gallons of water per day at an elevation of 300 feet above sea level at the Rye Pond reservoir to the north of the city limits, from which it would be led to Astoria as explained above. The cost of this deep tunnel is estimated at $500,000 per mile, and the total cost of the completed work would be over $90,000,000.

This briefly describes the first instalment of the future additional water supply. The report contemplates the construction of another aqueduct of equal capacity and probably greater length, which is to be constructed subsequently whenever it may be needed, to deliver 300,000,000 gallons of water from Catskill River at the same elevation at the city limit. The report further proposes that ultimately a third aqueduct of about the same length as the latter would be constructed, and draw yet another 300 million gallons a day from the lower waters of both the Catskill and Esopus creeks, this water to be delivered into Jerome Park reservoir. Although no estimate of the cost of the two latter additions is given, they may be presumed to equal that of the first reservoir and aqueduct; in which case the ultimate cost of the three aqueducts and reservoirs may be set down as about $275,000,000. For this sum a total of 900,000,000 gallons per day, it is estimated, could be furnished from these regions. This is about three times the present consumption of New York city.

The Burr-Freeman Commission reports to the Mayor that it concurs with Mr. Birdsall in the opinion that the waters of Esopus Creek are exceptionally pure and soft, and constitute an almost ideal source for public supply. They consider that the storage volume of the Ashokan reservoir would reach 66 billion gallons, which is more than double the addition which has been made to our present supply by the construction of the new Croton dam. Strong objection is made to the construction of a 97-mile deep-tunnel aqueduct. It is true that this method was adopted, in the case of the new Croton aqueduct, in order to render it safe against destruction by malicious persons or by a public enemy; but it is held that considerations of this character have lost their force at the present time, as the introduction of a small quantity of high explosive through a shaft, or otherwise, might easily damage a deep tunnel so that, because of its inaccessibility, its repair might be a question of many months. For this reason, and because it may be so much more quickly and easily constructed, the Burr-Freeman Commission recommends a surface aqueduct, built by the cut-and-cover method. The accessibility of such an aqueduct renders repairs easily and quickly made; moreover, as years of experience have shown, the liability to malicious injury is very remote. The capacity of the proposed deep tunnel is 300,000,000 gallons per day; but the conveniences for cleaning and repairs are such to-day that there is no reason, in the opinion of the Commission, why the cut-and-cover aqueduct should not be built, if so required, to have a capacity of 500,000,000 gallons per day.

The Commission is further of the opinion that it is not desirable to build a tunnel costing four or five million dollars, for the purpose of leading the water of Schoharie Creek into the new reservoir, but prefers instead to construct a pipe line from a dam built on Rondout Creek, and bringing an additional supply from that stream. Furthermore, instead of taking the water from a point at the center of the proposed Ashokan reservoir, the Commission would take the water from the lower end of the reservoir, so as to permit of a thorough circulation, and would build a cut-and-cover aqueduct to a reservoir known as the Hill View reservoir, located on the high ground between Yonkers and Mt. Vernon. The total length of this aqueduct would be 81 miles, a saving of 10 miles over the Birdsall line. The aqueduct proposed by the Commission would, however, connect with the new aqueduct at the Croton reservoir; and as the present total aqueduct capacity between Croton Lake and New York city is at least 75,000,000 gallons daily greater than the safe yield of the Croton watershed, including its proposed additional reservoirs, it would be necessary to build the Ashokan aqueduct for the present only as far as the Croton reservoir, and utilize the existing aqueducts, from that point to the city, to their full capacity. By adopting this plan it would be necessary to construct at once only 58 miles of aqueduct, comprising about 18 miles of steel tube, 5 miles of tunnel, and 35 miles of cut-and-cover aqueduct. After a careful review of precedents and circumstances, the Commission estimates that this work could be constructed in not less than from five to eight years, according to the conditions encountered.

As matters now stand, the Mayor is seeking the needed legislative authority at Albany for pushing through the scheme as outlined by his Commission. Meanwhile the late Governor, Mr. Odell, professes to have discovered that it will be to the interests of all concerned if the question of water supply were placed entirely in the hands of the State; and so this most vital of all questions affecting the health, and we might say the very existence of the people of New York city, must needs wait, for the present at least, upon the exigencies of party politics.

THE HEATON AIRSHIP FAILURE.

BY ENOS BROWN.

Heaton's airship, the "California Messenger," was driven into San Francisco Bay February 12. The aeronaut had a narrow escape from drowning. When the airship was taken out for a trial on the morning of February 12 across the bay in Oakland, it was cold but clear and there was a slight north wind. This wind increased rapidly, however, and when the airship was fairly well up it appeared to strike a current of air of great velocity, for despite the rudder it was driven rapidly toward the bay. The aeronaut tried to steer it south of Oakland, but the airship was driven steadily across the mud flats and then over the bay.

The wind had created a heavy sea and the airship began to sink, so that the aeronaut was in a dangerous position. Apparently some gas escaped from the compartments at one end of the machine, and as the ship sank, one end went down while the other, fully distended, stood nearly perpendicular above the waves. The aeronaut's predicament was seen by several yachts, which at once went to his rescue. He was taken off, and the airship was towed back to Oakland.

The Heaton airship consists first of a silk gas reservoir 76 feet long and 14 feet in diameter, with a capacity of 10,000 cubic feet of hydrogen gas, of a lifting power of 600 pounds. Directly beneath the bag is a sheet of canvas, denominated by the inventor an "aeroplane," designed to assist the movement of the airship in falling or ascending. The rudder is lightly constructed of bamboo covered with sacking, and is governed by ropes at the will of the engineer, the air current, generated by the rapid revolution of engine and propeller, assisting in the prompt control of the airship in the line of direction as the operator determines. The platform upon which the operator stands is built of bamboo rods trussed to the net above by linen lines.

The engine is a marvel of design and lightness in construction. Though generating 20 horse-power, the weight, exclusive of propeller, is but 55 pounds. It is described as a double-cylinder, 4 by 4, revolving around a stationary crankshaft, the propeller blades being attached to and a part of said cylinders. It is constructed of steel, and the motive power is furnished by gasoline. Power is increased by the elimination of flywheels, as well as lightness by dispensing with water coolers, the cylinders being kept cool by the strong air currents generated by the rapid motion in revolving. The two fans have each a surface of 8 square feet, and are 5 feet from tip to tip.

THE MOORE-HESKETT DIRECT PROCESS FOR THE MANUFACTURE OF WROUGHT IRON AND STEEL.

The Moore-Heskett process, of which mention has already been made in these columns, is designed for the treatment of iron sands, or pulverized concentrated iron ore in a fine state of division.

The apparatus consists of an upper and a lower brick-lined revolving cylinder attached to a gas furnace. The cylinders are lined with fire bricks, and have several brick shelves running along their whole length. They are placed at an angle of about 10 per cent from the horizontal, and revolve slowly. The finely-divided ore is automatically fed into the upper cylinder, and is continuously being lifted up by the shelves, and made to fall in a fine spray as it travels to the lower end. The inside of the cylinder is maintained at a low red heat by waste gases passing through it from the gas furnace to the chimney. The heated particles of ore, as they are delivered from the lower end of the upper cylinder, fall into a lower cylinder through a vertical flue, and are delivered into the upper end of the lower cylinder at a red heat. The lower cylinder is connected at its upper end to a gas producer or retort, and is the channel through which the reducing gas is delivered to the gas furnace. The vertical flue between the two cylinders is so arranged that the sand can enter the lower cylinder, but the gases cannot enter the upper cylinder. As the fine red-hot particles of ore travel through the lower cylinder, they are constantly being lifted up and made to fall through the reducing gases in the same way as in the upper cylinder, and are delivered at the lower end in a continuous stream, falling into the bath of the gas furnace below, where the deoxidized sand is melted as fast as it accumulates.

The gas furnace both for steel and wrought iron is made to revolve, and digest and deliver its product automatically.

The essential feature of the process is that iron ore in a finely-pulverized state is heated, deoxidized, and melted particle by particle, which enables the various operations to be carried on rapidly and continuously in one furnace, without loss of heat, and requiring practically no labor. The whole process can be carried out automatically from the ore to the fluid steel. Each separate particle of ore is made to fall a great number of times through the heating and deoxidizing atmosphere, kept at a suitable temperature below its fusing point. Under these conditions heating and deoxidation take place in a few minutes. The reduced ore then falls directly into a bath of molten metal, which is maintained at a very high temperature. As the reduced ore is gradually and constantly falling into the bath, and at a red heat itself, it is not difficult to keep up the temperature of the furnace and bath with a minimum of fuel.

The revolving cylinders of the feeding apparatus may be stopped at any time, in order to add any alloy and test samples before tapping.

In working, only a proportion, say half, of the metal is tapped out at any time, the bath being maintained constantly.

The hearth is lined with the most refractory basic material known, and should last for many months.

An excess of gas is passed through the deoxidizing cylinder; the balance not taken up by the iron ore follows the reduced ore into the furnace, and being highly combustible combines with the heated air. This arrangement insures thorough deoxidation in the cylinder and also prevents any possibility of reoxidation taking place, as the gas passes over the reduced ore in the bath, before combustion takes place, and effectually prevents any waste of gas, as complete combustion is obtained in the furnace, and the resulting products pass into regenerators for heating the air and afterward the ore-heating revolving cylinder.

THE CURRENT SUPPLEMENT.

Emile Guarini opens the current SUPPLEMENT, No. 1521, with an article on wireless telegraphy experiments at the Eiffel tower. Some interesting statistics are given of telephones and telegraphs in the United States. Mr. Frank Koester gives some practical data on European practice with steam turbines. The ore concentration plant exhibited at St. Louis, which has already been made the subject of some discussion in the SUPPLEMENT, is described in full. Mr. Philip Bjorling writes on pumps—machines that are much neglected. The Matitsch lace-making machine, a combination of the bobbinette and the English twist-lace machine, is fully described and illustrated. Sir John Eliot writes on meteorology in the British empire. Mr. J. A. Formoy recently lectured most instructively before the English Camera Club on "Suns: Their Various Stages of Development as Revealed by the Spectroscope." His lecture is abstracted. Prof. N. Monroe Hopkins presents his seventh paper on "Experimental Electrochemistry." The subjects treated in this installment are the following: Energy Required in Electrolysis, Practical Formula for Computing, Electrolytic Separation of Metals, the Rotating Anode in Electro-Analysis.

EXPLOSION OF A SUBMARINE.

On February 16 an explosion occurred on board the British submarine torpedo boat A5, resulting in the death of the commander and two of the crew and the disabling of fifteen men. From all accounts, it seems that the crew was engaged in filling the liquid fuel tanks of the vessel, and that the vapors from the gasoline became ignited. The explosion was terrific. Men were hurled in every direction, nine being afterward picked out of the water. A rescuing party sent from a nearby gunboat had hardly reached the scene of the accident when a second explosion occurred, which resulted in the injury of some of the rescuers. The submarine caught fire internally. When docked soon after, she was found to be not materially damaged.

THE CHARCOT ANTARCTIC EXPEDITION.

Much concern is felt for the fate of Dr. Charcot, who is leading an Antarctic expedition, which started more than a year ago.

It is known to have encountered a terrible storm in April last year and has not been heard of since, nor have any traces of its movements been discovered by Uruguay, which sent out a party to its rescue. M. Charles Rabot, a member of the committee of the Society of Geography of Paris, intends to organize another search party to ascertain its fate.

Dr. Charcot is the son of the famous nerve specialist, who was chief physician at the Salpêtrière Hospital.