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NEW YORK, SATURDAY, MARCH 22, 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.

THE NEW ERA FOR THE STEAM ENGINE.

Unquestionably, in the development of the steam engine, we are just now entering upon a new era, which, when steam has ceased to be used as a prime mover, and the history of the age of steam comes to be written, will be distinguished sharply from the first era, which is now apparently drawing to a close. To Watt, we take it, must always belong the credit of having opened, in a practical way, the era of the reciprocating steam engine, and to Parsons will belong the credit of being the first to demonstrate in a commercial sense that the term of usefulness of the reciprocating engine was, at least for the majority of uses to which it has been put, drawing to a close, and that the era of the simpler and more efficient turbine had arrived. In saying this we would be careful to emphasize the fact that as long as steam continues to be used, the reciprocating engine will, for some classes of work, continue to be the most serviceable motor. To particularize, we have only to refer to the steam locomotive, to convince everyone who is familiar with the demands and exigencies of locomotive service, that the turbine is never likely to displace the reciprocating engine in this class of work.

As an electrical drive, however, it is pre-eminently qualified, and since electrical power seems destined to indefinitely enlarge its field of application, the growth of the steam turbine in connection with the electrical industries is destined to be rapid and widespread. But although the turbine is not applicable directly to the locomotive and the street car, it is the ideal motor for the propulsion of steamships. This is said with a full appreciation of the fact that there are difficulties of reversing which limit the maneuvering power of a ship in entering or leaving a dock, or in making landings; for this objection has been largely overcome by the provision of separate reversing motors. In any case, the difficulty is so greatly outweighed by the economy of the turbine in weight and fuel, and by the advantages of a complete absence of vibration, that we look to see the steam turbine enjoy a monopoly, as a marine engine, second only to that which it will achieve in connection with electrical power on land. Indeed, the only classes of work to which the turbine may not prove to be immediately applicable are those which involve much starting and stopping, and considerable running at slow and intermediate speeds. In work of this kind the reciprocating steam engine will always find a limited sphere of usefulness, unless, indeed, even here it is driven out by the ubiquitous electric motor.

The advance of the steam turbine during the past few months, both in size and power, and in its application to large plants, has been quite remarkable. Two of the largest manufacturing concerns in this country have been for some years watching closely its development, and have themselves been conducting experimental work to determine its efficiency and to improve upon existing forms. Although the Parsons turbine is an English invention, and practically all the work with large units that has been accomplished has been done by these machines, it is a fact that the Westinghouse Company, which secured the rights for the Parsons turbine in this country, has already built, or is now building, eight turbines of from 750 to as high as 2,500 horse power. These Westinghouse-Parsons machines, as they are called in this country, have been giving most excellent results, and the 2,500 horse power turbine, which has now been employed for about a year in an electric light and power plant at Hartford, Conn., is the largest turbine and probably the most economical steam engine in the world. In addition to these machines, we understand that the same company has received an order for a large turbine for South Africa, which is to be used in a big power-transmission scheme that is being worked out in the Rand gold fields. The General Electric Company have in operation at their works a 750-horse power turbine of the bucket-and-nozzle type, the plans for which have been worked out by the company's engineers. This turbine has also shown excellent economy, and we understand that the company stands ready to manufacture it upon a commercial scale.

Most significant fact of all, pointing to the ultimate monopoly of the steam engineering field by the new type of engine, is the confidence with which the great railway and power companies are adopting the turbine in large units as a drive for electrical generators. We referred last week to the fact that the London underground railways were equipping a 100,000 horse power plant with ten 10,000 horse power turbines. We are now able to announce that it is only the conviction that nothing of an experimental nature must be allowed to enter into the equipment of the new Rapid Transit Subway's power plant that prevents its equipment with the steam turbine. As it is, only six engines of the reciprocating type have been ordered, and the balance of the order has been left open with the expectation of installing the turbine when there is a demand for the full power of the station. Reference was also recently made in these columns to the probability of the new 25-knot liners for the Cunard Company being driven by turbine engines, while a sister ship to the turbine passenger steamer "King Edward," which did such good work on the Clyde last year, is under construction, and three large steam yachts have also been ordered in Great Britain which are to be equipped with the same motive power. Incidental evidence of the widespread appreciation of the fact that we are on the eve of revolutionary changes in motive power came to our notice the other day in the case of one of the largest steam yachts that has ever been planned in this country. At the eleventh hour the owner requested that the plans be held in abeyance for another season until the performance of the new British turbine-propelled yachts could be noted.

TEMPORARY RELIEF AT THE BROOKLYN BRIDGE.

For want of the necessary farsightedness on the part of city officials and the heads of the great railroad companies, New York city is confronted with a series of deadlocks in its transportation which are bad enough to-day, and promise to be considerably worse in the future. One of these is occasioned by the notorious Grand Central tunnel and the wretchedly inadequate facilities of the Grand Central Station terminal yard. For this condition of things there is nobody to thank but the Directors of the road, who, rather than make the necessary expenditure in an experimental equipment looking to the electrification of the road, allowed matters to drift to their present intolerable condition. Other deadlocks are to be found at the various points of concentration in the traffic of the Manhattan Elevated Railroads. The City Hall terminal, the transfer station at Harlem River, the express trains on the Ninth Avenue, and the whole stretch of Sixth Avenue, from near the Battery to above the Park, witness, morning and night, a condition of crowding and jostling which can only be matched in the mad struggle of the occupants of a stockyard train at Omaha or Chicago. Here again the intolerable conditions would never have been reached had the railroad company instituted the present changes in motive power some three or four years ago, when the state of the electrical art was quite sufficiently advanced to warrant the change. As an instance of what an aggressive and broad-minded company can accomplish in the struggle to meet the ever-rising tide of travel, we turn with pleasure to the work of the Metropolitan Street Railway Company, who alone seem to have provided for the increasing travel of the future, and have at all times had under way great and costly changes in equipment, which have enabled the company to handle its traffic under conditions that are crowded, but by no means intolerable.

Of all congested centers in the city, unquestionably the worst is the Manhattan terminus of the trolley roads that cross the Brooklyn Bridge. Here, during the past few weeks, it has been a not infrequent occurrence for passengers to be thrown down and so seriously injured as to necessitate their removal to a hospital. Indeed, it was only last week that a policeman that stood six feet something in his stockings was himself dragged unconscious from the crowd. Bridge Commissioner Lindenthal, who has been devoting constant attention to this problem ever since he took office, has recently presented a plan looking not merely to the relief of the Brooklyn Bridge, but to the proper handling of the travel over the bridges which are now under construction. His plan involves the purchase of the block on which the offices of the Staats Zeitung are located, and its conversion into a great terminal yard for the use of bridge trains and surface cars. This improvement, together with the running of the Brooklyn Bridge tracks by way of an elevated structure to the terminus of the two new East River bridges, would involve an outlay of something like $14,000,000, and it is likely that the great cost of the scheme, excellent as it otherwise is, will prevent its adoption.

In any case it is imperative, pending the carrying out of a scheme of relief on a large and permanent basis, to devise some emergency measures which will give immediate relief at the Brooklyn end of the Bridge. The plan proposed by the Bridge Commissioner is to provide a series of loops in the Bridge Plaza at Brooklyn, and run, during rush hours, a series of circulating trolleys over the Bridge, these trolleys to use the new loops on the plaza and the present four loops at the Manhattan end of the Bridge exclusively. Extra loops are to be laid at the Manhattan end of the Bridge, which will be used exclusively for through trolley service. It is estimated that this plan, by greatly increasing the number of trolleys that can pass over the Bridge in a given time, will provide a relief which will make conditions tolerable until a more comprehensive scheme can be devised and put through. The two extra loops could be put down in three or four weeks' time, and by using timber in place of structural steel, as the Commissioner suggests, the necessary changes at the Bridge terminal could be carried out very expeditiously. It certainly seems to us that this emergency plan is about the best that can be devised under the circumstances.

USE OF VARIOUS MOTORS IN AEROSTATICS.

M. Armengaud, Jr., in a paper which he read lately before the Société Civile upon the progress of aerial navigation and the experiments of Santos-Dumont, passes in review the different sources of motive power which are applicable to dirigible balloons, namely, steam, electricity, and explosion motors. As concerns the steam engine, as long as the aerostat is filled with hydrogen it would be imprudent to carry in the car a furnace or burner whose sparks could produce the inflammation of the gases and the explosion of the balloon. Nevertheless, if it were possible to isolate sufficiently the balloon from the car, or to make the former of incombustible material, the danger would be warded off. In the case of the steam engine there is to be considered the weight corresponding to the supplies. This weight is considerable, since it necessarily includes the water and combustible. M. Serpollet, the inventor of the steam system so successful for traction cars and automobiles, says that with his system of flash-tube boiler he is able to reduce to 420 pounds the weight of a machine giving 30 horse power, or 14 pounds per horse power, but it must carry 2½ gallons of water, which would be too heavy a load for the balloon. Perhaps the weight could be reduced still further by replacing the engine by a steam turbine of the Laval or Parsons type. As to electricity as a source of motive power, he mentions that Renard and Krebs in their experiments of 1884 succeeded in reducing the weight of the battery to 880 pounds for a motor giving 9 effective horse power. In this weight of 880 pounds is no doubt included the motor which was constructed by Capt. Krebs and weighed only 22 pounds; this figure has not been diminished since. As to the question of explosion motors, the author considers briefly the history of their development since Lenoir and Hugon, down to the modern forms of Daimler, Panhard and De Dion. It has been necessary to arrive at great speeds in order to utilize to advantage the heat-producing power of the fluid combustible. From 160 revolutions per minute at first, we have now reached 1,600 or more, and it is understood that by thus increasing the speed we obtain ten times the power for a given weight, or what is more interesting here, we diminish the weight ten times for the same power. This lightness may again be increased by reducing the dimensions of certain organs and by using materials which are sufficiently resistant with a small weight; thus steel may be used instead of cast iron, aluminium for the parts which do not work, etc.

The development which has taken place in France in the construction of motors for automobiles pushed the constructors to make motors as light as possible for the class of automobiles known as voiturettes and light vehicles. The De Dion type of motor is a good example of a successful light motor, and this type is now used, with modifications, by many other constructors. Before the experiments of Santos-Dumont it does not appear that aeronauts have been greatly encouraged to use the explosion motor, but it may be remarked that since the time he began his experiments, which is several years ago, the motors have been greatly improved. Among the motors which are now in competition for lightness and power may be cited the Buchet (which is the type last used by Santos-Dumont), the Mors, and the Panhard and Levassor, which arrives at 11 pounds per horse power. A new type is the Bourdiaux, in which the radiating circles on the cylinder are of aluminium and which weighs only 7.7 pounds per horse power for sizes ranging from 10 to 25 horse power and 7.3 pounds from 25 to 50 horse power. For experiments of short duration the aeronaut must add about 1-10th of the weight of the motor for gasoline, and for a voyage of 10 hours it would require the same weight for gasoline as for the motor. As regards the stability of the balloon it would be preferable if the diminution of weight due to the burning of the combustible were compensated by a decrease in the ascensional force. This could be brought about in other ways than by letting the hydrogen escape, for instance, by taking in the atmospheric air and compressing it in a reservoir or by using a rudder placed in the horizontal sense.

INCOMES OF SUCCESSFUL INVENTORS.

BY ANSLEY IRVINE.

It is generally believed that inventors are an unfortunate class of individuals who struggle through life surrounded by an unsurmountable barrier of penury and misfortune. This, doubtless, is true of many cases, but the obverse of the picture is gratifying and full of encouragement. Innumerable instances could be given where comparatively large fortunes have been made out of a simple article, which necessitated neither elaborate design nor great initial expenditure, and, when judged from a strictly utilitarian point of view, did not possess any practical value.

Some of the largest fortunes appear to have been derived from the invention of trivialities and novelties, such as the once popular toy known as "Dancing Jimcrow," which for several years is said to have yielded its patentee an annual income of upward of $75,000. The sale of another toy—"John Gilpin"—enriched its lucky inventor to the extent of $100,000 a year as long as it continued to enjoy the unexpected popularity that greeted it when first placed upon the market. Mr. Plimpton, the inventor of the roller skate, made $1,000,000 out of his idea, and the gentleman who first thought of placing a rubber tip at the end of lead pencils made quite $100,000 a year by means of his simple improvement.

When Harvey Kennedy introduced the shoe-lace he made $2,500,000, and the ordinary umbrella benefited six people by as much as $10,000,000. The Howard patent for boiling sugar *in vacuo* proved a lucrative investment for the capitalists, who were able to remunerate the inventor on a colossal scale. It is estimated that his income averaged between $200,000 and $250,000 per annum. At first the process proved an entire failure and had to be laid aside as useless. It was not until an old German workman casually made a suggestion for a possible improvement that it was once more tried. The suggestion was improved upon and the invention rendered successful. All sugar refiners who used the new method allowed Mr. Howard a royalty of twenty-four cents per hundredweight on the raw material passing through the process.

Sir Josiah Mason, the inventor of the improved steel pen, made an enormous fortune, and on his death English charities benefited by many millions of dollars. He was one of the most generous of men, and during his life gave enormous sums to hospitals and industrial schools. The patentee of the pen for shading in different colors derived a yearly income of about $200,000 from this ingenious contrivance. It is stated that the wooden ball with an elastic attached yielded over $50,000 a year. Many readers will remember a legal action which took place some years ago, when in the course of the evidence it transpired that the inventor of the metal plates used for protecting the soles and heels of shoes from wear sold 12,000,000 plates in 1879, and in 1887 the number reached a total of 143,000,000, which realized profits of $1,150,000 for the year.

Women seem also to possess the inventive faculty, and, indeed, they must find plenty of scope for new ideas, as there are hundreds of little things waiting to be superseded by simple appliances that will minimize handwork and obviate the necessity of so much toil being daily expended in the household. The lady who invented the modern baby carriage enriched herself to the extent of $50,000; and a young lady living at Port Elizabeth, South Africa, devised the simple toilet requisite, known as the "Mary Anderson" curling iron, from which she derives royalties amounting to $500 a year. It was the wife of a clergyman who designed an improvement for the corset and made a fortune out of it. Instances of ladies bringing forward inventions which have added to personal comfort and general utility could be given *ad infinitum*. They occupy all ranks of society, from the poor struggling seamstress to the Empress of France, who, by the way, invented a dress improver, which years ago developed into the then fashionable crinoline. The gimlet-pointed screw, the idea of a little girl, brought many millions of dollars to the clever inventor. Miss Knight, a young lady of exceptional talents, was gifted with wonderful mechanical powers, as will be seen by the complicated mechanism of her machine for making paper bags. We are told she refused $50,000 for it shortly after taking out the patent.

The history of the wire-wound gun, which was invented by Mr. J. Longridge, the famous engineer, throws some light on the *insouciance* and apathy that formerly enveloped the British War Office. Longridge invented the gun in 1854, and did all in his power to place it before the authorities, but they would have nothing to do with it. Thirty years afterward, however, the Ordnance Department at Woolwich subjected one of the guns to exhaustive tests, and so satisfactory were the results that they declared that nothing could equal it for heavy ordnance. Unfortunately, the inventor died from a broken heart before this end was attained. Another case illustrating the treatment sometimes meted out to inventors by the English War Office is that of Dr. Conan Doyle, the popular author of "Sherlock Holmes," who recently discovered a way to insure approximate accuracy in high-angle or dropping rifle fire, the need of which has so often been felt in the present war in the Transvaal. The inventor states that the apparatus would be fitted to the rifle and would weigh comparatively nothing, cost but a few cents, take up very little space, and interfere in no way with the present sights. The novelist communicated with the officials in London and received the following reply: "With reference to your letter concerning an appliance for adapting rifles to high-angle fire, I am directed by the Secretary of State to inform you that he will not trouble you in the matter." As Dr. Doyle remarks, the invention might be absolute rubbish or it might be epoch-making, but he has been given no chance of either explaining or illustrating it.

The machine with which the Brothers Morley, in the latter years of the eighteenth century, made their enormous fortune was the stocking loom, invented three generations earlier by the Rev. William Lee, a Fellow of St. John's College, Cambridge, England. Lee's life-story is full of sadness. According to one account Lee, falling in love with and marrying an innkeeper's daughter, lost his Fellowship, and was consequently reduced to extreme poverty. The wife knitted stockings for a living, and the husband, sitting by her side as she worked, watched the intricate movements of her hands, and was thereby led to speculate on the possibility of constructing a machine that would do the work more expeditiously. Lee came to grief, because his machine was believed to be a device for throwing people out of employment. He went ultimately to France, where he died poor and friendless, a disappointed man. Many years afterward English legislators so appreciated the value of the stocking loom that they prohibited its exportation; and so jealous was Parliament of foreign competition that it seems to have been doubtful, even as late as the middle of the eighteenth century, whether it was lawful even to publish a technical description of the apparatus. When the frame was introduced it completely revolutionized the stocking trade, producing fifteen hundred loops per minute as against the hundred loops in skilled hand-knitting.

It is difficult to realize that the art of perforating paper was unknown fifty years ago. Prior to 1854 postage stamps were issued in sheets, the purchaser having to cut them up in the way he found most convenient. In 1848 an Irishman named Archer introduced a machine for cutting small slits round each stamp. This was tried by the English postal authorities, but for some unexplained reason it did not work to their satisfaction, and, notwithstanding that Archer went to great trouble and expense in altering the machine so as to meet the objections, it was refused by the government. Archer then constructed an entirely new machine which cut out circular holes. He received sufficient encouragement to induce him to still improve his invention, when, in 1851, after three years' continual labor, the Treasury proposed to buy the patent rights for $3,000. This parsimonious offer was, of course, refused, as Archer had spent considerably more than this on his various experimental machines. Eventually the matter was placed before the Select Committee of the House of Commons, and the pertinacious inventor was awarded $20,000, which, considering his apparatus in a few years saved the government many thousands of dollars, was not excessive.

Liverpool, England.

LEAD MINING IN WISCONSIN.

About the year 1824, some thirty-six years before the coming of the first pioneers, lead was first mined in Wisconsin. Although the original lead miners were chiefly Americans, Cornishmen, driven out of England by low wages, soon entered the field. Reports which they sent home to their relatives and friends of the richness of the American lead-mining district soon brought an army of Cornishmen to Wisconsin. Skilled in deep mining as they were, these men from Cornwall were a valuable acquisition to the newly-opened region. Americans engaged chiefly in superficial mining, and when the results were not equal to their expectations, proceeded elsewhere. The Cornishmen, on the other hand, appropriated the claims left by their predecessors, worked them, and found ore enough to give work to many men.

In southwestern Wisconsin lead mining differs much from that in other parts of the State, since the lead was found nearer the surface. For that reason the work has received the name of "diggings" to distinguish them from the mines. The diggings were not worked deeply enough. Two men, whenever they opened a pit, would find "pay" almost immediately. A pit once exhausted or difficult to follow, because the vein led back too far, was abandoned. So numerous and so certain and immediate were the results of working these diggings that few of the men labored for wages.

The Cornishmen who emigrated to Wisconsin were not prospectors in the American acceptation of that term. Accustomed as they were to working for wages in their own country, they lacked the enterprise and energy so characteristic of the American miner. But they were steadier and more pertinacious in their work. Rarely indeed could an American be induced to work a claim after he had reached hard rock. But the Cornishman worked the abandoned rock until the mineral was exhausted, and thus earned for himself the title of a "hard-rock miner."

SCIENCE NOTES.

E. Bourquelot recommends, as a test for the presence of cane sugar, the use of the invertin of yeast, which doubles cane-sugar. It has also the same effect on gentianose and raffinose; but these carbohydrates are rare in plants. By this means he has determined the presence of cane-sugar in the rhizome of *Scrophularia nodosa*, in the succulent pericarp of *Cocos yatai* (25 gm. per kilo.), and in the horny endosperm of *Asparagus officinalis* (15 gm. per kilo.). In neither of the two latter plants was the reaction with emulsin obtained, showing the absence, in these organs, of a glucoside which is doubled by that ferment.—Comptes Rendus.

Writing from Sierra Leone, under date of November 26, 1901, Consul Williams says: "The superintendent of Mahometan education for British West Africa—whose work extends from the hinterlands of Sierra Leone to the Niger—visited this consulate recently and requested that I procure from American publishers catalogues and specimen pages of common-school text-books in the English language for his examination, with a view to their introduction and use in the schools under his supervision, if satisfactory. Much interest is being manifested by the colonial government at present in Moslem education. This being, perhaps, the first opportunity for the introduction of American text-books into this country, it is very important that those concerned respond promptly. Literature may be sent to this consulate."

Prof. Alexander Agassiz is in charge of an expedition to the Maldive Islands in the Indian Ocean which has recently been sent from the Agassiz Museum at Harvard. Prof. Agassiz fitted out the expedition and is assisted by W. McM. Woodworth. They expect to find rare and beautiful coral formations and will gather as exhaustive a collection as possible. A steamer was chartered at Colombo, Ceylon, from the British India Company, to transport the expedition to the southern part of the Indian Ocean, where the Maldive Islands lie. The islands of the Indian Ocean are the only group remaining which Mr. Agassiz has not examined in his explorations for the study of coral. The islands are remote and unfrequented, and it is expected that the expedition will prove fruitful. The work will occupy about two months.

Leather, even when soft, does not present itself to the mind as a particularly good filtering medium; indeed, it might seem just the reverse; so one must commend Mr. W. G. Stratton for noting his experience with it in the Chemist and Druggist. The so-called chamois skin is there recommended as an excellent medium for the clarification of thick liquids. The leather is to be well rinsed in cold water, he says, and after being wrung to express the excess of moisture it should be affixed to the top of the funnel so as not to hang down very deeply. Small clothes-line pegs are useful for this purpose. Immediately after use, the chamois should be well washed and carefully dried. The same piece may thus be kept serviceable for a large number of filtrations.

In a reply to a letter, asking the cause of autumn haze, the Chief of the United States Weather Bureau recently prepared a letter, part of which is quoted in what follows: The dry haze is undoubtedly due to fine particles of dust. The finest dust is composed of one or all of the following substances, namely, fine particles of soil or the dead leaves of plants, smoke or ashes from wood fires, salt from ocean spray, the shells or scales of microscopic silicious diatoms, germs of fungi, spores of ferns, pollen of flowers, etc. In the still air of the damp nights these dust particles settle slowly down, and the morning air is comparatively clear. During the daylight the sun warms the soil, which heats the adjacent air, and the rising air currents carry up the dust as high as they go. Under certain conditions which are named in the letter the layer of dust reaches higher and higher every successive day. During long, dry summers in India it reaches to 7,000 feet with a well-defined upper surface that is higher in the daytime than at nighttime. This is a general explanation of dry haze weather and applies to Indian summer also. The reason why we have more of such weather in the autumn is because there is then less horizontal wind and less rising air.