Scientific American.

ESTABLISHED 1845

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PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

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(Established 1845.)

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(Established 1876)

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(Established 1878)

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NEW YORK, SATURDAY, JUNE 26, 1897.

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(Illustrated articles are marked with an asterisk.)

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No. 1121.

For the Week Ending June 26, 1897.

Price 10 cents. For sale by all newsdealers.

AMERICAN INSTITUTE FAIR.

The managers of the American Institute Fair, which is to be held from September 20 to November 4, at Madison Square Garden, intend to put forth special efforts to make this one of the most interesting fairs in the history of the institution. As our readers are doubtless aware, the American Institute is one of the oldest organizations of its kind in America. It is now verging on its seventieth year. During its long life it has been one of the most powerful factors in the promotion of invention and industry in the country. Many of the famous inventions of the past forty years received their first recognition at its hands, and to secure the institute medal was one of the most coveted indorsements which could be given. It is the intention of the board of managers and the general superintendent of the fair, Mr. Alfred Chasseaud, to make the department of engines and machinery the strongest in the whole exhibit. It is to include a very wide variety of prime movers, and particular attention will be given to stationary engines operated by steam, gas, water, or wind. There will also be a large exhibit of pumping machinery, steam fire engines, iron and wood working machinery, textile and paper machinery and that used for the manufacture of leather and rubber. We are glad to note that the fair is to be held in the capacious Madison Square Garden, and the scale on which it is to be carried out indicates that the renewed life and vigor which marked the operations of the institute last year is likely to be permanent.

THE ENGINEER MOTOR CAR COMPETITION.

The celebrated motor car competition organized by The Engineer, of London, has resulted, according to our contemporary, in a miserable failure, only five vehicles putting in an appearance at the Crystal Palace, London ; and even this pitiful remnant of the original seventy-two entries was, in the opinion of the judges, so lacking in the qualities that go to make up a really useful and reliable motor that they made no award, and the six thousand dollars which was to have been awarded in prizes was handed back to the promoters of the competition.

The first offer of a prize of one thousand guineas was made about two years ago, and the conditions, as formulated a few months later, announced that prizes would be awarded "for the encouragement of manufacturers and designers of horseless carriages," The Engineer "believing that an important trade may be created in this class of machinery, and that the removal of the restrictions on the use of mechanically propelled vehicles will result in great benefit to the farmers."

In the course of a pessimistic editorial, The Engineer congratulates itself on the fact that although the essay has failed in its original purpose, it has "cleared the air" and shown the true facts concerning the so-called motor car industry in England. "There is at present no such industry. There is no such thing as a thoroughly satisfactory self-propelled vehicle. If a motor car of the kind existed, it would have been submitted for competition." Now these are sweeping assertions and not altogether warranted by the facts. In the first place the competition was narrowed down by the exclusion of all vehicles propelled by light oil or petroleum spirit, against which The Engineer has shown a persistent prejudice from the very first, although on its own admission "very little success had been obtained with vehicles which did not use petroleum spirit." This prejudice was so marked that it is not surprising that the subsequent offer of a special prize of five hundred and twenty-five dollars for vehicles using light oil failed to bring forward the manufacturers of what are admitted to be the only successful motor cars on the market. Everybody that keeps in touch with the motor car industry is well aware of the defects of oil-driven motors, and none more so than the makers themselves. But for The Engineer at this early stage of the work to sweep aside three-fourths of the inventors and their machines, and suppose that it can be determined by an ex cathedra mandate what shall and what shall not be the surviving type of motor car, may be agreeable to the traditions of that journal, but, as the recent fiasco has proved, will have a very small effect upon the motor car industry at large.

In defense of the course it took it is explained that it had no particular desire to develop pleasure carriages, as its "purpose was utilitarian," and it is pointed out that the unpleasant odor which comes from most oil motors would prohibit their commercial use in a crowded city. But in taking it for granted that this difficulty is incurable our contemporary assumes altogether too much, and the most that is proved by the attempted competition is that the motor car industry cannot be arbitrarily controlled so as to proceed along certain prescribed lines of development

Although The Engineer claims too much in stating that there is absolutely no motor car industry, it has done the British public good service in showing that the industry has no such proportions as to warrant the company-promoting speculations which have entrapped the unwary investor.

In the next issue of the SCIENTIFIC AMERICAN SUPPLEMENT we shall give illustrations and particulars of some of the motor cars which were present on the morning of the contest, including the two which received favorable mention from the judges.

FALL OF A NEW BUILDING IN NEW YORK CITY.

The collapse of a building on Fifty-second Street and Twelfth Avenue has again drawn attention to the risks which are liable to be incurred by the erection of massive water tanks on the top floors of a building. When the tanks themselves and the supports which carry them are properly designed, there is, of course, no more risk than is involved in carrying any other form of static load at the top of a building. As a matter of fact, however, this construction is too often very faulty and marked by an ignorance or carelessness, or both, which has brought many a well constructed building to grief. The most frequent disaster from roof tanks is that caused by a fire in the upper stories burning through the tank supports, and causing it to fall through the floors beneath. In the case of the Twelfth Avenue building the heavy load of the tanks was sufficient to bring about the collapse of an extraordinarily faulty building. The accident happened before the occupants had moved in, and it is owing to this circumstance that the death list is not a painfully large one.

The building, which was to have been used as a soap factory, is in the form of a hollow square, and measures about 200 feet on a side, the width from wall to wall being about 60 feet. It was five stories in height, and was built of composite construction, with cast iron columns and steel floor girders. On the lower floors the girders are 15 inch I beams, but on the fourth floor 24 inch I beams, with their flanges reinforced with two ⅝ inch plates were used, the girders being made heavy to carry the weight of fourteen tanks, each of which with its full load weighed nearly eighty tons. The tanks were 13 feet square and 15 feet deep, and were placed in a double row on the outside of the building, one row of seven standing near the outer wall and the next row about ten feet from it and close against an interior row of columns. The collapse took place while the tanks were being tested for leaks. They were approximately full of water when, without any warning, five out of the seven in the outer row fell through the building, carrying the floors below with them, and, of course, throwing down the outer wall at the same time. The accident will call to mind the fall of the Ireland building, on West Broadway, where the same class of construction was employed, and although in that case the wreck was primarily due to faulty foundations, the debris showed all the usual defects in the cast iron columns.

The great gap in the outer wall is very suggestive as to the origin of the disaster, and a closer inspection of the wrecked iron work, and of the plan of construction as shown in the work which is still standing, makes it reasonably certain that it was the columns in this wall that failed. These columns were of square section, with flanges for bolting them together at the abutting ends. They were built within the wall, but considered as part of a framed structure for carrying weight, they were virtually without bracing. On one side, that next the tanks, they were theoretically held in the plumb position by the 24 inch I beams which were bolted to lugs cast on the columns, but on the other sides they had no metal connections whatever. The stiffening afforded by the I beams was of doubtful value, for the heavy load which they carried was transferred to the columns eccentrically by means of the small lugs above referred to. This would set up cross bending strains of a kind which are very undesirable in any member subject to compressive strains, and especially so when the material is cast iron.

In the course of some tests on full size cast iron columns recently carried out at the Yorkshire Engineering College, Leeds, it was found that, when the load was applied to side brackets or lugs such as we are considering, the column failed by a diagonal transverse fracture whose appearance indicated that it was the bending effect of the eccentric load that produced the failure. A load applied from the side cannot be treated as a load applied in the direction of the axis of a column, and a very liberal allowance should be made for this in determining the cross section of the member.

In addition to this predisposing cause, the throwing of the columns out of line is rendered easy in this form of construction by the unsatisfactory nature of the connections, which usually consist of simple flanges, in the present case held together by only four bolts. While it is true that this might be sufficient to keep the columns in line when there was no load or a light load upon them, the flimsiness of the connection is apparent when we remember that, in addition to the various floor weights, a load of over 40 tons of tank and contents was carried by each vertical line of columns. The danger of collapse will be evident if we consider the outer wall (which carried none of the weight) to be taken away. The columns would then be left entirely unbraced on three sides, perfectly free to buckle at the joints in the line of the wall, and only kept from buckling outward by a few bolts fastening column to girder.

It is to be hoped that the day is coming when cast iron will be entirely replaced by steel in buildings of a composite character. Its great compressive strength is more than offset by its low shearing and tensile strength and its uncertain behavior renders it altogether unfitted for use where the strains are more or less complicated and where, as in the present case, the lives of many scores of operatives are at stake.

If cast iron is to be used at all in the skeleton of a composite building, it should be used with great care and careful judgment. The abutting ends of posts and columns should be in all cases carefully machined, and the flanges and flange bolts should be larger than are now frequently employed. Loads should be concentrically applied to wall columns, even if it involves the use of twin girders, one on each side of the column. Above all, transverse bracing of some kind should always be employed for the exterior or wall columns, and it should be attached to the columns as close as possible to the abutting joints. Where heavy superimposed loads are to be carried the wall should not be entirely depended upon to furnish lateral stiffness. There is liable to be poor contact between wall and columns, and a small clearance would be sufficient to allow a fatal lateral movement of the column line.

It is sincerely to be hoped that the lessons of this disaster, which might well have been one of the most calamitous on record, will be noted by the building departments of this and other cities, and that, if cast iron columns continue to enter into building construction, they will be subject to a most searching scrutiny by expert professional men.

CHARGES AGAINST A PATENT FIRM.

Owing to the large number of complaints from inventors received at the Patent Office relative to the alleged unprofessional methods used by Wedderburn & Company to obtain clients and their neglect to serve them properly before the department, Commissioner Butterworth has summoned the firm to appear before him and answer numerous charges of unprofessional conduct. A hearing is to be had before the Commissioner in a few days, and if the charges are sustained they will be debarred from practicing before the Patent Office.

ANOTHER TRANSATLANTIC STEAMSHIP SERVICE.

After some years of unsuccessful agitation of the question of a subsidized express steamship line between England and Canada, it now seems that the Canadian fast Atlantic service is to be established on a permanent basis. The contract has been signed by Messrs. Peterson, Tate & Company, of Newcastle, who are the parties interested. Four vessels are to be provided, each of which must be able to maintain an average speed of 500 nautical miles per day, or about 21 knots. The contract calls for ships 520 feet long and of 10,000 tons register, and they are to be equal in every respect to the best steamers in service on the Atlantic to-day. Each vessel is to accommodate 300 first-class, 200 second-class and 800 steerage passengers, and must possess a cargo accommodation of 1,500 to 2,000 tons, 500 tons of which must be cold storage.

Two of the ships are to be ready by May 31, 1899, the other two by May of the following year. The ships will be run fortnightly during the season of 1899 and weekly during the season of 1900. The starting point will be from Liverpool, and during the summer months the ships will run to Quebec and Montreal as long as the navigation permits; during the winter season they will run to Halifax, N. S., or St. John, N. B., according to the option of the contractors. Vessels are to call at an Irish port, if required to do so by the government.

Messrs. Peterson, Tate & Company will receive a subsidy of $773,000, one-third of which will be paid by the British government and two-thirds by the Canadian government, and the contract is to cover a term of ten years.

This addition of four first-class express steamers to those already afloat, together with the giant Oceanic building for the White Star Line, and the truly splendid twin ships of the North German Lloyd Company, which commence active service this year, will give transatlantic passengers the choice of over a dozen boats that are of 20 to 22 knots speed and furnished with the latest luxuries of ocean travel.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

The twentieth convention of the National Electric Light Association met at the International Hotel, Niagara Falls, N. Y., on June 8, 9, and 10. There was a very large attendance, three hundred members being present, and nearly one thousand visitors who were interested in the proceedings were also at Niagara Falls. The meeting was called to order by President Frederic Nicholls at 10:45 A. M., on June 8. Letters of invitation were read from the various companies located in Niagara Falls and the vicinity which invited the members to visit the various plants. Letters of regret from Lord Kelvin and others were read. President Nicholls made an interesting address and the reports of the committees and reading of papers followed. Each day of the convention was filled up with the transaction of business, the reading of papers, and excursions to the interesting places and plants in the vicinity. The following were the principal officers elected: President Samuel Insull, of Chicago; first vice president, A. M. Young, Waterbury, Conn.; second vice president, George R. Stetson, New Bedford, Mass.

THE AEROPLANE FLYING MACHINE.

BY A. M. HERRING.

Owing to the wide interest excited by the many articles on the mysterious but elusive airships with which the daily papers have been filled in the past few months, it may be of interest to the SCIENTIFIC AMERICAN'S readers to learn that though these "news items" were all the creations from the brains of imaginative persons, yet scientific experiment has been carried on by many able inventors in working on what may be called the true flying machine; that is, one which is hundreds of times heavier than the air upon which it rests, by reason of its dynamic impact, and not by the aid of any balloon or gas bag whatsoever. This line of experiment has resulted in such great progress in the last few years (and especially so in the last six months) that the attainment of long, free flight for man, which not long ago seemed an invention for the far distant future, is a thing now near, if not quite at hand.

Of all the experimenters who have attacked this problem previous to the last decade, but very few indeed have seemed to have known and comprehended the nature of the real difficulties which were to be met with in the securing of the flying machine; i. e., the difficulties involved in obtaining automatically a safe equilibrium, and in securing horizontal flight. Perhaps the greatest genius who ever worked on the flying machine problem was M. A. Pénaud, a Frenchman, who in 1871 produced a screw-driven flying model provided with a small rear surface which acted as a regulator. This regulator controlled his model to such an extent that its average flight, as a whole, was horizontal, but its course, however, was composed of a number of undulations. It has been pointed out, and insisted upon by several writers, that in the elasticity of its surfaces it contained the fundamental principle which made this regulation possible—but this is not the case; for actual experiment distinctly proves that a Pénaud model will fly farther and is more stable with perfectly rigid surfaces than with those which are flexible. This regulator does not maintain a horizontal equilibrium except in very mild winds. Yet this model should stand out above all others, because it was the first dynamic aeroplane provided with an automatic regulator that actually made free flights. These were up to 131 feet in length and lasted on some occasions as much as eleven seconds. Pénaud calculated that it sustained 81 pounds per horse power.* (His model weighed a little over half an ounce and had half a square foot of sustaining surface.)

As his model exposed 15 square feet per pound weight, it is evident that a practical machine on this basis could never be built. Besides that of Pénaud many dynamic aeroplane models have been produced in the past by Tatin, Moy, Stringfellow (whose model is now preserved as a historical relic in the National Museum in Washington), Lawrence Hargraves, of Australia, an indefatigable worker, who produced no less than twenty models which would actually fly, the most of them being actuated by rubber springs, but some by steam and a few by compressed air. One of the latter type, which was presented three years ago to the Field Museum, of Chicago, is on exhibition in this country. It is remarkable for the fact that it sustained a horizontal flight for 19 seconds, during which time it covered a distance of over 300 feet and carried in flight a little over 75 pounds per horse power.† Its surfaces, however, are unduly large, 6½ square feet per pound weight. (A practical machine will probably be required to sustain from six to fifteen times this loading.) Mr. Hargraves is the inventor of the cellular kite used by the weather bureau. He is purely a scientific experimenter who has given his valuable work to the world without reserving to himself any patents. Besides the above mentioned the writer, in 1890, produced a rubber spring driven model which attained horizontal flight through the action of an automatic regulating device, working on a new principle, but in outward appearance somewhat similar to that of Pénaud. This model sustained 157 pounds per horse power with 6 square feet per pound weight.‡ Its flights lasted from six to seven seconds, during which time it covered distances from 100 up to 135 feet. This model, which is still in existence, was exhibited in the spring of 1892 to an acquaintance who, some time later, described its flight in a small account in one of the Rochester, N. Y., papers, and in the fall of 1895 it was exhibited also to Dr. Langley, the distinguished secretary of the Smithsonian Institution, who took dimension sketches of it and who was so much pleased with the flights and the action of its regulator that he requested the writer to fly it repeatedly, first with the regulator in action and then without it.

In the year 1891 the writer constructed an improved and larger model (weighing 5 lb. and exposing 15 square feet of surface), fitted with compound steam engines and a condenser. This model furnished the power for its own start—but its best flight was only about 240 feet—although it carried fuel and supplies for several miles. Petroleum was used instead of water in the boiler. The reason that only a short flight was obtained was due to the boiler blowing up before enough trials were had to properly adjust the regulator. The damage from the heat of the burning of the boiler's contents ruined the small engines, which were built of tempered tool steel. Owing to the pressure of other affairs, this model was not rebuilt.

Pre-eminent in the field of aerodynamics stands the secretary of the Smithsonian Institution, Dr. S. P. Langley, who has done more than any one else (except possibly it be the late Otto Lilienthal, of Berlin, Germany) to place the subject on a sound basis; for his "Experiments in Aerodynamics" will hereafter be looked upon as one of the pioneer lights which directed modern scientific effort to the subject of aerial navigation. This work, contrary to the prevalent belief of engineers, showed that in so far as the question of power was concerned, flight was possible. Dr. Langley has since then directed his efforts to the production of a model which should demonstrate that the further difficulties might be overcome. This model flies from one-half to seven-eighths of a mile, uses steam, weighs about 30 lb. complete, and employs a pair of engines furnishing between one and one and one-half horse power. It may be questioned, however, whether Dr. Langley's expressed views as to what he has accomplished, and his predictions of the future prospects and uses of the flying machine, are not too sanguine; for it is doubtful whether with the most economical heat engines that have ever been constructed the flying machine, carrying even one passenger alone, will ever be able to fly for a day—not days at a time or at a speed which exceeds 80 to 90 miles an hour. That it will never carry freight is almost certain. It is even probable that the machine of sufficient size to carry more than two persons is an invention for the relatively distant future. With all deference to the opinions expressed by so eminent a scientist, it might be pointed out that with the low economy in supporting effect obtained with this model (30 lb. per horse power) * it is not possible to add a condenser, and a machine built on anything like a similar scale for carrying a man would not be able to lift its own weight! For, if we double the lineal dimensions, we would have but four times the surface (lifting effect), while we would be hampered by eight times the original weight. It may be argued that, by reducing the angles at which the surfaces are presented to the air, a larger lifting effect per horse power would be obtained. The maintenance of a small angle in flight is, however, one of the most formidable difficulties of the whole flying machine problem. From the simple laws which govern the thrust of helical screw propellers, it might be shown that the expenditure of 1 horse power on a pair of screw propellers 39 inches in diameter (the size given by Langley) would produce a flying or a standing thrust of 16·3 lb., or 54·3 per cent of the weight of his aerodrome. It can further be shown that with a boiler pressure of 150 lb. to the square inch, the pair of engines of the size given (1¼ inch bore, 2 inch stroke) would each produce 40 to 45 foot lb. (net) on the shaft per revolution. This much spent on a 39 inch properly made screw would produce a thrust (flying or standing) of at least $10\frac{29}{100}$ lb., and the pair of engines acting on a pair of propellers would give a thrust $20\frac{58}{100}$ lb., that is, $68\frac{6}{10}$ per cent of the weight of the aerodrome, and possibly more. The lower boiler pressure given, 110 lb., would give a thrust in flight for standing of 16·4 lb. These thrusts are so extraordinarily large in proportion to the weight carried on the aeroplanes that it might well be questioned if the possibilities of aerial navigation, which Prof. Langley claims to have demonstrated, are not more imaginative than real.

It has not been possible in an article of this length to touch upon the value of the work done by the late Otto Lilienthal nor the exceedingly valuable results published of the experiments of Mr. Hiram Maxim, which, although fragmentary, are of the utmost value to the engineer.

* Even if we accept Pénaud's figures and reduce the weights sustained to what it would have been on a model loaded to 1 pound per square foot, we should find that he could have carried but $81 \div \sqrt{15}$, or say 22 pounds per horse power.

† Seventy-five pounds per horse power on 6½ square feet of surface to the pound weight is equivalent to 29·8 pounds per horse power, if the model were loaded to 1 pound per square foot.

‡ One hundred and fifty-seven pounds per horse power on 6 square feet to the pound is equivalent to 60 pounds per horse power with a loading of 1 pound per square foot.

* The dimension sketch given by Prof. Langley in the Aeronautical Annual for 1897 shows about 75 square feet of supporting surface. The whole weight is given about 30 lb., equivalent to 2½ square feet per lb. wt. Assuming the power at 1 horse power, it shows 30 lb. were carried at that weight with a loading of 1 lb. on 2½ square feet. This, reduced to a loading of 1 lb. per square foot, is equivalent to barely 19 lb. per horse power, with which lift neither a condenser nor man flight is possible.