A GIGANTIC KITE.

After remaining for a long time an object of amusement merely, the kite is becoming one of study for the mechanician, who finds in it a means of applying and verifying formulas relating to the resistance of the air, and of thus contributing to the progress of the difficult and complicated problem of flight. So we believe it will be of interest to give a summary of two recent studies—one of them purely scientific and relating to the theory of the kite, and the other an experimental one, in which the author succeeded in raising from the ground a gigantic apparatus, powerful enough to carry a weight equivalent to that of a man.

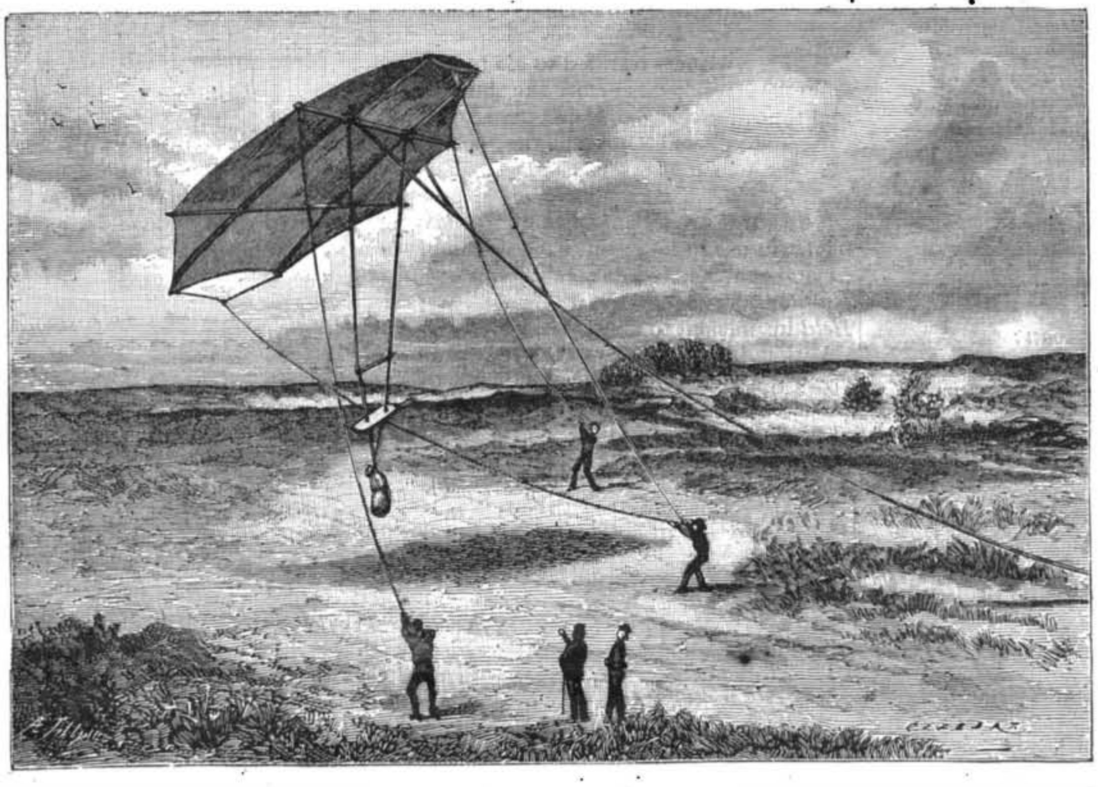
In a communication to the French Association for the Advancement of Science, at the meeting held at Grenoble, in 1885, Mr. J. Pillet, teacher of machinery drawing at the Polytechnic School, presented a very simple and elegant theory as to the equilibrium of the kite, and deduced therefrom certain general principles that may be useful to some of our readers as a guide in the construction of this affair.

In a kite, the elements to be considered are its weight, P; its plane surface; the position of its center of gravity, which the trial has the effect of bringing very near the lower extremity; the center of the wind's pressure, which, as a general thing, is confounded with the geometrical center; and, finally, the point of attachment of the string.

Theory indicates that it requires a certain ratio between the position of the center of gravity, the center of pressure, and the point of attachment of the string, in order to obtain with a given kite a maximum of altitude and of ascensional force. The point of attachment should be upon the straight line passing through the centers of pressure and gravity, higher than the center of pressure, and so that the distance from the center of gravity to the same point of attachment of the string shall be triple the distance from the center of pressure to the same point of attachment. A calculation of the tension of the string in a properly constructed kite shows that such tension varies between very narrow limits only, whatever be the velocity of the wind. In a light wind, all that the string does is to hold the kite, which hangs vertically, and the lower value of the tension is then equal to the weight, P, of the kite and its tail. In an infinitely swift wind, the upper value of the tension of the string is equal to 2 P only. This weight represents quite a feeble tension, and one which even quite a fine cord could easily withstand. Consequently, when the kite is pulling very strongly, this proves that it is badly attached, and not, as one is tempted to suppose, that it is prepared to rise well.

We trust that Mr. Pillet will complete his study and let us know the considerations that he has drawn from it relative to the best form to give a kite, as well as the consequences relative to the problem of flight. The note presented at Grenoble stops at the principles that we have just recapitulated.

The experiments that we shall now speak of offer Mr. Pillet an almost unique opportunity of verifying the accuracy of his theory and formulas on a large scale. It concerns a huge kite constructed and experimented with last May by Mr. Maillot, and a description of which we find in the *Aeronaute*.



MAILLOT'S GIGANTIC KITE.

This kite is a regular octagon, having a superficial area of 85 square yards, and the frame of which weighs 150 pounds. The canvas and cords weigh 99 pounds, and the kite has lifted a bag of earth weighing 150 pounds. The structure of the affair and its unusual dimensions render the maneuvering of it peculiar. Two cords, maneuvered from the earth, and connected with the two extremities of the vertical line passing through the geometric center of the kite, permit of giving the latter the proper inclination, according to the velocity of the wind and its variations. Two assistants prevent a lateral inclination.

After firmly fastening the cord, which was 820 feet in length, Mr. Maillot and his assistants lifted the top of the kite and let the wind in beneath. The affair then arose, and lifted a 150 pound bag of earth to a height of 32 feet above ground. It is in such a position that it is shown in the accompanying figure. Each operator pulled in or paid out the cord according to the velocity of the wind, and the kite preserved a certain amount of stability.

In the discussion that followed the communication to the French Society of Aerial Navigation regarding these experiments, Mr. H. De Villeneuve recalled the fact that the English journals had once spoken of a woman being lifted by a kite in the last century.

It was the constructor's idea that the maneuvering of the cords that regulate the inclination ought to be performed by the person lifted in the place of a bag of ballast; and the kite would then have been connected with the earth only through the main cord. This bold and dangerous experiment was opposed by the spectators on the 16th of May last, when Mr. Maillot operated his kite in the presence of the members of the Society. It was rightly feared that Mr. Maillot, after he had been lifted, might not manipulate the cords properly.—*La Nature.*

THE NEW TUNNEL, KONIGSTRASSE, BERLIN.

This tunnel is about 52 feet wide, 14 feet high, and 188 feet long, and is arched, as is shown in the accompanying cut. The masonry of the crown of the arch, that is to say, the central fourteen feet of the curve, is about 2 feet 1½ in. thick, and from these points to the impost its thickness is about 2 feet 5·3 in. The abutments and arch are faced with Greppin brick, and the frontal face and projecting edges with hewn stone.

The abutments are made of hard burned brick set in cement, and the voussoirs are arranged according to the line of pressure. To effect a saving of masonry, the abutments are not solid, but are built with openings; and to prevent the tipping of the abutments before the completion of the arch, 9 in. braces were placed 6 ft. 6 in. apart, and walls were built from the arch to the outermost limits of the street. These walls, as well as the wings, the faces, and the under surface of the arch, are faced with Greppin brick.

The arch was very carefully built of narrow voussoirs, so that when completed the crown sank 1·5 millimeters. The centering had to be arranged so as not to interfere with the traffic of Konigstrasse. So two passages, each 10 ft. wide, were left for the vehicles, and a passage about 5 ft. wide was left on each side for pedestrians. Tubs filled with sand were used for the support of the centering, and each of these tubs was provided with a plug, all of which plugs could be removed at the same time when the arch was finished, so that the tubs could be emptied, and in this manner an even and rapid settlement of the arch was accomplished.

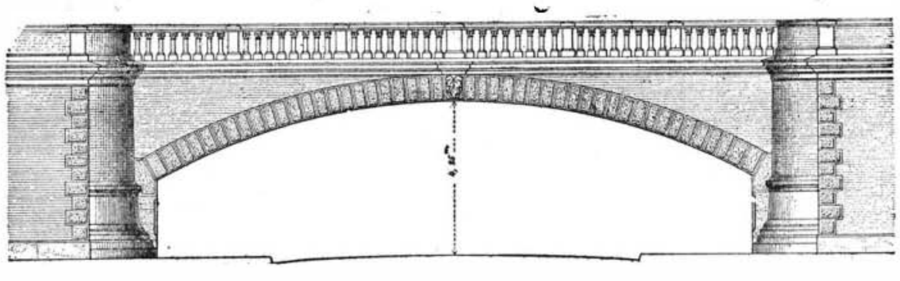


Fig 2 Querschnitt nach c d (in Fig 3.)
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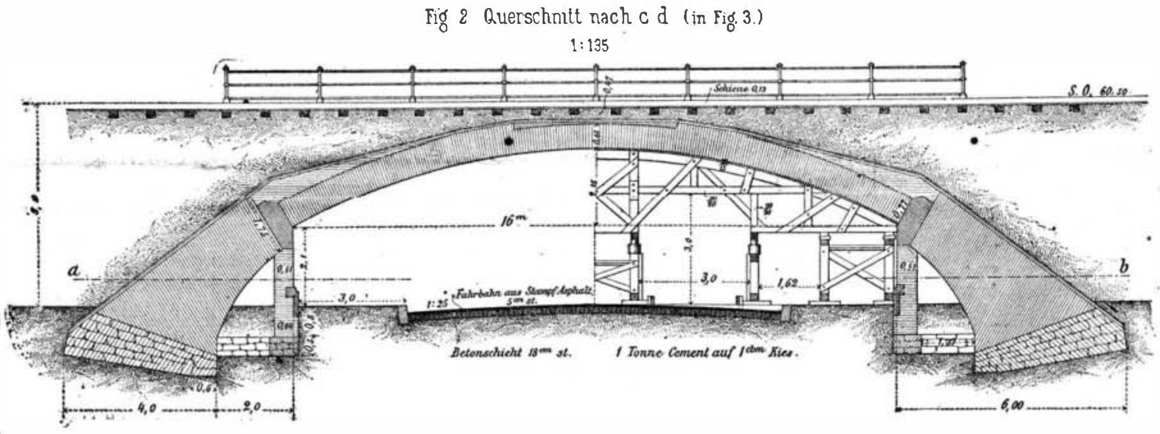

Fig. 3. Grundriss nach a b (in Fig. 2.)
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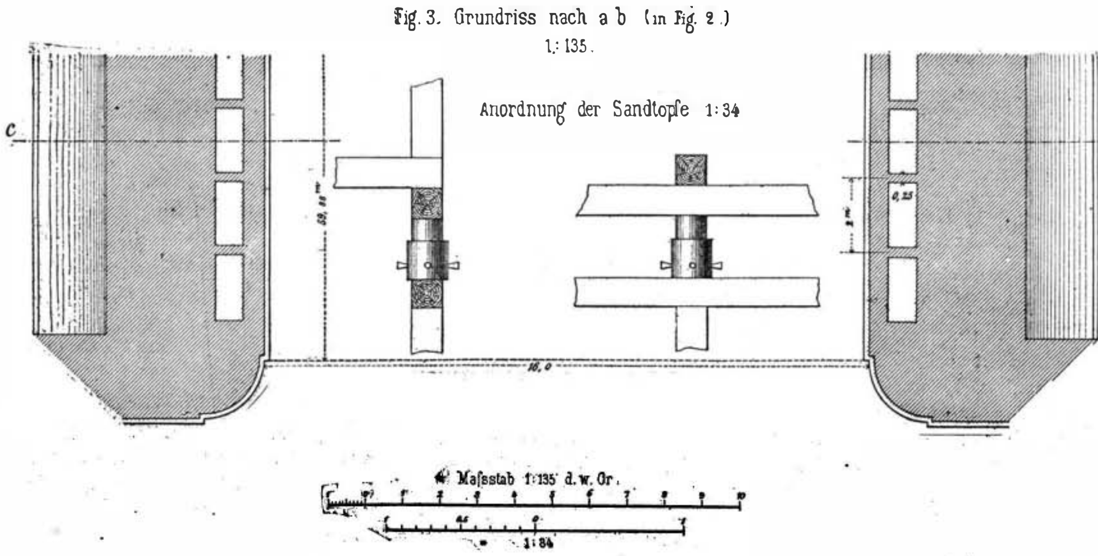


THE NEW TUNNEL, KONIGSTRASSE, BERLIN.

In calculating the strength of the arch, moving weights were considered.

The entire cost of the tunnel was about $5,964.00.--*Zeitschrift des Archit.*

Economy of Triple Expansion Engines.

The Coot is a vessel of 2,650 tons dead weight carrying capacity, is 270 feet long by 37 feet beam, and 18·5 draught above keel. Her triple engines have cylinders of 19½ inches, 32½ inches, and 53 inches diameter by 36 inches stroke, working on three cranks, and are all fitted with piston valves and dynamic valve gear. The Moorhen, a sister ship with which comparison of coal consumption and speed was made, is a vessel by the same builders, having a dead weight carrying capacity of 2,455 tons, is 260 feet long by 32½ feet beam and 19·3 draught above keel. She is fitted with ordinary compound engines by an eminent North Country builder, the cylinders being 33 inches and 62 inches in diameter, and 39 inches stroke.

On the completion of the voyage, Captain Croft, the marine superintendent of the Cork Steamship Company, reported that the Coot had steamed 8,258 miles on a consumption of 526 tons of coal, of which 320 tons were North Country coal of very inferior steaming quality, and 206 tons Welsh procured at Malta. The Moorhen steamed 7,535 miles on a consumption of 692 tons, the ship having still 703 miles to go to make up the distance covered by the Coot, and the 692 tons coal being made up of 552 tons of Welsh and 140 tons of West Hartley coal. Captain Croft further states that "there were exceptional circumstances telling against the Coot, head to wind for several hours going from Alexandria to Smyrna, through heavy rolling and the cargo getting adrift; and on homeward passage from Malta the Coot had strong head winds, while the Moorhen had fair wind and fine weather."

The average speed of the Coot in moderate weather is 9¼ knots per hour when fully laden.

Mr. F. C. Kelson, of Liverpool, the engineer superintendent to the owners, reported: "As far as we can at present make out, the Coot burns 25 per cent less fuel than the Moorhen for the same length of steaming, which is of course very satisfactory, considering that the Coot's average speed is quite equal to the Moorhen's, and also that the Coot has greater carrying capacity than the Moorhen."

EXPERIMENTS IN EQUILIBRIUM OF FLUIDS.

T. O'CONOR SLOANE, PH.D.

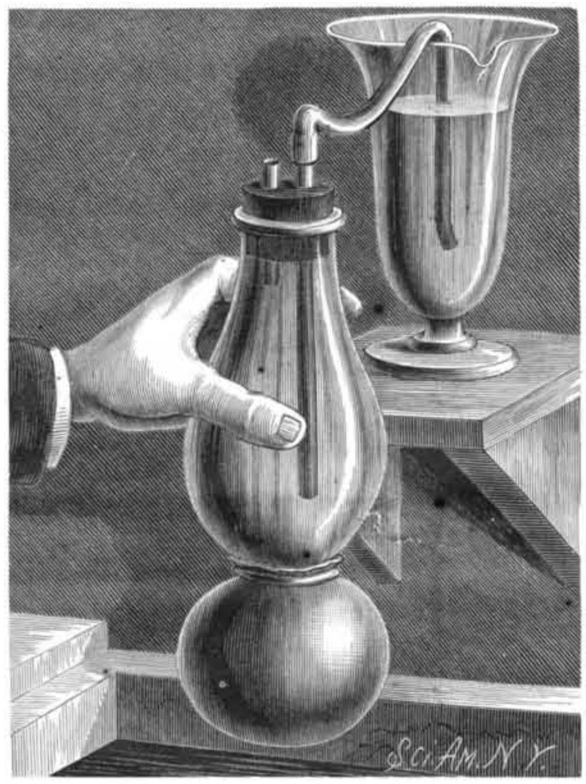
In the last issue was described a simple construction of the well known cup of Tantalus. In the cuts are shown two additional illustrations of siphon action, in which the expansion of thin India rubber is used to indicate the effect. A lamp chimney having a projecting flange around its lower edge is used. A piece of the thinnest pure gum India rubber sheeting is placed across and covering the opening of this end. A rubber band is sprung over it, so as to confine it to its place. As this connection must be very secure, a strong band is essential. A ring such as is sold for use on umbrellas for confining the ends of the rods is very good. This

SUCTION OF A SIPHON.

will force the sheet against the glass and into all irregularities, so as to make a watertight joint. The rubber is not to be stretched in doing this, but is kept a little loose.

A tight cork of India rubber with one perforation, or if with two, one must be stopped, is provided that fits the upper end of the chimney. A tube of glass is inserted in the opening in the cork and is connected to a flexible tube of rubber. This forms the siphon. The chimney is filled with water. The rubber will bulge a little under the weight, but not very much. The cork is then inserted and the end of the flexible siphon tube is immersed in a vessel of water standing on the same level as that occupied by the chimney.

To illustrate suction, the chimney is lifted up until two feet or more of siphon tube depends from it. The rubber is now pressed in and upward. It expels air from the siphon and charges it, or fills it with water. Suction immediately begins to be felt, and the rubber curves inward. If the column is of a particular height with reference to the thickness of the rubber and diameter of the opening, nothing more than a slight inward bulging will thus be produced; but if the rubber is pressed further inward with the fingers, it will gradually yield to the pressure and rise up and in



PRESSURE OF A SIPHON.

more and more. After getting started it will slowly rise up without assistance, growing thinner until so transparent as to be almost invisible. The way in which the pushing upward seems to help it is to be noticed particularly. This increases the area on which atmospheric pressure can be exerted.

To illustrate the pressure at the lower end of a siphon, the position of things must be reversed. The chimney is lowered and the vessel of water is raised up. The rubber immediately straightens, and begins to curve outward, and gradually assumes an almost perfectly spherical shape. Thus it also affords an illustration of the equality of hydrostatic pressure in all directons.

In both these experiments, the chimney should be held over a basin or pitcher, as there is danger of breaking the thin rubber.

The last experiment shown is one illustrating the mechanics of a drop of water, and incidentally some other laws of equilibrium of liquid bodies. A hoop of wood or metal, from fourteen inches to two feet in diameter, is required. This may be made from a cheese box, or a hooped section may be sawed off from a well-made barrel. A piece of the same thin rubber is spread over it, and tied on securely. To make it act well, the tension on the rubber must be just right. If too much or too little, a poor result will follow. For a fourteen inch hoop a slight tension is enough. A string wound tightly around it for five or more turns, and then tied, will secure it. This is then supported over a tub or receptacle for water, in case it should break.

Water is then poured into it. As it is introduced, the rubber takes the form of a portion of a sphere, and descends more and more as water is added. At last a point is reached when it is in unstable equilibrium, and the addition of a little more water causes it to suddenly descend two or three inches, and change its shape materially. These two conditions are shown in the drawing, the first by a dotted line. Sir William Thomson uses this in illustration of the equilibrium of a drop of water, as showing that it has two forms of rest. If the amount of water added is just right, the rubber will remain in either of the two positions indifferently. If added as just described, the withdrawal of a small amount will effect the purpose. The original paper of Sir William Thomson, published under the head of Capillarity, in the SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 562 and 563, may be referred to here.

If the amount of water is a little less than is required to produce the lower position, and the hand is immersed in it, the same effect is produced as if water were added; as the hand is lowered, the rubber descends in the most curious manner, receding from the hand. If a coin is previously placed in the center, and an effort is made to extricate it, the effect is quite peculiar. A paradoxical aspect is given by the fact that apparently no weight is added. As everything immersed in water is buoyed up by a force equal to the weight of the water displaced, so the hand is pressed upward by this factor. But an upward pressure implies an opposite and downward one, and under this the water descends. Another way to treat the question is based on the fact that the pressure of water varies with the depth. By introducing the hand as described, the water is made to rise by the displacement. Hence a deeper column acts upon the rubber, and presses it down.

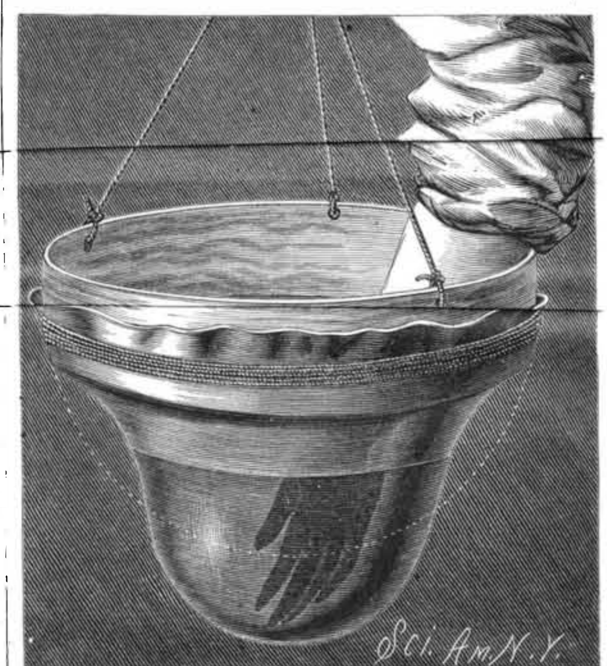
In constructing the apparatus, the thinnest rubber sheeting is the proper substance to use. Of course, no woven fabric, such as is used for waterproof cloaks, is available. If this and the question of tension are attended to, after one or two trials the apparatus will be successful. The tension will probably not work well on the first trial. The size of the hoop is important. It is not worth while to try it on a small scale. The sizes given really represent the minima from which a satisfactory result can be obtained.

Fireproofing Wood.

A mode of rendering wood incombustible not generally known is described as follows: Soak 27·5 parts by weight of sulphate of zinc, 11 of potash, 22 of alum, and 11 of manganic oxide in lukewarm water in an iron boiler, and gradually add 11 parts by weight of 60 per cent sulphuric acid. The wood to be prepared is placed upon an iron grating in an apparatus of suitable size, the separate pieces being placed at least an inch apart. The liquid is then poured into the apparatus and the wood allowed to remain completely covered for three hours, and is then air dried. The mode of application described is, we fear, a serious obstacle to the general use of this process for timber employed in building, especially as the rough timber, before being worked or framed, could only be conveniently treated in this manner. If joists, ceiling beams, and all joinery exposed to fire could be treated after being fixed with some chemical solution of proved resistance to the action of flame, we believe many architects would be found to employ it.

Longevity of Turtles.

In 1824 Mr. J. W. Warrington, one of the pioneer pedagogues of this vicinity, found a small *Testudo carolina* Linn., on the plastron of which he engraved, with his penknife, "J. W., 1824," and set it free near Albion, Ill. Some time during 1865 Mr. W. Hodson found it in the same vicinity where it had been set free forty-one years before. He engraved the letter "W" on the carapace and again set it free. Nothing more was seen of it until August, 1885, when it was found by Mr. Herbert Hodson (brother to W.), about one-half a mile from the spot where it had been set free twenty years before. He put it into his cellar, where it remained until this (1886) summer, when it by accident was poisoned by "Rough on Rats," and died from the effect. The engravings are all apparently as clear as when first made. The tortoise was below the medium size, and appears to have grown very little since the first engraving was done, sixty-two years



WATER DROP.

ago. The shell is darker and smoother than usual. On the back is a scar, which appears to be the remains of an extensive fracture. Mr. H. Hodson has three other tortoises that were engraved twenty-one, seventeen, and sixteen years since respectively. In illustration of the slow growth of these reptiles, I will mention that more than a year since, he broke open an egg in which was found a young tortoise. This he has since kept in confinement. It has made no perceptible progress in size during this time. Several years since, I kept a young *Pseudemys elegans* Wied. in confinement for more than two years. It made no perceptible increase in size, yet it partook quite freely of food.—*J. Schneck, Mt. Carmel, Ill., American Naturalist.*