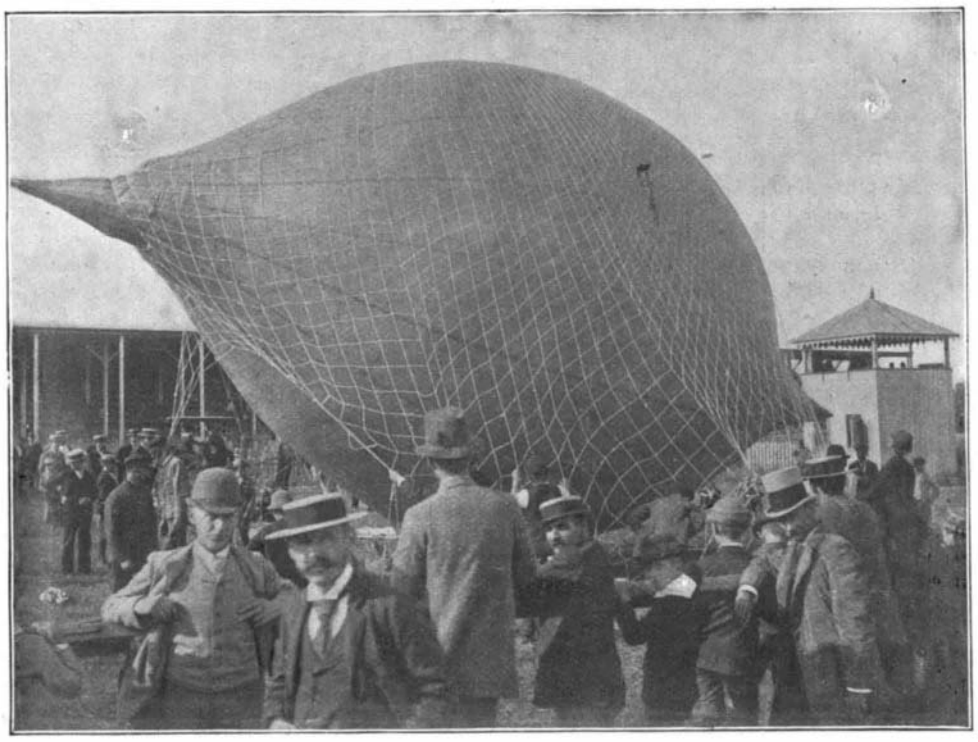


READY FOR THE ASCENT.

Taste and Smell.

While the physics of the senses of sight and hearing have attracted the attention of many philosophers, and have been elucidated by numerous ingeniously contrived experiments, those of taste and smell have been comparatively neglected. The very phraseology by which we are accustomed to describe the impressions which we receive through these portals of sense is indefinite, obscure, and uncertain. There are, indeed, several terms which would call up corresponding sensations in regard to the sense of taste, such as sweet, acid, alkaline, oily, and mawkish, but our vocabulary is small in calling up sensations of smell, and is almost limited to such general terms as pleasant and unpleasant, pungent and aromatic, fetid and fresh, which have none of the definiteness or precision that the terms blue or green possess in ordinary conversation or that the expression treble G gives to the musician. Our memory of odors is in general very imperfect. Attempts have been made, but not very successfully, to establish a gamut of odors, and it is difficult in many instances to dissociate the senses of smell and taste. Cuvier observed that these two senses are nearly allied to common sensation. In those animals which are only capable of breathing through the nose, like the horse, the extent of surface ministering to the sense of smell is immense as compared with that of man. A large area of the nasal cavities is covered with mucous membrane which is thick in both, studded with numerous acinous glands, covered with stratified ciliated epithelium, supplied by the fifth pair of nerves, and is probably dedicated to other functions than those of smell, as, for example, the warming and moistening of the air, and its purification from dust before entry into the lungs, and a large portion also of the upper region seems merely to act as a periosteum to the frontal and ethmoidal cells, and to possess but a small share of special sensibility. The turbinal bone, on the other hand, the volutes of the ethmoid, and a considerable area of the septum between the nostrils, is covered with a thin, yellowish-red membrane, the epithelium of which is unprovided with cilia, to which the branches of the olfactory nerves are distributed, the ultimate fibrils being traceable to the very surface, covered only by a thin layer of fluid and being well placed therefore for the perception of delicate impressions. Common observation shows that while man is capable of perceiving a great variety of odors, many animals surpass him in the acuteness of their perceptions. The nature of these emanations probably varies considerably. Water, which has no smell to man, can be perceived by some animals at considerable distances. Sexual odors appear to be peculiarly expansive. Scarpa found that if he plunged his hand into water after handling a female toad, the males were attracted to him. Insects, and especially those of nocturnal habits, are guided to each other by their emanations. Judging from the actions of animals, the odors of plants are only in rare instances, as in the case of valerian by the cat, perceived or at least enjoyed by the carnivora. Putrid meat is devoured by the vulture and jackal, though it is not touched by many flesh-eating animals that feed on living prey, while it produces a kind of convulsion in many horses and madness in the bull.—Lancet.

SPIRAL DESCENT OF THE "SKYCYCLE," SHOWING POSITION OF SCREW, SAIL, AND PLANES.

The Growth of Our Public Libraries.

The phenomenal increase in the growth of public libraries in the United States, which began some thirty years ago, continues to excite the surprise and interest of European students and statesmen, who regard such libraries an important adjunct to the American system of public education. Consul-General Du Bois, St. Gall, Switzerland, says that the United States is now teaching many useful things to the old world in the way of educational advancement and commercial progress, and now we are no longer regarded as a nation whose chief aim is the making of money, but are recognized as a potent element in the higher civilization.

The Swiss press frequently contains intelligent articles on our public school systems, colleges, universities, libraries, charitable institutions, etc. Albert Schinz writes in the Lausanne Bibliothèque Universelle et Revue Suisse that not only does the United States publicly contribute five times as much annually for public library purposes as does any other nation in the world, but it spends nearly as much annually for educational purposes as do England, France and Germany combined.

AIR SHIP EXPERIMENTS.

To the Editor of the SCIENTIFIC AMERICAN:

Interest excited by illustrations of Dr. Danilewsky's dirigible flying machine in SCIENTIFIC AMERICAN, December 31, 1898, may be increased by acquaintance with my experience with kindred apparatus extending over ten years in time and a large portion of the United States in space, the air vessel used being originally known as the gas kite and later as the "skycycle." The gas kite was a boat-shaped gas bag, inverted, as shown, while inflating, and floating with its flat deck surface acting as a kite drawn forward by a screw propeller, as shown in two other views.

The mechanism is shown in annexed engraving and consists of a bicycle seat, below which are foot cranks or pedals which connect by shaft and gearing with hand cranks, replacing the ordinary steering bar of a bicycle, so that the whole effective muscular effort of the rider may be conveyed to the screw shaft projecting forward to revolve a "screw sail." 15 feet in diameter. To permit of swifter revolution and avoid accidents in landing, this screw sail was later reduced to about 8 feet diameter. The gas vessel was next made more symmetrical by uniting two such vessels, deck to deck, forming a spindle, as in perspective view, showing the aerial torpedo about to be launched skyward. In this form, with various propelling and steering appendages, it has now made flights over the States of Maine, New Hampshire, Massachusetts, Connecticut, New Jersey, Delaware, Maryland, Virginia, Ohio, Michigan, and Illinois, and over nearly every county in New York State, without injury to person or vessel. Unlike a gas balloon, it usually sails at a low level (though it has occasionally reached two miles elevation), and it is purposely balanced or weighted to come down if left to itself, only slight effort being necessary to keep it aloft, though speedy movement requires as much effort as to ride a bicycle up hill against a wind, and a more enduring and powerful motor than human muscles is desirable. Progress to right or left, up or down, or turning in a circle, is quite simple, and any movement or shift of the operator's position is responded to by reaction in the apparatus. A rudder attached behind the rider, and having a universal joint which permits fixing the rudder at any angle or in any plane, flat or perpendicular, aids guidance. Two of these, placed on each side of the operator, were afterward substituted, as shown above, and the rudder discarded. Various features were patented, when tests in midair showed their value. The complete apparatus, now in good order after

OPERATOR'S SEAT AND PROPELLING MECHANISM.

THE "SKYCYCLE" AT THE HEIGHT OF A QUARTER OF A MILE.

much use each season for ten years, weighs as follows: Gas spindle, 56 pounds; bicycle seat, framework, and gearing, 15 pounds; screw propeller and rudder aeroplanes, 4½ pounds; netting, cordage, and anchor, 15½ pounds; total, 91 pounds. My weight is 115 pounds, making 206 pounds lifted, besides about 30 pounds sand ballast used to load the apparatus down. With such apparatus I have passed over a considerable portion of the Eastern and Middle States without reference to any weather, except rain and winter cold.

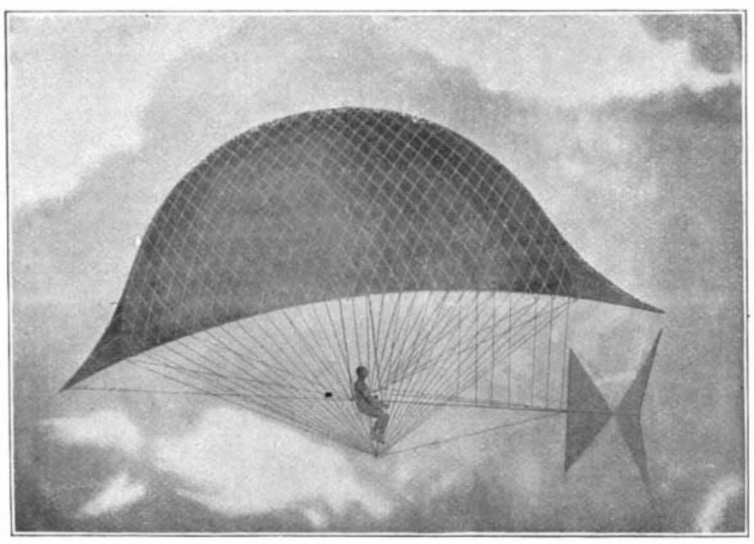
A kindred apparatus built by me, varying somewhat in weight, form, and dimensions, was operated several times by W. A. Barnard at the Nashville, Tenn., Exposition, 1897, inspiring many sensational and exaggerated newspaper accounts of its somewhat impossible performances. This apparatus was constructed for use with a two horse power motor, which was not applied there. This vessel had a cylindrical gas bag like Danilewsky's, but a sharper bow and stern. The stern of Danilewsky's, like the butt end of a projectile, is one of the worst possible forms for swift aerial movement, as it produces a suction behind which greatly retards it. I should not regard the apparent method of attachment—harness or netting—as safe under any other than the evidently pacific weather during which his experiments must have been made. The rigging should be such that under no circumstances of high wind or foul weather, whether in the air or anchored to earth, can the gas spindle escape from it. No mechanism is apparent whereby the vessel could be impelled backward or forward, or otherwise than up or down, except by inclining its body or steering by the rudder while rising and falling. The movement of a balanced gas vessel upward by muscular power is easy. I have jumped skyward thus a hundred or more feet, and have many times tossed a balloon and aeronaut skyward.

The movement of almost any form of gas bag through the air in any direction at slow or moderate speed with well-known appliances is an easy matter. Complete success in the art of aerial navigation is at present dependent upon the most approved features for propulsion and guidance, backed by a powerful light motor supported by a gas spindle of best form possible for speed and safety combined, which involves a strictly hydrogen-proof vessel incapable of flinching from the stress put upon it.

American invention is competent to create such appliances readily. The Patent Office shows some valuable features of this class, and our inventors' minds teem with aerial contrivances, only needing capital and construction to float them to success. Meanwhile "our doubts are traitors, and make us lose the good we oft might gain through fearing to attempt."

Air navigation is already at hand, if we but use the means at command.

Frankfort, N. Y. CARL E. MYERS.



THE GAS-KITE IN MID-AIR.

Artificial Eyes.

According to German authority, people wearing false eyes must be pretty nearly as common as the remainder of the victims collectively whom fate has deprived of a portion of their bodies, be it organ or limb. Every year, it is said, no fewer than 2,000,000 of glass eyes are manufactured in the German empire, and it is, of course, far from probable that the whole of the world's supply should be made in Germany. On the contrary, it is stated in La Médecine Moderne that a single French firm turns out at least 300,000 glass eyes annually, and that there are several other factories in France the output of which is about the same. How, it will naturally be asked, can this enormous stock be utilized? Glass eyes, although essentially brittle, are little liable to injury, do not wear out quickly, and are quite independent of the vagaries of fashion. Once suited, the owner of a glass eye may make it serve him a considerable time.

A writer in the Journal d'Hygiene is disposed to regard the oculiform millions as a fantastic creation, seeing that one-eyed people are rare comparatively speaking and that the majority of them do not wear false eyes; but a little consideration should suffice to show the critic that his doubts are not well founded. Like many an objector, he assumes the premises—to wit, that all the eyes are used to replace human losses, whereas most likely false eyes of every description are included in the list.

Evidently taxidermists, bird stuffers, the makers of wax figures, etc., must use an immense quantity, to say nothing of the artists who are responsible for the innumerable army of dolls large and small. Viewed in the light thus thrown upon the matter, the 2,000,000 which seemed to be so amazingly beyond the mark dwindle to a mere bagatelle—a mere drop, so to speak, in the ocean of false eyes. In this connection allusion to the singular fact that it is only the one-eyed who seek to conceal the deficiency by means of a substitute may be permissible. The totally blind never wear false eyes, or if an instance now and then occur, it merely serves to prove the rule. In consequence of his æsthetic sense a one-eyed man feels compelled to endure the discomfort which in greater or lesser degree attends upon any foreign body which has obtained lodgment in the human economy, but the man who has lost both his eyes is free from this weakness—his æsthetic sense expired along with his vision.—The Lancet, London.

Testing Purified Wool Fat.

Purified wool fat has in the course of the last few years become a favorite article as the body for salves and unguents, and continues to crowd out of use the former unreliable constituents used for salves. For this reason the governments of nearly all the civilized countries have prescribed the demands with which a purified wool fat has to comply. Although the German pharmacopœia has not yet incorporated such provisions, German druggists have felt the necessity of possessing a standard to which the fat shall conform, and some time ago the German Apothecaries' Society debated the matter and established rules for the purpose.

On page 12 of the second edition of the minutes of the Society the following style of testing is laid down, viz.: "When 50 grammes wool fat are with 300 grammes water heated in a retort to 100° C., and if then steam of a temperature of 100° C. is passed through the mixture, the parts first passing over by distillation must not contain alcohol, acetone, ether, or benzol." It is difficult to understand why only these and not the numerous other impurities should be ascertained. If an unalterable standard is to be established, it would be advisable to take cognizance of all the agents employed for extracting the fat. Before everything else it is also important to not only examine the distillate, but likewise the mixture of fat and water in the retort.

According to Dr. J. Lifschütz, the introduction of aqueous steam of 100° into a fat melted according to above prescription over water is an excellent and highly commendable criterion of the purity of the wool fat to be examined. While a well purified wool fat separates clearly and sharply by each manipulation, without any cloudy intermediate layer and with a lustrous plane of separation, from the water below it, this distinct separation does not at all take place with a fat that has either not been purified sufficiently or become partly decomposed in the process. On the contrary, a white, milky emulsion, that will not clarify even after long standing, will be formed underneath the fatty layer. This method of testing, which Lifschütz calls the "separation test," he considers to be by far the most important criterion for a purified wool fat that has remained unaltered.

When a purified, water-containing wool fat is to be examined, the process may be facilitated by dispensing with the introduction of steam into the water-containing fat. It is sufficient to melt this preparation for thirty minutes in the water bath over water. If the sample is a truly pure wool fat, the operator will notice, precisely as stated above, the distinct separation between anhydrous and clear, transparent fat and clear water free from fat, with a sharp and mirrorlike line of separation, while, if the sample was a defectively purified or decomposed product, this distinct separation between fat and water is entirely wanting; and also the upper layer of fat is not perfectly clear and transparent. This test has, in consequence of its eminent importance, been accepted in different pharmacopœias, for instance, the Russian and Austrian. If, however, an anhydrous wool fat is to be tested, the fat must first be emulsioned with 30 per cent water so as to obtain the water-containing fat, and this mixture must then be submitted to the test, or else, as above stated, steam must be passed through the fat above the water.

Lifschütz establishes the following rules for the purity of wool fat:

1. A well-purified and sound wool fat must not smell like the crude fat. Its consistency must be fatty, soft, and pliable, which properties it must also retain even after prolonged exposure to air. Should in this case its surface become pitchy and sticky, this condition may be regarded as the decomposition of the fat.

2. The wool fat must not turn darker subsequently when exposed to higher temperatures. To satisfy one's self whether the fat will do this, a sample is to be heated to 140° C. for thirty minutes, after which its color must not darken noticeably. Nor must it turn dark when exposed to daylight. Imperfectly purified wool fats are inclined to essentially change their color thereby, while a well purified article is rather apt to bleach than to darken; at any rate, it will remain unchanged.

3. Characteristic of an impure and deteriorated fat is also the reaction produced by concentrated sulphuric acid in a glacial acid solution of the fat. One-half gramme of the fat is boiled with 5 c. c. glacial acid, and 4 or 5 drops concentrated sulphuric acid are, after cooling and filtering, added to it. With a well purified fat, the solution will at best become slightly brownyellow, while an impure preparation will, after thirty to fifty minutes, assume a full green color, and when examined in the spectroscope exhibit a vivid absorption band between the lines C and d.

4. An analysis for free fatty acids is performed in ethereal solution, not with normal potash, but with one-tenth normal potash. A good preparation must in the presence of phenolphthalein assume a permanent red colorization with one drop or two drops one-tenth normal potash.

5. An important indication is the above mentioned light and complete separation of the purified fat from the water incorporated with it. The water-containing preparation must, when warmed with the quintuple quantity water in the water bath, separate in short time into two clear and transparent layers. If the preparation is free from water, it must first be well rubbed together previously with about 30 per cent water. Much more characteristic and defined in both cases, however, is the above mentioned ready inclination to separate after the stirring of the wool fat with a hot jet of steam and subsequent standing at rest in the water bath.

6. When testing for freedom from ashes, the accidental residue must not only be examined for its alkalinity (with moist red litmus paper), but care must also be had that it contain no metals, such as lead, manganese, etc.

7. For proving manganese, the residue is melted with a little soda and saltpeter upon the platinum sheet. As is known, the fused mass turns intensively green in the presence of manganese.

8. For proving chlorine, a sample of the fat is boiled with absolute alcohol with the addition of one drop of diluted nitric acid and filtered perfectly clear after cooling. No opalization must show after an addition of a little alcoholic silver nitrate to this filtrate.—Pharmaceutische Zeitung, Berlin.

The Philadelphia Exposition.

The directors of the Philadelphia Exposition Association, of which Mr. P. A. B. Widener is president, have chosen Dr. W. P. Wilson to be the director-general. It was decided that the exposition should be opened about September 15 and closed about November 10. The national government has appropriated $300,000 for the exposition, contingent upon an equal amount being raised from other sources. This contingency fund is about complete, $200,000 being appropriated by the Philadelphia City Councils and $50,000 by the State Legislature; $50,000 has also been raised through private subscription. Plans for the work are now under way. It will be given under the auspices of the Commercial Museum, and it is thought probable that some of the buildings erected for the exposition will remain as permanent museum buildings. An additional appropriation of $50,000 has been made by Congress for the purchase of samples of foreign goods to enable domestic manufacturers to acquire knowledge of the kind of goods wanted by foreigners.

The Storage of Eggs.

An interesting experiment in egg storage was recently tried at Leith. In June a batch of 50,000 Scottish, Irish, and Danish eggs were sealed up in a storage apparatus, and were opened and examined four months afterward, and only a small proportion of the eggs were found unfit for use. In this method the eggs are kept cool and the air is allowed to have free access around each egg, which is kept in an upright position. The eggs are turned periodically, so that the yolk of the egg is constantly embedded in albumen. This is accomplished by placing the eggs in frames which, by the action of a lever, can be inclined in different directions as needed. In this way 23,000 eggs can be turned over in a minute without any chance of breakage.

The Work of the School of Athens at Corinth.

Three years ago the Ephor-General of Antiquities, in Greece, granted to the American School at Athens the privilege of conducting excavations on the site of the ancient city of Corinth. The director of the school, Prof. Richardson, and his colleague for the year, Prof. Benjamin Ide Wheeler, of Cornell University, agreed, says The Tribune, that no valuable site in the kingdom promised more important results in excavations than this city, which in all Greece was second only to Athens in magnificence, wealth, and population, and had great historic interest. They were well aware of the magnitude of the task, for the ancient city was of very large size, and the ruins are also covered by a layer of earth from 15 to 20 feet thick.

The work in 1896 was of a tentative nature, as the topography was almost unknown, except the two harbors and the Isthmian sanctuary in the suburbs. Twenty trial trenches were dug, and the ancient Greek theater was discovered, with portions of a Roman theater resting upon it; also indications of the proximity of the Agora. In 1897 the work of excavation was interrupted by the war between Greece and Turkey. In 1898 excavations were continued with one hundred and twenty men, and were facilitated by the use of a track and twelve cars. The fountain Pirene, which was the center of the life of the ancient city, was one of the results of these excavations. They also discovered the lintel of the synagogue of the Jews, which, it is assumed, is the very synagogue in which St. Paul taught when he first came to Corinth. The American School has not money with which to continue the excavations at Corinth in the spring, and it will greatly be regretted if work must cease on account of a lack of a very few thousand dollars which is necessary to carry on the work.

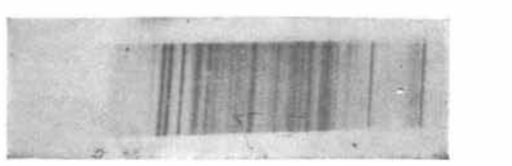
SIMPLIFIED APPARATUS FOR SPECTROSCOPIC PHOTOGRAPHY.

BY JOHN HELLYER WHITE.

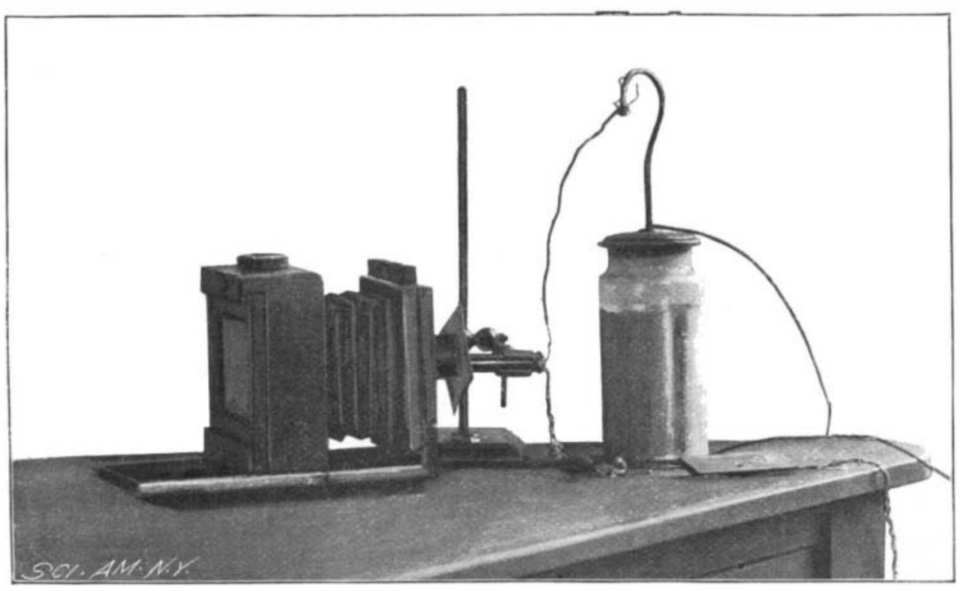
The spectroscope has always been an interesting but somewhat unfamiliar instrument to semi-scientific people, partly because of its expense and partly because of the care and skill that are required to use it successfully. I have made some experiments with apparatus that is very simple and have got very good results with it. It consists of only an ordinary 4 × 5 camera, a small Browning pocket spectroscope, and a stand to hold the spectroscope in place.

Nearly everybody has some sort of a camera, and the spectroscope would be the only extra expense. These small spectroscopes are manufactured by many optical firms, and a very good one can be obtained for ten dollars. With this apparatus I obtained a picture of the solar spectrum nearly three inches long, after an exposure of fifteen seconds. This showed an abundance of lines, the group about the "G" line being especially fine. On orthochromatic plates the exposure was doubled, but a negative was obtained that went from the invisible "M" line in the violet to the sodium "D" line in the yellow end of the spectrum.

The cut of the aluminum spectrum here shown was taken in the Jefferson Physical Laboratory with this apparatus. The accompanying engraving represents the camera with a movable ground glass screen. The spectroscope is at the front supported by a stand. In front of the tube is the source of light, either an electric arc or spark. Of course, when the sun is used for the light, other light is not needed, and the sun is focused on the adjustable slit of the spectroscope with a common double convex lens. Considerable care is needed to keep out all extra light from the plate, and for this purpose several pieces of the black paper that comes wrapped round plates were taken. Cutting a hole through them the size of the barrel of the spectroscope, pushing them up to the camera so that all the light was kept out, proved to be the best method, although black cloth can be used. The electrical apparatus used to take the aluminum spectrum was quite complicated, but before this I used simpler apparatus that is within the reach of everybody. For my spark I used a small induction coil that gave a spark half an inch long. This was operated by a plunge battery of moderate size. I used terminals of the metals I wished to photograph, condensing the spark by means of a small Leyden jar, which was insulated from the ground by a piece of glass, the outside of the jar being connected with one pole of the secondary of the coil and the inside with the other. This Leyden jar condensed the spark from one-half to about one-quarter of an inch, but it also made it very bright. The exposure needed on orthochromatic plates was about ten minutes. In the case of the spark spectrum, the spectroscope was put within three-fourths of an inch of the terminals, in order to get the necessary light. The extreme simplicity and smallness of this apparatus make it especially valuable where a larger apparatus cannot be used.



SPECTRUM OF ALUMINUM.

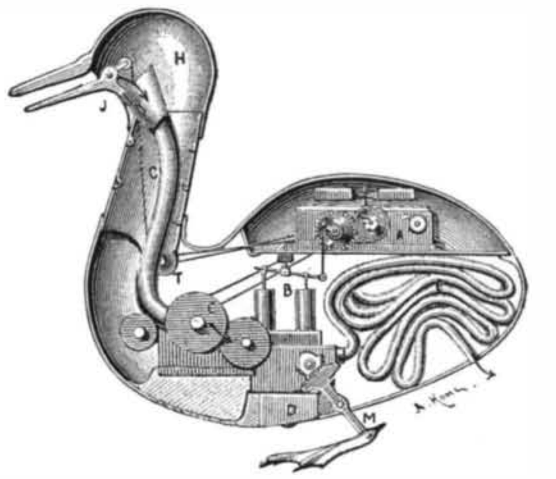


SIMPLE APPARATUS FOR PHOTOGRAPHING THE SPECTRUM

SOME CURIOUS AUTOMATA.

Of all the inventors of mechanical curiosities, Jacques Vaucanson was certainly the king. In the ingenuity of his mind he equaled, if he did not surpass, the most skillful of men.

In the first book of the Odes of Horace, we read that Arckytas manufactured a wooden pigeon, which, actuated by a mechanical movement, flew from place to place. This, however, was nothing as compared with



INTERIOR OF VAUCANSON'S AUTOMATIC DUCK.

A, clockwork; *B*, pump; *C*, mill for grinding grain; *F*, intestinal tube; *J*, bill; *H*, head; *M*, feet.

the automatic fly manufactured by John Müller, and which flew around the table during a dinner, and alighted upon the hand of its owner and manufacturer, to the great astonishment of his guests.

Philippe Camus describes an extraordinary automatic group, which was specially constructed for the amusement of Louis XIV. It was a minute coach to which were harnessed several horses, and which rolled over the table. Upon starting, the coachman cracked his whip, and the horses began to prance and then became quiet and started off on a trot. The coach stopped in front of the king, and the lackey jumped from his seat, and, opening the door, handed out a handsomely dressed lady, who walked toward his majesty, saluted him ceremoniously, presented a petition to him, and then re entered the coach. The lackey closed the door and jumped upon his box, the whip snapped and the horses galloped off.

Vaucanson did better still. His automatic duck was, to connoisseurs, an object of admiration. The bird waddled off in search of food, and picked up and swallowed the seeds that it met with. These seeds, says an article in the Biographie Universelle, passed into the stomach through a series of triturations that facilitated the introduction of them into the intestines and caused them to accomplish all the phases of digestion.

It was impossible to distinguish this duck from a living one. It splashed about in the water and quacked at pleasure.

Vaucanson's mechanical flute player also was a marvel. It was a life-size figure clothed in the fashion of the period, and standing alongside of a broken column, upon which it slightly leaned. It was capable of playing a dozen different airs with remarkable ease. To effect this result, there was a system of weights that actuated a bellows placed in the interior of the automaton, and, through an invisible tube, forced air to the flute, where it acted in the usual way upon the stopple of the opening. In order to obtain the modulations, and, consequently, a complete air, the fingers of the automaton were movable and closed the holes of the flute hermetically when at rest, and also rose and replaced one another through the traction exerted by wires and cords that were tautened and relaxed by the play of a toothed cylinder.

About sixty years ago, a jeweler of Boulogne constructed a wonderful automatic prestidigitator. This figure, correctly dressed in black, performed various sleight-of-hand tricks with remarkable dexterity, and, when it was applauded, gracefully saluted the spectators to the right and left. One of its tricks was the following: It struck a table several times and made an egg come out of it. It then blew upon the latter, when out of it came a bird that flapped its wings and sang, and afterward entered the egg again. This trick finished the exhibition.—Lectures pour Tous.

Queen Victoria's Yacht.

The new royal yacht for the Queen of England was commenced on December 23, 1897, when the first keel plate was laid at the government dockyard at Pembroke. The name for the new yacht has not been chosen as yet, and the Admiralty have not, until recently, given out any particulars of the new vessel; but now, however, they have done so. The new yacht will be 380 feet long; her beam is 45 feet; the draught is to be 18 feet, and her displacement is to be 4,600 tons.

It will be seen that this yacht is much larger than W. K. Vanderbilt's yacht "Valiant." The new royal yacht is as large as the cruiser "Baltimore," larger than the "New Orleans," and much larger than the "Hohenzollern," the German Emperor's yacht. The latter boat is really nothing more than a cruiser, with apartments for the Emperor. The new royal yacht will be a yacht pure and simple. The hull is to be steel sheathed with wood and covered with copper. She will have three funnels and two masts; her twin screws will be driven by triple-expansion engines; steam will be supplied by eighteen Belleville boilers, which will work at a pressure of 300 pounds, which will be reduced at the engines to 250. It is expected that the yacht will be driven at a speed of 20 knots an hour with the engines making 140 revolutions a minute. It is expected that the new vessel will cost in round numbers about $1,500,000.

The Current Supplement.

This week's number of the SUPPLEMENT, No. 1203, contains a large portrait of the much-talked-of Dowager Empress of China. Prof. Lewes has a popular and valuable article on Acetylene, giving all the information that has been obtained up to date regarding this peculiar gas. There are several illustrations of interesting electric motors, and an illustration of a compound French locomotive of high speed. An account of the construction of the Gatling cast steel gun and an explanation of the test recently given, by Mr. Gatling himself, is of interest. There is a striking illustration of the new artists' Vienna Exhibition building. An illustrated article on Archæological Museums explains the best mode of lighting exhibits. There is an extensive report of the recent meeting of the Geological Society of America, as well as the report of an interesting lecture on the "Diseases of Nations," which describes rather fully the causes at work tending to their ultimate downfall. The "Evolution of the Song Bird" is treated at length, and interesting illustrated articles on the "Utilization of Unio Shells for Buttons" and on "The Principles and Practice of Bulb Growing" are of present practical value. There are also the usual notes on electrical, railway and engineering matters and useful formulæ.

Contents.

(Illustrated articles are marked with an asterisk.)