note that the tire is mounted on what appears to be the usual steel clincher rim. As far as the bottom and inside edge of the rim is concerned, this is correct, though the flat face of the rim has a small groove in it near its outside edge. The outside clincher ring is entirely separate from the rim, and it too contains a groove on its outer edge that matches the groove in the rim, being nearly opposite it when the tire and clincher ring are in place. As soon as this is accomplished, all that is necessary to secure the tire is to crowd it against the inner clincher ring sufficiently to allow of inserting the light locking ring in the rim (see Fig. 2). This ring is of the special cross-section shown in Fig. 1, and when the tire is inflated, it takes all the side pressure exerted by the inner tube and casing upon the outer clincher ring. If the tire is deflated, the weight upon it will, it is claimed, still keep the ring in place. The outer surface of the locking ring is flush with that of the clincher ring, there being no projections to come in contact with the curb, nor any crevices or openings through which dirt or water can penetrate. Rims of this type can be fitted to any wood wheel and can also be adapted to any style of clincher tire. Besides being extremely simple in construction, this form of attachment offers the great additional advantage that no tools whatever are required to remove an inner tube. This of course can be done in a minimum of time and with practically no exertion, by pressing in on the deflated tire and removing the split locking ring (Fig. 2), whereupon the clincher ring will come off and the tube can be removed (Fig. 4) or the complete tire be taken off (Fig. 3) if necessary.

The new rim has been tested by the inventor on a heavy touring car throughout the past year, and has been found to work satisfactorily. That it will be a boon to automobilists, to whom the repair of tires by the roadside is one of the greatest drawbacks of the new locomotion, is obvious to all.

THE PROGRESS OF AVIATION SINCE 1891.

(Continued from page 260.)

Hundreds of "gliding experiments" were made without accident in 1896-7, the longest flight being 109 meters with a descent of 10 deg. The equilibrium was so nearly automatic that the aviator never had to move more than 60 millimeters.

In 1900, on the dunes of Kittyhawk, N. C., the brothers Orville and Wilbur Wright began their experiments with a Chanute or two-surface aeroplane, but replaced the long and awkward tail by a horizontal rudder at the bow,* and lay on their faces to lessen air resistance. Two assistants ran with the apparatus against the wind unless the latter exceeded 8 meters per second, when a standing start could be made. The machine rose, recoiled a little, then, answering the helm, set itself parallel to the slope and glided forward. On reaching the bottom of the dune it rose slightly in obedience to the rudder and, its speed being thus checked, alighted like a bird. In 1901-2 the Wrights made hundreds of flights, some of 300 meters. In 1902 they added a vertical rudder at the stern and flew in curves. Finally, in 1903 they succeeded in hovering over one spot by rising with a brisk and variable wind, gliding forward when it lulled and drifting backward and upward with each gust. They hovered for 72 seconds without advancing more than 30 meters.

This result rehabilitates the scattered minority that for forty years has contended that certain birds remain aloft without exertion. It is now certain that this occurs with ascending air currents. Such currents are common in the mountains, and so are soaring birds, but neither is found on the plains. There is a certain analogy between a sailing vessel and an aeroplane. The former tends to approach a definite vertical, the latter a horizontal plane. These skillful experimenters sailed within 6 deg. of the horizontal—doing almost as well as vultures—and they hold in their hands prompt and complete realization of flight.

In December, 1903, they began to experiment with a machine of 50 square meters surface and 12 meters breadth, weighing 338 kilogrammes and having astern two screws driven by a 16-horse-power motor. Starting on level ground from an inclined monorail they made four flights, the longest of 59 seconds at a speed of 16 kilometers per hour relatively to the ground. December 17, 1903, marks the date of the first real flight of a manned flying machine and the honor of this memorable achievement belongs to the Wrights.

The French newspapers having spoken of Lilienthal's apparatus as a "parachute," it was not until 1898 that I learned its real nature from an old copy of the Illustrirte Zeitung. Convinced that Lilienthal had discovered, if not the art of perfect flight, at least the way to learn to fly, I determined to follow his method. My first model, whose length exceeded its breadth,† was dashed to pieces at the first trial. The second, flown as a kite, proved unstable. No. 3, with 15 square meters surface, 7 meters wide, and weighing 30 kilogrammes, proved unable to sustain my weight. No. 4, of the same weight and area, but 8 meters wide, was launched in 1901 from a scaffold 5 meters high. It landed gently after a flight of 15 meters, which occupied two seconds. Similar results were obtained from further experiments, but the stabilty was still unsatisfactory.

Then I entered into communication with Mr. Chanute and finally adopted his two surfaces, chiefly because they double the sail area for a given weight and allow the frame to be stiffened like a truss bridge.

My aeroplane No. 5 was of the Chanute-Wright type (weight 50 kilogrammes, width 9.5 meters, length 1.8 meters, sail area 33 square meters). Its first flight, in 1902, was 25 meters, its second 50 meters. Its chief defects, marked lateral deviation and sudden landing due to insufficiency of the rudder, were avoided in 1903 in a slightly smaller machine with two lateral horizontal rudders acting as a keel. This machine, when flown as a kite, exerted a horizontal pull of 20 kilogrammes, whence it was inferred that a screw traction of this amount would keep it afloat.

Then I bought the lightest motor then obtainable, a 6-horse-power Buchet, weighing 39 kilogrammes alone and 90 kilogrammes with its accessories and the twin screws—the last made necessary by the dangerous torque introduced by a single screw. To favor equilibrium by increasing moment of inertia I put all the machinery at the bow and balanced it by the weight of the aviator at the stern. At the rate of 1 horsepower for 50 kilogrammes,* which has been found sufficient for the Chanute type, my motor should drive an aeroplane weighing 300 kilogrammes which, again, should have a sail area of 50 square meters to agree with the ratio of surface to weight observed in large birds. This area was divided into two surfaces 10 meters broad, 2.5 meters long, and 2.5 meters apart. The total weight of the aeroplane (No. 6), allowing 75 kilogrammes for the aviator, was 230 kilogrammes.

Though this marks a record of lightness it is still too great for the methods of starting previously employed. Every aviator has been confronted by this problem of starting. Lilienthal used an artificial hill 15 meters high, Pilcher a kite cord, Langley a catapult, Eiffel proposes to stretch an inclined wire from the first story of his tower, Goupil suggests a circular railway, Bazin has patented an aerial merry-go-round. Though the last introduces centrifugal force, it permits the safe study of continued flight.

So I constructed a 30-meter cantilever pivoted on a pillar 18 meters high and hung the aeroplane over it by a cable having a counterpoise at the other end. I found the maximum traction of the screws, 20 kilogrammes, insufficient for flotation, but military duties postponed the construction of new screws until 1904.

Prof. Langley is not of the school of Lilienthal. After some remarkable experiments on air resistance he proceeded at once, like Maxim and Ader, to construct a complete aeroplane. In 1896 he made the record for unpiloted models with a flight of three quarters of a mile (1,200 meters).†

In 1903 he built a machine large enough to sustain a man's weight which, with Prof. Manley aboard, was projected by springs from a barge and fell into the Potomac after a flight of 30 meters. According to the Scientific American this failure was caused by starting at a wrong angle owing to a defect in the catapult. But why did not the machine right itself? Either because the rudders were insufficient or because Prof. Manley, untrained by previous experience, did not operate them promptly. Here again we see the genius of Lilienthal in mastering equilibrium before attempting propulsion. But the failure is only temporary. Prof. Langley, aided by the government, will correct defects. Prof. Manley will acquire dexterity, and the aeroplane will fly.

In conclusion, I will mention the machine recently constructed at Chalais-Meudon for M. Archdeacon. It is of the Wright type with planes 7.5 meters broad, 1.44 meters long, and 1.4 meters apart, a total surface of 22 square meters, and a weight of 34 kilogrammes. It has a horizontal rudder in front and a vertical one behind. Experiments made with it on the aerodrome by M. Voisin and myself are herewith illustrated.—Abstract of a paper by Capt. F. Ferber in the Revue d'Artillerie.

* Birds use their heads as rudders for small and sudden changes, their tails for large ones only.

† Experience proves that a rectangle moving parallel to its shorter side has more sustaining power than a square of the same area, probably because it meets a greater number of fluid filaments. The rear element of the surface seems to have little effect except to increase friction.

* Wright has increased this to 75 kilogrammes. This is a good sign.

† In the same year MM. Latin and Richet launched, near London, a very remarkable model driven by steam which made a flight of 200 meters.

Several minerals contain thoria. The mineral supposed to be uraninite or pitch-blende proves on complete analysis to be a new mineral, which it is proposed to name thorianite. This mineral is one of the richest known in the rare earth thoria, of which it contains more than 75 per cent, uncombined with silica, and is of very considerable value and commercial importance.

Correspondence.

Some Weather Observations.

To the Editor of the Scientific American:

The article "Grandfather's Barometer," in issue of March 4 contains much truth.

These signs and omens originated when the people lived in the country; their observations covered great distances and it was almost obligatory on them to watch the weather. Those who live in the city are unable to note these signs and are therefore inclined to ridicule them.

Having left the city for the country many years ago, I have observed closely the weather and have noted the following. No. 1 I have found almost always correct, and were one situated so as to be hourly cognizant of the temperature and the force and direction of the wind over a large territory, as is the Washington weather bureau, I believe it would prove invariably so. It applies in this locality from about October 1 to May 1.

1. Double the hours or days from the clearing of a storm to the next calm period; the result will enable one to foretell very closely the coming of the next storm. The sooner the calm, the sooner the storm.

2. When the sun sets between dark banks of clouds with a yellowish red cast, and appearing (to me) like an evil eye, there will be a heavy southeast storm the following day.

3. The same general appearance when the sun rises, but with a reddish yellow cast, is shortly followed by a heavy easterly storm.

4. Long and narrow clouds in the west late in the day, having the appearance of condensed fog and below dark banks of clouds, is an almost sure sign of storm the following day.

5. When the electric lights of the city, viewed from an elevation in the suburbs, scintillate with a peculiar diamond-like brilliancy, a storm shortly follows.

There are other indefinable signs, whereby, like a sixth sense, one can foretell the approach of a storm or the clearing away of a present storm.

I trust these observations will be of value. L.

Worcester, Mass., March 8, 1905.

Astronomical Anomalies.

To the Editor of the Scientific American:

In the English Mechanic of Nov. 4, 1904, under the heading "Astronomical Anomalies," Mr. Fred G. Taylor (letter 345, page 299) presents four queries, with the request that he be helped in his "difficulties"; and as I now have in preparation a book to be entitled "Facts and Fallacies of Astronomy," containing numerous questions for astronomers to answer, and illustrating the errors to be found in various textbooks on the subject, I was much interested in his communication, having given considerable attention to the "contradictions" mentioned by him. Well may we exclaim with the late and lamented Prof. Proctor: "It may well be questioned how far it is just that those who have still so much to learn should undertake to write textbooks of science."

The exact time of the earth's rotation as given in Lockyer's "Elements of Astronomy," to which the above-named writer refers, is of course wrong, and should be 23 hours, 56 minutes, 4.09 seconds. But Lockyer's book, a copy of which I have had in my library for many years, contains other errors equally glaring and surprising, coming as they do from one who is supposed to be an authority on the subject, and in my forthcoming volume I refer to many of his statements which I have corrected and explained. All the queries included by the writer mentioned are important and deserving of attention, but I was particularly interested in query No. 4, in which he says: "Sir Robert Ball, in 'Starland' and elsewhere, says that by looking up a vertical shaft—that of a coal pit for example—the stars may be seen during the day. Maunder, in 'Astronomy Without a Telescope,' chapter 8, treats the statement as an unproved tradition. Again, which is correct? The above are samples of the contradictions frequently met with. If astronomy be an exact science, why in the books mentioned do we find such contradictory statements?"

The belief seems to be widespread, and generally accepted by the public, that the stars may be seen in the daytime from a deep well, shaft, or pit, and it is mentioned as a fact by many popular writers, while others equally well known and eminent treat the belief as a fallacy. In many textbooks and other writings on astronomy the statement is made that stars are visible even at midday from such localities, some going so far as to claim that they may be seen in the tube of any large telescope from which the lenses or mirrors have been removed. As I have never had an opportunity to view the heavens under the conditions mentioned, I am not able to verify the statements from personal observation, and cannot, so far as my own knowledge is concerned, say whether they are true or false. But it would seem that a belief so widely prevalent, even among scientific persons, must have some foundation, and it would be interesting to know if it has really ever been demonstrated as a fact by observation. I should be glad to hear from other writers in regard to this disputed question, and to know if any have ever "tried the experiment," and been able to corroborate the statements or establish the observations so long accepted as truthful by students of astronomy.

Washington Irving, in his charming story of "The Alhambra," has given currency to this belief, and contributed to the popular error, if such it be, for he thus mentions an observation of the kind: "He caused the cave to be enlarged so as to form a spacious and lofty hall, with a circular hole at the top, through which, as through a well, he could see the heavens and behold the stars even at midday." If this belief is indeed a fallacy, it is surprising that it should have been allowed to remain so long uncorrected and accepted as a scientific fact; and for the benefit of students and the general public, the truth should be known and published in every textbook on astronomy. Any prominent celestial object, such as the moon, a large comet, or the planet Venus when most brilliant about five weeks before or after inferior conjunction, would in all probability be visible from a deep well or shaft, if favorably located directly over the opening, even in bright sunshine, as they are plainly seen by the naked eye in the daytime when not too near the sun. But in my opinion no star, except perhaps Sirius, would be visible in daylight from such a locality, for the very evident reason that the darkness is merely local and does not extend far enough into the sky for any stars to be seen, especially with the naked eye.

Notwithstanding the superficial darkness of the well or other inclosure, the great atmosphere, extending to an unknown height above the earth's surface, would still be brilliantly illuminated, and the diffused light of the sun would, it seems to me, be sufficient to prevent any ordinary star being seen in the daytime even from the darkest and deepest shaft. We should be confronted with a luminous atmospheric envelope compared with which any well or shaft, of whatever size and depth, would be insignificant; and it seems reasonable to conclude that the darkness would not be intense enough, with the glaring sunshine overhead, to render the stars visible under the circumstances we have mentioned.

As an offset and in direct opposition to the statements commonly accepted, we have the positive testimony of Prof. William H. Pickering, the eminent American astronomer, who from actual observation has been able to effectually dispose of the question and refute the popular belief together with another equally prevalent and absurd. The Century Magazine for March, 1903, contains an illustrated article by this well-known writer and observer entitled "An Outlook Into Space," being an account of a far search by American astronomers for an observatory site, in which he says: "This expedition to Pike's Peak helped to destroy one old popular superstition. It had frequently been stated that from the bottom of a deep well or from the top of a high mountain the sky would appear dark even at noon, so that some of the brighter stars could be seen. Observations from the bottom of deep mining-shafts had disproved the first statement, and our expedition disproved the second. From the top of El Misti, in Peru, at an altitude of over 19,000 feet, the sky is somewhat darker, perhaps, than at sea-level—what might be described as a deeper color—but it is not enough so to warrant the old-time belief."

This important testimony, emanating from such a trustworthy and authoritative source, supports my own views expressed above, and appears to establish beyond a doubt the fallacy of the belief which, however, does not reflect in any way unfavorably upon astronomy as an "exact science," as the writer in the English Mechanic seems to imagine. I am glad that he has called attention to the question, and trust that his letter and my own will arouse an interest in and a further discussion of the subject, which has been so long neglected and misunderstood.

Battle Creek, Mich. ARTHUR K. BARTLETT.

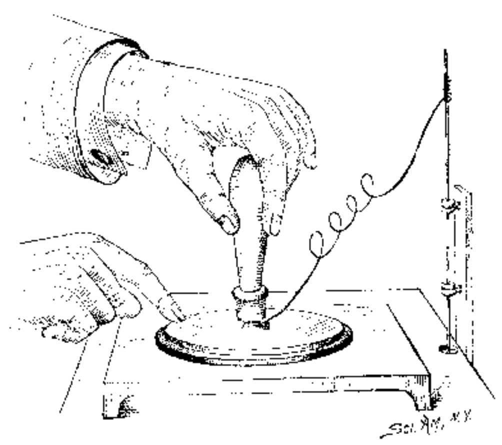
[We have no personal experience on the subject, have not been able to locate any authority who makes this statement, except Ball; and Ball carries a very high reputation for veracity in astronomical circles, which would give his statement some weight at least. There is no question that it is at least very probable that stars should be visible under the conditions mentioned. The reason why we do not see them ordinarily is that the glare of the light diffused by the atmosphere blinds the eyes; even then, Venus can sometimes be seen in daytime. At the bottom of a well, in the dark, the eyes have a greater light-collecting power, owing to the expansion of the pupil, which might make the matter possible, and besides a good deal of the glare that strikes the retina from the sides is cut out. That even a small telescope will show up the brighter stars at any time cannot be questioned. Observations on Sirius are frequently taken in bright sunshine; and records of many such observations can be found in the publications of various observatories. If we are not very much mistaken, the Greenwich annuals contain some, among others.—ED.]

A HOME-MADE WIRELESS SIGNALING TRANSMITTER.

BY A. FREDERICK COLLINS.

In a recent issue of the SCIENTIFIC AMERICAN an account was given of two home-made wireless telegraph receivers; in connection with these it may prove interesting to your readers who are desirous of making their own experimental apparatus, to describe an exceedingly simple form of wireless transmitter.

In sending wireless signals the essential factor is a disruptive discharge or spark, and this should take place between the ends of two wires, one of which



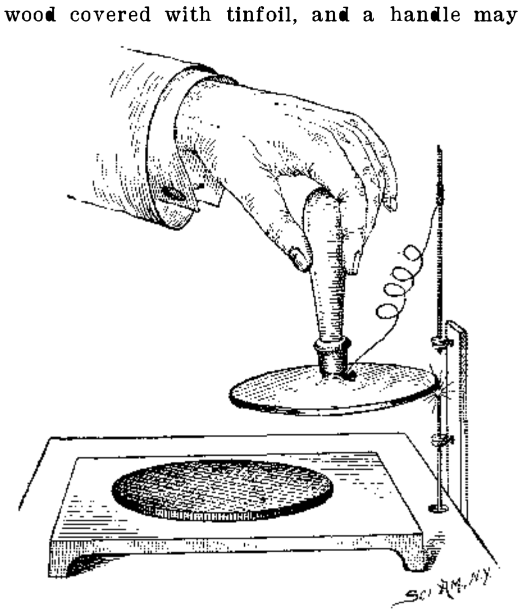
CHARGING THE LID OF THE ELECTROPHORUS.

projects vertically upward in the air, and the other is connected with the earth; or if the signals are to be sent over a short distance, say 15 or 20 feet in a room, the latter wire may be connected to a bit of tin or copper plate and merely allowed to rest on the floor.

The simplest way to obtain an electric spark is by means of an apparatus called an electrophorus, an instrument for generating static electricity by induction. This little device is usually made of a flat disk of resin on which rests a metal disk having an insulating handle of glass or vulcanite.

Our illustrations show clearly the tin or brass plate and resinous disks; and although the former is placed on the latter, their surfaces touch each other in only a few places, since the air forms a thin insulating film which practically separates them.

To construct an electrophorus, it is only necessary to fill a shallow tin pan—a pie-tin answers admirably—with a mixture of resin, Venice turpentine, and shellac in equal parts. When these substances are heated to the melting point, they should be thoroughly mixed by stirring, which should be carefully done so as to prevent the formation of air bubbles. If the turpentine is not readily obtainable, it may be dispensed with. Care must be taken in either case that the mixture does not take fire. When the mass has cooled, it will become hard and brittle and it will then be ready for use. This constitutes the sole of the device. A lid may be made by obtaining from the tinners a disk of tin cut half an inch smaller all around than the resin sole. A stick of sealing wax forms a good handle. The lid may be made of a disk of wood covered with tinfoil, and a handle may be



PRODUCING THE SPARK IN THE ANTENNA.

made by attaching to the center of the wood a heavy piece of wire covered with rubber tubing. Either of the former makes a satisfactory lid.

Used as a wireless telegraph transmitter, the aerial or suspended wire should be attached to the metal plate of the lid in such a manner that when the plate is charged, the wire will not touch the sole. The wire leading to the earth or metal plate on the floor should have its upper end attached to a table, wall, or any convenient place, so that the charged lid carrying the aerial wire may be held closely to it, when a spark will pass between the edge of the tin disk and the end of the lower wire, as shown in one of our views. There will then be set up in it and the aerial wire a series of strong electric oscillations, the energy of which will be damped out in the form of electric waves.

In order to charge the metal plate, the resin disk must first be excited by whisking or rubbing it with a piece of hot flannel or a silk pad. After the resin is well rubbed, the tin lid is placed upon it for a few seconds, and the finger occasionally touching it as shown.

Now, on lifting the lid, if the knuckle or wire leading to the earth or floor is presented to it, a spark will pass, showing that the plate was charged. If a receiver, such as either of those referred to, is set up at a little distance, even though the walls of a room or two intervene between it and the electrophorus transmitter, the instant the spark passes a characteristic click is heard in the telephone receiver.

In order to repeat the process, the lid will need to be recharged, and this will require merely the placing of it on the resin sole and removing it again, although the plate will have to be freshly excited occasionally if energetic sparks are to be produced. It will be readily seen that the electrophorus is in fee simple a miniature electric machine.

The theory of the apparatus is very simple. The resin when rubbed briskly is negatively electrified and the neutral electricity is divided into positive and negative charges. When the lid is resting on the resin the former is acted on inductively and not by direct contact, since the resin is a non-conductor, and touches the lid at only a few parts. When the lid is touched with the finger, the free negative electricity is dispersed through the body of the operator when, simultaneously, the positive charge of the sole is communicated to the lid, which with its attendant aerial wire will be positively electrified. The wire leading to the earth will be charged to the opposite sign, and the mutual attraction between the two results in a spark. By grounding the terminals of the sending and receiving instruments, a distance of several hundred feet should be easily obtainable.

The Camphor Industry of Japan.

One of the most interesting exhibits made by Japan at the late St. Louis Exposition, illustrating camphor and its by-products, was shown in the Forestry Building. This large collection formed a part of the Formosan government exhibit and represented a great national industry known as the camphor monopoly. By a provision of the law of 1903 the sale of camphor produced in Japan is monopolized by the government through a restriction of the sale of crude camphor and camphor oil.

Every part of a camphor tree, even to the leaves, contains camphor. The forests are not confined to Formosa alone, but are also found in Japan proper. With the extension of the industry the large areas of this tree have been greatly reduced, though replanting and cultivation are practised to a considerable extent, a tree requiring fifty years to attain a diameter of one foot. In Formosa, however, there is still an extensive supply of native forest growth, and many huge trees are to be found in regions still unexplored. The supply, therefore, is assured for years to come.

Camphor is found in the form of crystals in the wood tissues, and is separated from the crude oil by double distillation. From the first distillation is secured an oxidized product, camphogenotol, the principle of the camphor oils of commerce. The crude camphor is a dark-colored substance fusing at 170 deg. C.

Among the by-products may be mentioned crude camphor oil, which comes out simultaneously with the camphor; white oil, obtained by sublimating the crude oil, and used in the manufacture of soap. Red oil is also obtained from the crude camphor oil, as well as black oil, which is extensively used in the preparation of varnishes. A turpentine is secured from the white oil that is in great demand for medical and industrial purposes. From red oil is obtained the product known as saffrol, employed to a considerable extent in the manufacture of perfumery, and also soap; and a disinfectant is also distilled from red oil, after the addition of other substances, claimed to kill the cholera bacillus. Another product is an insecticide, which when mingled with 100 parts of water, destroys insects injurious to farm crops.

The camphor products are: Refined granular camphor obtained by sublimation from crude camphor, price in Tokyo, yen 0.85, about 40 cents per pound; refined camphor, sublimed and compressed, worth one yen per pound; and refined camphor tablets, of Fujisawa camphor, obtained from crude camphor, worth yen 1.70 per pound.

The annual export of camphor from Japan is about 6,000,000 pounds, three-fourths of which is produced in Formosa, the other fourth coming from Japan proper, chiefly from Kyushu and Shikoku. The superior jury at the St. Louis Exposition awarded the Japanese camphor exhibit a grand gold medal.