ordinary gas pipe, about three quarters of an inch in diameter, and is rigidly attached to the cylindrical cistern or cup. The upper end of this tube fits into a piece of bronze, into which a glass tube, three quarters of an inch in diameter and about four feet high, is securely cemented. This tube terminates in a cup inclosing a rubber packing. Graduated scales provided with indicators are placed at each side of the glass tube, the one on the left side indicating the inches and tenths of inches, and the right-hand scale shows the equivalent measure of a corresponding column of mercury. The scales are attached to an oaken plank, which is fastened to the wall of one of the upper stories of the observatory, and the large tube passes down to a room situated twenty-six feet nine inches lower. The glycerine in the barometer is colored with aniline red. Before putting the glycerine in the tube it is boiled at a temperature of about 180° to expel the air and to make it purer. The air is exhausted from the barometric tube by means of an air pump. Regular observations are made with the instrument at the Kew Observatory under the surveillance of Mr. Whipple, who considers the apparatus to be a scientific instrument of the greatest precision.

TAGUAN FLYING SQUIRREL.

The beautiful and active group of animals of which the English squirrel is so familiar an example, are found in almost every portion of the globe, and, with one or two exceptions, live almost exclusively among the branches of trees. In order to enable them to maintain a firm clasp upon the branches and bark, they are furnished with long, finger-like toes upon the fore-feet, which are armed with sharp curved claws.

In the flying squirrels, of which the taguan is a good example, the skin of the flanks is modified in a method similar to that which has already been noticed in the petaurists of Australia and the colugo of Java.

This skin is so largely developed, that when the animal is sitting at its ease, its paws but just appear from under the soft folds of the delicate and fur-clad membrane.

When the creature intends to make one of its marvelous leaps, it stretches all its four limbs to their fullest extent, and is upborne through the air on the parachute-like expansion which extends along its sides. This animal is a native of India, where it is tolerably common.

It is rather a large species, as its total length is nearly three feet, the tail occupying about one foot eight inches, measured to the extremity of the long hairs with which it is so thickly clothed. The general color of this animal is a clear chestnut, deepening into brown on the back, and becoming more ruddy on the sides. The little pointed ears are covered with short and soft fur of a delicate brown, and the tail is heavily clad with bushy hairs, grayish black on the basal portions of that member, and sooty-black toward the extremity. The parachute membrane is delicately thin, scarcely thicker than ordinary writing paper, when it is stretched to its utmost, and is covered with hair on both its surfaces, the fur of the upper side being chestnut, and that of the lower surface nearly white. A stripe of grayish-black hairs marks the edge of the membrane, and the entire abdomen of the animal, together with the throat and the breast, is covered with beautiful silvery grayish-white fur.

TAGUAN FLYING SQUIRREL.—*Pteromys Petaurista.*

Sharks in New York Bay.

A remarkable school of sharks was recently met with between the Narrows and Bay Ridge shore, in the lower part of New York Harbor. According to the story of Captain Alec Robertson, a well known fisherman of Fort Hamilton, there were thousands of them. His attention was first attracted to a dark spot in the water, moving toward the Long Island shore, and expanding rapidly. On sailing for the spot he suddenly discovered that it was a school of sharks, which snapped angrily at the boat's sides, and lashed the water into a foam. One fish, larger than the rest, leaped toward the stern and crushed the back strip and rudder between its jaws. It appeared to be fully ten feet in length. The water seemed alive with black fins, which darted in all directions. George Morris and John Haffey, the companions of Robertson, rushed to the forward part of the boat. Morris had been sitting on the stern seat, and narrowly escaped the bite of the infuriated fish. Robertson tore up one of the seats, with which the little craft was fitted, and used it effectively on the hard black snouts of more than one of the sharks. The breeze filled the sails and carried the boat steadily through the danger. Not until Bay Cliff was reached did the boat get clear of its pursuers.

Palm Fossils in Colorado.

Mr. E. Johnson, the expressman, brought into the *Gazette* office recently some very interesting fossils, which he had just discovered. In speaking of his discovery he said: "A year ago my son reported that he had found upon the bluffs northeast of the town a petrified fish tail, but embedded in too large a rock for him to carry. He has often urged me to go with him and get it. I finally went, and to my astonishment found that he had discovered a very fine impression of a palm leaf, and I soon found three other perfectly printed leaves of the same variety. The leaves were of enormous size, the ribs diverging from the base just like palm fans, but upon a very much larger scale. The estimated size of one leaf, calculated from reliable data furnished by the ratio of divergence, is found to be eight feet long by six feet wide." Mr. Johnson also found several sections of palm tree trunks, one of which he brought to the *Gazette* office, together with the impressions of the leaves.—*Colorado Springs Gazette.*

A North Carolina Industry.

During recent years the collection of medicinal and other plants has become a large and profitable industry in North Carolina. The trade centers at Statesville, where an enterprising firm have established one of the largest botanical depots in the world. Their stock comprises 1,700 varieties of roots, herbs, barks, seeds, flowers, and mosses, and all sorts of plants for herbariums, some of them peculiar to the flora of the State, and others found more abundantly there than elsewhere. The quantities now on hand vary from 50 to 35,000 pounds of each kind. They pay the collectors either in cash or goods, and last year they disposed in this way of $400,000 worth of merchandise. Their warehouses have 270,000 square feet of flooring, which will give an idea of their capacity for storage of the products they are collecting from all quarters. Their shipment last year, as given in the Raleigh *News*, amounted to 1,800,000 pounds. The collectors are largely Cherokees.

New Polarizing Prism.

M. Crova commends, for photometric purposes, in the *Journal de Physique*, M. Prazmowski's polarizer, which is a Nicol, with faces normal to the axis of a prism, the two halves of which are joined with linseed oil. It requires large pieces of spar, and the joining is long and difficult, but there are several advantages. Thus the layer of oil (unlike Canada balsam) causes hardly any loss of light; its index, 1·485, being nearly equal to the extraordinary index of spar, the polarized field is limited on one side, as in Nicol's, where the total reflection of the ordinary ray commences, by a red band; but the second limit, corresponding to total reflection of the extraordinary ray, is thrown out of the field of vision; the angular value of the polarized field is thus increased. The increase of field, the angular separation of the only colored band, and the direction of its bases, normal to the axis, are qualities to be appreciated in certain cases.

Spread of Disease by Earthworms.

Recent researches by M. Pasteur appear to throw considerable light on the origin of anthrax, or splenic fever, and allied diseases, which attack cattle, sheep, etc. When an animal dies of anthrax it is not uncommonly buried on the spot. The conditions of putrefaction prove fatal to the small parasitic organism, or *bacteridium*, which is abundant in the blood at death. The gas given off causes it to break up into dead and harmless granulations. But before this can occur not a little of the blood and humors of the body have escaped into the ground about the carcass, and here the parasite is in an aerated medium favorable to the formation of germs. These corpuscular germs M. Pasteur has found in the soil, in a state of latent life, months and years after the carcass was buried; and by inoculation of guinea pigs with them, has produced anthrax and death. Now, it is specially notable that such germs have been met with in the earth at the surface above the place of burial, as well as near the body. The question arises: How came they there? And it would appear that earthworms are the agents of conveyance. In the small earth cylinders, of fine particles, which these creatures bring to the surface and deposit after the dews of morning or after rain, one finds, besides a host of other germs, the germs of anthrax. (The same process was proved also by direct experiment; worms kept in ground with which *bacteridium* spores had been mixed were killed after a few days, and many of the spores were found in the earth cylinders in their intestines.) The dust of this earth, after the cylinders have been disaggregated by rain, gets blown about on the neighboring plants, and the animals eating these thus receive the germs into their system. It is suggested that possibly other disease germs, not less harmless to worms, but ready to cause disease in the proper animals, may be in like manner conveyed to the surface in cemeteries. This would furnish a fresh argument for cremation. The practical inference as to anthrax is, that animals which have died of this should not be buried in fields devoted to crops or pasturage, but (wherever possible) in sandy, calcareous ground, poor and dry—unsuitable, in a word, for worms.

To Moisten the Air in Cotton Mills.

A device for moistening the air in cotton mills is suggested by Mr. L. E. Bicknell, of West Cummington, Mass., in a communication dated July 1. It consists of a line of steam pipes running under the rows of looms, with perforations under each loom. The pipes should be laid in grooves in the floor to prevent tripping, and should be laid upon asbestos paper to prevent the overheating of the floor. Under each loom the steam pipe should carry a perforated slide or sleeve, with holes corresponding with those in the pipe, by means of which the jets of steam could be regulated. The rising steam would act directly upon the extended warp above, and afterward by diffusion would secure that humidity of atmosphere essential to the satisfactory working of cotton mills.

American Cements.

At the recent convention of the American Society of Civil Engineers, an interesting paper on American natural cements was read by Mr. F. O. Norton, from which we condense the following:

The principal deposit of the magnesian limestone producing a cement possessing hydraulic energy occurs in the town of Rosendale, Ulster Co., New York. It was first brought into use about the year 1823, in the construction of the locks and other masonry of the Delaware and Hudson Canal, which passes through that county. Its production has gradually increased until there are now made from one million to one million and a half barrels in each season, of about eight to nine months, or during the period of navigation on the Hudson River between Rondout and New York. It is the chief industry of a large section of country, its reputation is extended, and it is sold in most of the large markets of the United States.

There has been a general impression that the use of a very small amount of water in mixing cement gave greater resulting strength than when sufficient water was used to form a paste of the consistency of stiff mortar. The tests recorded prove that the dry mixture does give decidedly higher tensile strength in twenty-four hours after mixture, and that it continues to be stronger than the stiff mortar for some three months. But after that time the reverse becomes true; the curve of strength of the stiff mortar rises to and passes above that of the dry mixture, and the strength of the cement mixed as a stiff mortar continues greater than that mixed with very little water, and this is the case continuously thereafter.

The strength of Portland cement, unmixed with sand, is, of course, very great. It develops a large proportion of its ultimate strength in the first seven days, say from one-half to two-thirds.

Rosendale cement of the best qualities develops great hydraulic energy in twenty-four hours, being at that time equal to the Portland. The Portland then gains very rapidly upon it up to seven days, the difference between the two then being the greatest; at the end of a month, however, the strength of the Rosendale cement begins to approach nearer to that of the Portland, and the difference between the two seems to be continually reduced after that time, this referring to mixtures of pure cement.

For practical purposes, however, neither of the cements is generally used without an admixture of sand. The addition of sand to Portland cement reduces its strength rapidly.

This reduction of strength is, in round numbers, as follows: One part of sand gives mortar one-half as strong as pure cement; two parts, one-third; three parts, one-fourth; four parts, one-fifth; five parts, one-sixth.

This reduction of strength of Rosendale cement by the admixture of sand seems to be somewhat less. The strength of the mortar of Portland cement in the proportion of one of cement to two of sand is, at the end of six months, say 224 pounds to the square inch. The strength of a mortar of Rosendale cement in the proportion of one of cement to one of sand is, at the end of six months, say 257 pounds to the square inch.

Careful experiments made by General Gillmore, and published in the appendix to the last edition of his treatise on "Limes, Hydraulic Cements, and Mortars," give the quantities of mortar produced from the mixture of cement, sand, and water, in various proportions, and using different kinds of cement. Adopting these results, and assuming the cost of the Rosendale cement at $1.10 per barrel, and the best English Portland at $3 per barrel (the market prices, May, 1880), and the cost of sand at 5 cents per barrel, we find that a mortar of Portland cement, in the proportions of one of cement to two of sand, will cost per barrel $1.22.

We also find that a mortar of Rosendale cement, in the proportions of one of cement to one of sand, will cost 68 cents per barrel.

Summarizing the comparison, we find that a mortar of Rosendale cement, in the proportions of one of cement to one of sand, has a tensile strength of 257 pounds to the square inch, and costs 63 cents per barrel; and that a mortar of foreign Portland cement, in the proportion of one of cement to two of sand, has a tensile strength of 224 pounds to the square inch, and costs $1.22 per barrel.

Therefore, the mortar of Rosendale cement, one to one, is 34 pounds per square inch stronger, and 54 cents per barrel less expensive, than a mortar of foreign Portland cement one to two.

This seems to show that for all uses which will be served by a mortar of the tensile strength of 257 pounds per square inch, the Rosendale cement is economical.

The remaining question is, whether this mortar of Rosendale cement, one to one, is strong enough for the practical purposes to which it may generally be applied.

The facts which answer this question are that for fifty years past, and up to within a very short time, *all* the important masonry in this country has been laid with American cement. The great fortifications on the coast, the Croton aqueduct, the Boston aqueducts, both old and new, all the government dry docks, the lighthouses, the locks, culverts, and aqueducts on the Erie and other canals; all the masonry of railroad bridges, viaducts, and culverts, the sewers of our cities, the masonry of our gas works, many hundreds of miles of wrought iron water pipe lined and laid in cement; the mills and mill dams in various localities; in fact, nearly all the masonry built under water and out of water in the United States up to within a few years has been constructed with American cement.

Professor Kirchhoff's Views on Connecting Lightning Rods with Gas and Water Pipes.

The city gas company of Berlin, having expressed the fear that gas pipes may be injured by lightning passing down a rod that is connected with the pipes, Professor Kirchhoff has published the following reply:

"As the erection of lightning rods is older than the system of gas and water pipes as they now exist in nearly all large cities, we find scarcely anything in early literature in regard to connecting the earth end of lightning rods with these metallic pipes, and in modern times most manufacturers of lightning rods, when putting them up, pay no attention to pipes in or near the building that is to be protected."

Kirchhoff is of the opinion, supported by the views of a series of professional authorities, that the frequent recent cases of injury from lightning to buildings that had been protected for years by their rods, are due to a neglect of these large masses of metal.

The Nicolai Church, in Greifswald, has been frequently struck by lightning, but was protected from injury by its rods. In 1876, however, lightning struck the tower and set it on fire. A few weeks before the church had had gas pipes put in it. No one seems to have thought that the new masses of metal which had been brought into the church could have any effect on the course of the lightning, otherwise the lightning rods would have been connected with the gas pipes, or the earth connection been prolonged to proximity with the pipe.

A similar circumstance occurred in the Nicolai Church in Stralsund. The lightning destroyed the rod in many places, although it received several strokes in 1856, and conducted them safely to the earth. Here, too, the cause of injury was in the neglect of the gas pipes, which were first laid in the neighborhood of the church in 1859, shortly before the lightning struck it. The injury done to the schoolhouse in Elmshorn, in 1876, and on the St. Lawrence Church, at Itzehoe, in 1877, both buildings being provided with rods, could have been avoided if the rods had been connected with the adjacent gas pipes.

"If it were possible," says Kirchhoff, "to make the earth connection so large that the resistance which the electric current meets with when it leaves the metallic conducting surface of the rod to enter the moist earth, or earth water, would be zero, then it would be unnecessary to connect the rods with the gas and water pipes. We are not able, even at immense expense, to make the earth connections so large as to compete with the conducting power of metallic gas and water pipes, the total length of which is frequently many miles, and the surface in contact with the moist earth is thousands of square miles. Hence the electric current prefers for its discharge the extensive net of the system of pipes to that of the earth connection of the rods, and this alone is the cause of the lightning leaving its own conductor."

Regarding the fear that gas and water pipes could be injured, the author says:

"I know of no case where lightning has destroyed a gas or water pipe which was connected with the lightning rod, but I do know cases already in which the pipes were destroyed by lightning because they were *not* connected with it.

"In May, 1809, lightning struck the rod on Count Von Seefeld's castle, and sprang from it to a small water pipe, which was about eighty meters from the end of the rod, and burst it. Another case happened in Basel, July 9, 1849. In a violent shower one stroke of lightning followed the rod on a house down into the earth, then jumped from it to a city water pipe, a meter distant, made of cast iron. It destroyed several lengths of pipe, which were packed at the joints with pitch and hemp. A third case, which was related to me by Professor Helmholtz, occurred last year in Gratz. Then, too, the lightning left the rod and sprang over to the city gas pipes; even a gas explosion is said to have resulted.

"In all three cases the rods were not connected with the pipes. If they had been connected the mechanical effect of lightning on the metallic pipes would have been null in the first and third cases, and in the second the damage would have been slight. If the water pipes in Basel had been joined with lead instead of pitch, no mechanical effect could have been produced.

"The mechanical effect of an electrical discharge is greatest where the electric fluid springs from one body to another. The wider this jump the more powerful is the mechanical effect. The electrical discharge of a thunder cloud upon the point of a lightning rod may melt or bend it, while the rod itself remains uninjured. If the conductor, however, is insufficient to receive and carry off the charge of electricity, it will leap from the conductor to another body. Where the lightning leaves the conductor its mechanical effect is again exerted, so that the rod is torn, melted, or bent. So, too, is that spot of the body on which it leaps.

"In the examples above given it was a lead pipe in the first case, a gas pipe in the last case, to which the lightning leaped when it left the rod, and which were destroyed. Such injuries to water and gas pipes near lightning rods must certainly be quite frequent. It would be desirable to bring them to light, so as to obtain proof that it is more advantageous, both for the rods and the building which it protects, as well as for the gas and water pipes, to have both intimately connected.

"Finally, I would mention two cases of lightning striking rods closely united with the gas and water pipes. The first happened in Dusseldorf, July 23, 1878, on the new Art Academy; the other August 19, last year, at Steglitz. In both cases the lightning rod, the buildings, and the pipes were uninjured."—*Deutschen Bauzeitung.*

A Sea-going Steam Pilot Boat.

Unlike the Pilot Commissioners of New York and New Jersey, the Baltimore Pilots' Association have taken kindly to the use of steam pilot boats, and are having built for their use a first-rate sea-going steamer. The new vessel is intended to carry sea pilots, with fuel, stores, and accommodations for a month's cruise. The hull will be of iron, with close iron bulwarks at each end, and, with iron siding, forming a quarter deck for about 68 feet of the middle run of the boat. The quarter deck will stand 3¼ feet above the main deck, which will extend about 30 feet from the stem and 20 feet from the stern. Both the main and quarter decks will have iron deck beams, and will consist of heavy pine deck stuff. The pilot house and captain's room will be on the quarter deck, where the boarding yawls will be carried. The length will be 113 feet between main posts, and 122½ feet over all; extreme moulded beam, 23 feet; depth, 12¾ feet; from base line to the top of quarter deck, 18 feet. There will be one iron athwartship collision bulkhead $\frac{5}{16}$ inch iron, braced, and one forward of the boiler. Coal bunkers on either side of the boiler hold 40 tons each. Below the quarter deck will be the main cabin, with 20 sleeping berths, wash room, mess room, kitchen, pantry, chief-engineer's room, and store rooms. The forecastle will contain 10 bunks, store rooms, etc. The vessel will be heated throughout by steam. She will have two masts, schooner-rigged, two 17 foot yawls, two 1,000 gallon water tanks, three anchors of 800, 500, and 175 pounds weight, 120 fathoms chain cable, and a pump brake windlass.

The machinery will consist of an inverted direct-acting compound engine, with 22 and 36 inch cylinders, 26 inches stroke, fitted with tubular surface condenser, and air, feed, bilge, and circulating pumps, one cylindrical return tubular boiler, to carry a working pressure of 70 pounds of steam to the square inch, an independent feed pump to supply boilers, wash decks, fire service, etc.

This pioneer sea-going pilot steamer is now building at Wilmington, Del., by the Harlan and Hollingsworth Company.

CLOTHING IN ITS RELATION TO HEALTH.

The ideas and scientific views of Prof. Dr. Gustave Jaeger, of Stuttgart, regarding the properties of animal wool, gain more and more in popularity with German scientists, and in one of the latest numbers of the *Homœopatische Monatsblatter* (Homeopathic Monthly), which appears in Stuttgart, Dr. E. Schlegel, a well known physician of Tübingen, has published an essay, in which he speaks of Professor Jaeger's theories as follows:

Among the discoveries that have been made during the last few years in medical science, some facts brought to light by Dr. Gustave Jaeger regarding the amount of water contained in the human body may prove to be of the utmost importance. In his paper concerning "The resistibility of the human body against epidemic diseases and the power of constitution,"* Professor Jaeger has proved that the specific gravity of several individuals is very different, and that the state of the health of those individuals is closely connected with their specific gravity. The greater the weight of the human body in comparison to the space which it occupies, *i. e.*, the greater its specific gravity, the more it is able to resist epidemic diseases. Persons of a low specific gravity are taken ill from very insignificant causes, such as a cold, and are very susceptible to contagious diseases. Such persons have usually a certain fullness of body, and are even corpulent, but just that which gives them a great size is useless ballast, namely, fat and water. These substances endow the heaviest bodies with a comparatively low specific gravity, giving at the same time to the constitution little power of resistance.

Very different is the case with bodies of high specific gravity. Here neither fat nor water is superabundant, the flesh feels solid, and the bodily constitution possesses a high power of resistance. Professor Jaeger has investigated these differences of constitutional resistibility by comparing the specific gravity of a number of persons with their state of health. An accumulation of water in the tissues of the body he calls "Hydrostasis chronica," an expression which, as the whole discovery itself, reminds us of the teachings of the homeopathist Von Grauvogel respecting hydrogenoid constitutions, while the theory that a chronic accumulation of water in the body is the cause of many sicknesses is in perfect accord with the "Sykosis" described by Hahnemann, and afterward by Wolf.

The investigations and measurements of Jaeger are of an entirely new date, and we would not mention them here had not this discovery proved to be of the highest value for hygiene, and had not the conclusions of Professor Jaeger already been corroborated in a most remarkable manner.

If it is true, namely, that the specific gravity of the body is the measure of its resistibility of disease, and if it is also true that few bodies have this resistibility, because of an overabundance of fat and water, then the question arises, Have we any means of counterbalancing this superabundance and therewith heightening the specific gravity? The

* "Seuchenschutz und Constitutionskraft."