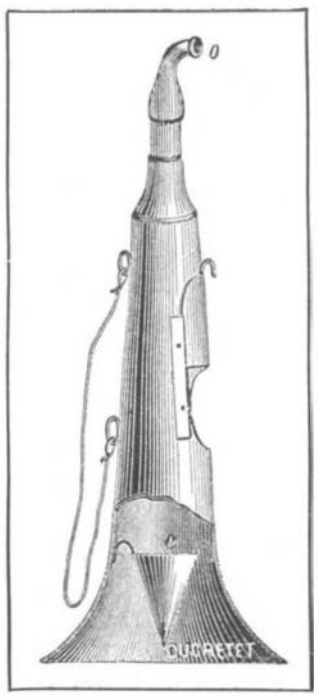
DETECTING UNDERGROUND STREAMS WITH AN EAR-TRUMPET.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

A new apparatus was presented to the Académie des Sciences during a recent meeting, by Messrs. Diénert, Guillerd, and Marrec, which is adapted to detect underground flowing water. The apparatus, which is shown in the accompanying views, is based on the principle of the "acoustele" or sound trumpet invented by Daguin, and it has now been modified and utilized in the researches for underground water which were made not long since by M. Diénert, engineer of the Paris water supply department. It consists of a large ear trumpet which is set mouth downward upon the ground and has in the interior at the lower part an inverted metal cone *C*. The cone is centrally placed so as to leave an annular space between the upper edge of the reversed cone and the sides of the trumpet. The instrument is surrounded by a box stuffed with sound insulating material to prevent the noise of the outer air blowing against the instrument from being heard. On the upper end of the trumpet there is a rubber tube *o* terminating in a pair of ear-pieces which the operator puts in his ears.



ACOUSTELE BROKEN AWAY TO SHOW THE CONE.

The tests referred to above were made in the suburbs of the city in the neighborhood of the aqueduct which brings the water of the Avre stream into Paris, between Vancresson and Garches, and the presence of the underground water could readily be detected by the noise which was heard in the acoustele. At a point near Vancresson there is an underground reservoir which lies at a depth of 230 feet below the surface of the ground. The reservoir is supplied with water from a spring which furnishes 30 gallons per minute. The water is brought into the reservoir by means of a pipe line which descends along the wall of the latter. The pipe line runs to a point below the water level of the reservoir 2 feet above the bottom. The total fall of the water is about 100 feet. Over this reservoir four different experiments were made, and the presence of the water was indicated by a rumbling noise heard in the instrument, and caused by the water flowing through the piping. The effect was observed even when the instrument was removed to a distance of 530 feet from a spot directly over the flowing water.

A second series of experiments showed the extreme sensitiveness of the instrument. In one case a water reservoir lies at a depth of 145 feet below ground, and it had a pipe line running into it as in the first case, with a total fall of 83 feet. The infiltrations of water from the earth into the reservoir could be perceived in this case, and it was observed that the water dropped from time to time into the basin. This effect was distinguished by the fact that the instrument gave a sound which resembled that of the strokes of a bell heard at a distance. A third test of the acoustele was made at a point near Garches, where the water reservoir lies but 10 feet below the surface. It was interesting to notice in this case that when one of the party descended the shaft leading from the surface of the ground into the reservoir by the aid of a ladder fixed to the side of the shaft, the noise of his feet could be heard in the instrument, and when he whistled, while at the bottom of the shaft, he could clearly be heard through the intervening ground by means of the acoustele.

In all these cases the noise made by the running water was somewhat like that which is produced by the wind in the leaves of trees. To show that the sound was actually caused by the water and not due to any effect coming from the outside, the instrument was taken a much greater distance from the spot, and the noise could no longer be perceived. In order to make use of the apparatus under the best conditions it must be properly placed in the ground, and should be set up in the spots which lie at the lowest level. A hole is dug in the ground about 18 inches square and from 10 to 12 inches in depth, and the surface is well flattened off so that the acoustele can be fitted tightly upon the ground, and it should be placed as flat as possible. The base of the instrument is then sealed with earth to a depth of four inches, but without packing it down. The two tubes are placed in the ears and the observer remains in this position for about five minutes. Should there be a flow of water within a reasonable distance, the observer should hear the sound as described above. The instrument will probably not detect the presence of water when removed to a distance of 800 feet to one side, as was found by the above experiments. When it is desired to explore a piece of ground in order to locate an underground spring for the purpose of boring a well, a series of holes of the kind we just mentioned should be dug at different parts of the ground, and the point which is best for carrying out the boring will be the spot which shows the loudest sound. Should outside noises interfere with such operations, the apparatus as well as the head can be covered by a blanket to deaden the noise. Persons should not walk near the apparatus at the time, nor should the observations be made when near a road except when vehicles are at a great distance. While the above-mentioned experiments were made upon a spot where the presence of the flowing water was known in advance, it will be remarked that the latter was at a considerable depth below the surface, and it is believed that the instrument will be of service in a great number of cases in finding underground water.

ACOUSTELE BOXED AND IN POSITION FOR LOCATING UNDERGROUND WATER FLOW.

PYTHONS AND THEIR PREY.

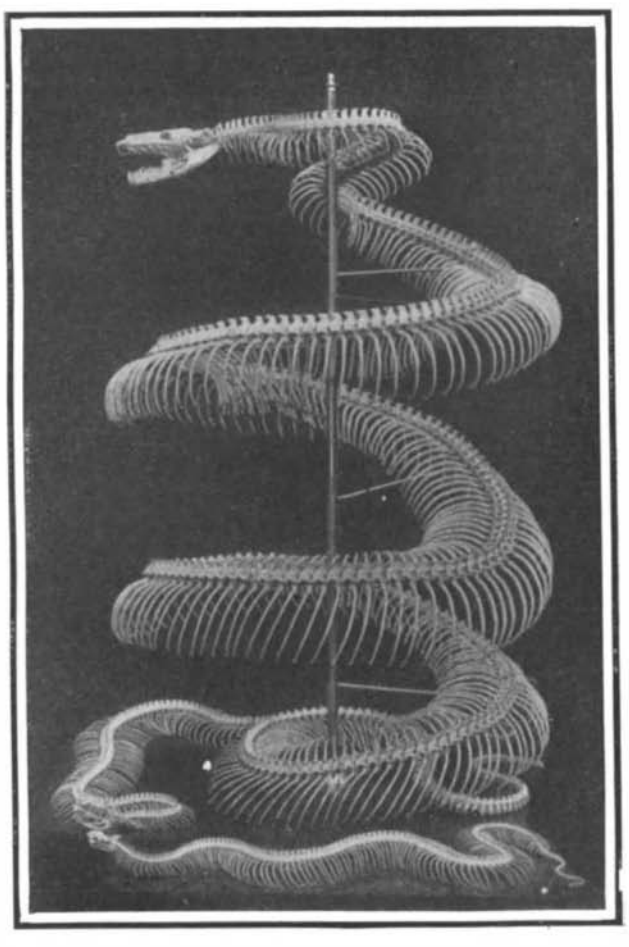
BY W. HENRY SHEAK.

The ability of snakes to perform feats of swallowing their prey is astounding. Recently a small boa, scarcely four feet in length, with a head no larger than a man's thumb, swallowed a full-grown pigeon. We put the pigeon in the cage at night, thinking that an Indian python seven or eight feet long would take it, but a great swelling in the body of the little boa showed what had become of the bird. As no snake chews or rends his prey, we knew that it passed his head and throat entire. The enlargement did not disappear for a week.

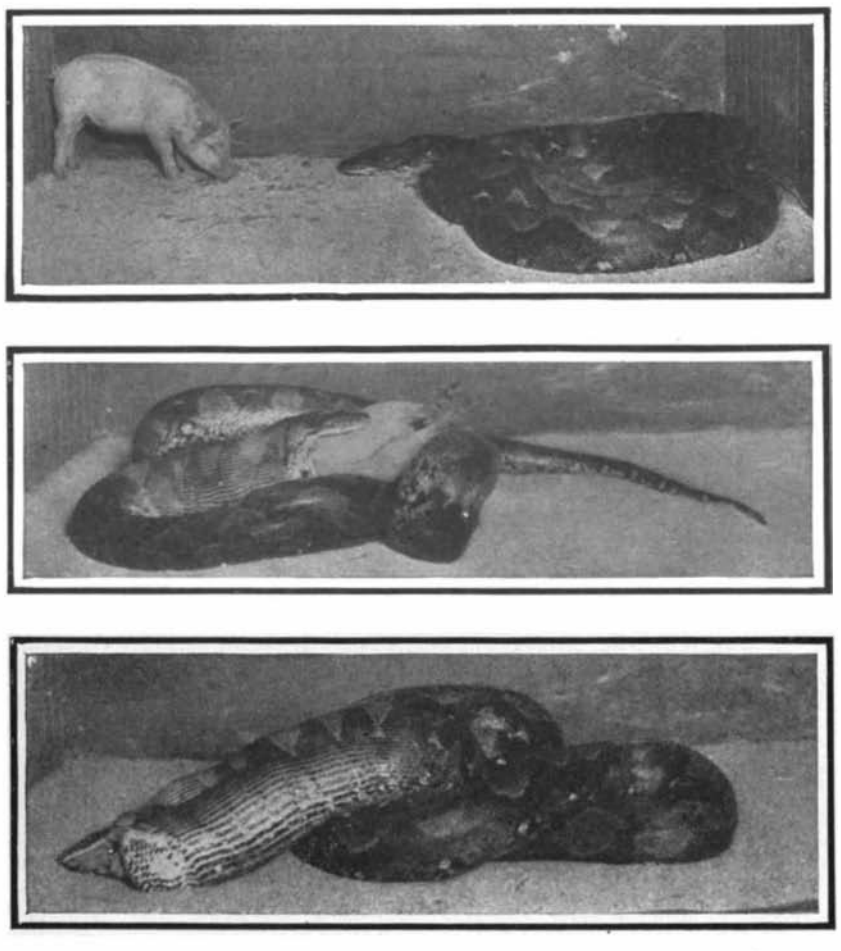
"Long Tom," a giant reticulated python, fed on a pig weighing forty-five pounds. We wanted to get some photographs of the monster reptile taking large prey, so the pig was put in the den alive; but as his prey had been killed for him in captivity, the snake got frightened when the pig began to move about and squeal, and backed away. When the pig was killed and he smelled the blood, he took the animal at once, and in twenty-five minutes it had disappeared. The pig is, however, an easy object to swallow, compared with a dense pelage of fur or feathers.

For two or three days the stomach was enlarged to almost the size of a beer keg, but on the third day the swelling began to diminish, and by the end of the fifth the body had returned to its normal diameter. Contrary to common belief, these big snakes will generally soon learn to take their prey after it has been killed. We usually feed them chickens or rabbits, killed, but while still warm. We have, however, fed them with cold-storage rabbits that were killed in Australia. Miss Grace Clark, the snake charmer, says that she once had a snake that would take a chicken after it was dressed and cut into pieces, receiving the pieces one at a time. A few months ago we wanted to feed a very large pigeon to a very small Indian python. In order to save him the trouble of working over the shoulders, we cut off the wings. After gorging the bird, we offered him the wings, which he took and swallowed.

The python which swallowed the pig was received from Carl Hagenbeck of Hamburg, Germany, in July, 1907. He has a photograph of it in the act of swallowing an Indian antelope weighing over ninety pounds. He had another reticulated python, which swallowed a ninety-seven pound ibex. A python in the Cincinnati zoological gardens swallowed a goat weighing forty-two pounds. All of



Skeleton of python reticulatus. Skeletons of a rattlesnake and a moccasin on the base.



The pig is in the python's throat.

PYTHONS AND THEIR PREY.

the goat that passed intact were the horns, the hoofs, and a piece of sash rope four feet long attached to his neck.

We recently had a big reticulated python, which passed the hoofs of a pig. They were shown to Dr. W. T. Hornaday, the director of the New York Zoological Park, who identified them as the hoofs of the Bornean wild pig, of about forty pounds weight. A ship's captain, in bringing over a large reticulated python, found in the excrement the quills of a Javan porcupine, lying in the same relative position they occupied on the animal's body. The reptile must have begun with the head, extending the coils backward over the body, and pressing the quills down horizontally in their natural state of rest. Evidently, this is a species of prey a snake could not disgorge.

Our small snakes feed largely on frogs, toads, and fish; the anacondas feed extensively on fish; king snakes and king cobras eat other species of snakes; but I have never known a boa or python to take a cold-blooded animal. We often keep small snakes and iguanas with the boas and pythons, but they never take any notice of them. In a state of nature their prey consists largely of small deer and antelopes, lambs, kids, pigs, other mammals weighing less than a hundred pounds, and any bird that may be large enough to attract their attention. That their prey does not always submit without a fight is shown from the number of broken ribs that are found in the skeletons.

We have an artificially mounted skeleton of a twenty-two foot reticulated python, in which there are thirty-seven ribs that show well-marked fractures, and a number of others that show indications of fracture. Some of them have been broken two and even three times. In one, the ends have slipped past each other for about a half inch, and the two sides are knitted together. In one place there are five fractured ribs in succession. A peculiar feature about these broken ribs is that they always occur toward the posterior quarters of the snake. It is probable that the animal responsible for these fractures is the Bornean wild pig. Doubtless the reptile usually seizes the pig near the head, and throws his coils about the shoulders. The posterior limbs are thus left free, and with these he fights desperately till life is crushed out, frequently, as is plainly evident, doing serious damage to his assailant.

In conformity to their attenuated form, snakes have a large number of vertebræ and ribs. A peculiarity of the skeleton is that there are but two cervical vertebræ. The atlas and axis, or first and second bones of the spinal column, next to the head, bear no ribs, but they start with the third vertebra. Neither are there any lumbar or sacral vertebræ. In the reticulated python there are 361 vertebræ. Of these, 2 are cervical, 37 caudal, and 322 dorsal. The caudal vertebræ all bear transverse processes, the proximal ones long and broad, diminishing gradually toward the tip of the tail, but they do not disappear, even on the last distal vertebra. It may be that these are but ribs ankylosed to the vertebræ. It is sometimes difficult to distinguish just where the ribs end and the transverse processes begin. This is true in the Indian python. As already intimated, there are 322 pairs of ribs. However, it is highly probable that this number will not hold constant. Even in man there may be thirteen, eleven, or as few as nine pairs. At least one human skeleton has been known with twelve ribs on one side and thirteen on the other.

Likewise the teeth of the python are numerous. In the upper jaw there is a row of teeth in the maxillary, and a second row, set at considerable distance inside the first and imbedded in the palatine bones. In the lower jaw there is but one row of teeth, that of the inferior maxillary, but it is really double, as there is a line of tiny teeth just inside the larger ones. The teeth are all acutely conical in form, smooth and with no cavities, depressions, or ridges, and set so that they point toward the back of the mouth. They serve merely for catching and holding the prey. As there are no particles of decaying food on the tooth to be carried into the wound and produce blood poisoning, a bite from one of these monsters usually heals quickly.

In seeking his prey, the python depends much more on his sense of smell than on that of sight. It is always dangerous to go near these big snakes with the smell of any bird or mammal on the hands or clothing. When they are hungry and scent their natural food, they will strike at the first thing they see moving. They will even strike at inanimate objects which have come in touch with their natural prey. One evening we were feeding a big python. For some reason it dropped the prey, and to get him to return to the chicken, a woolen duster was pushed toward his head. Instantly he struck and seized the duster in his teeth. His jaws had to be pried open to make him let go. Under similar circumstances, a python seized and swallowed a blanket. After retaining it for two days, he disgorged the article, rolled into a compact wad.

The sense of taste in the serpents is very keen. If chickens are kept in a dirty box, these reptiles will refuse to feed on them. If a python bites into the crop of a chicken containing bad-tasting matter, he will drop the chicken. To test the sensibilities of the serpents, a black snake was once given a stale egg. This species is very fond of eggs, but no sooner had the shell broken in his stomach than he commenced vomiting, and continued till the stomach was completely evacuated.

It is a common belief that snakes are so plentiful in India, that one can scarcely walk about without stepping on them. This is erroneous. It is possible to live for considerable periods of time in that country without so much as catching a glimpse of a snake. And this is especially true when we confine our references to the big pythons. Dr. Hornaday spent two years hunting in India and Borneo, and yet he declares he never saw but one python, and that was a small one. The pythons are timid and shy, and lie coiled among the foliage of trees or shrubs, or in the dense grass on the ground. They never attack man or the large animals so long as they are unmolested.

THE FILTRATION OF CITY WATER SUPPLY.

(*Continued from page 276.*)

K, of steel wire mesh; then a bed of charcoal *D*, followed by a fine screen, *L*, of fine mesh copper; and above this is laid the bed of sand *E*. It will be seen from the above description that this form is a modification of the slow sand system, with the direction of the flow of the water reversed.

Although, normally, the system operates under a very small head of water (the difference of the water level in the outer and inner chambers), as the sediment accumulates in the filtering medium, the height of water in the outer reservoir increases, and there is an automatic adjustment of conditions to overcome the increased friction in the filter bed, but this in practice does not exceed eight inches. The Jerome Park reservoir filters pass through 15 gallons per hour per square foot of filtering surface, which is about five times as fast as the flow through an ordinary slow sand bed. This means that the total area of filter bed required would be only one-fifth of that necessary by the ordinary gravity system.

The advantages of this system are, first, that the slow flow of the water through the outer chamber permits about 60 per cent of the impurities to be deposited there, leaving the filter bed to deal with the remaining 40 per cent only.

Secondly, most of the remaining suspended matter is deposited at the lower surface of the bed.

Thirdly, whereas in slow sand filtration the suspended matter is forced about two feet down into the bed, in the system being tested at Jerome Park it is found that after fifteen months' continuous operation, the suspended matter penetrates four inches only into the sand bed.

Fourthly, instead of removing the sand with great labor, as is necessary in slow filtration, the outer basin is discharged by opening a valve, and the pure filtered water, rushing through the bed, thoroughly cleanses the same.

Fifthly, the valuable biological action, which characterizes slow sand filtration, is also secured in this system, through the presence of the carbon and the septic stratum of sand which is formed in the lowest portion of the bed.

In conclusion, it may be stated that by a series of analyses made at the Jerome Park plant by Dr. John C. Sparks, the water expert, of the water before and after filtration, it was found that although there was an average of 262 organisms present for each cubic centimeter of the unfiltered Croton water, after it had passed through the filter bed, the total organisms were reduced 99.2 per cent; there was no trace of *B. coli communis;* and the water was free from odor, color, taste, or sediment.

An International Exhibition of Inventions.

An international exhibition of recent inventions will be held at the Michael Manege, St. Petersburg, from April to June, 1909. The exhibition is being organized by the Society of Military, Naval, and Rural Sciences. The object of the exhibition is to bring before the notice of the Russian public the latest inventions pertaining to technical science and national economy.

The inventions exhibited relate to military and naval technics, agricultural science, ways and means of communication, constructive work, new industrial and factory appliances, electricity, household novelties and appliances for the prevention of fires. Inventions pertaining to the fine arts, medicine, chemistry, pharmacy, sport, etc., have also been included.

The minister of finance has given permission for the exhibitors to take advantage of the exemption tariff, No. 163, 1894, that is, free return transport of the goods exhibited.

Foreign exhibits will be admitted duty free on the condition that they be returned abroad within a period of two months of the date of the closing of the exhibition. A deposit equal to the duty payable must be made, which will be refunded when the goods are leaving the country.

Exhibitors must bear all expenses in connection with the delivery of exhibits to, and packing and returning from, the exhibition. They will also be charged for the space allotted to them, as well as for electric light, gas, and water required for the special illumination and working of their exhibits.

All exhibits will be entirely under the care of the exhibitors themselves. The committee will take general precautionary measures against loss and injury, or damage by fire, and will insure the building of the exhibition, but it will not be responsible for the safety of the exhibits, and in consequence invites the exhibitors themselves to insure their exhibits. Should the occasion arise, the committee will undertake to effect such insurances by special agreement.

The judging of the exhibits will be carried out with the utmost care; the experts appointed for the purpose are well known in the various fields of science.

Exhibits should be addressed to the Exhibition Committee of the International Exhibition of Latest Inventions, Nevsky 13, St. Petersburg, Russia.

New Automobile Speed Records in Florida.

At the seventh annual race meet upon the beach at Daytona, Fla., recently a number of new records were established. On the first day, March 23d, David Bruce Brown made a mile in 33 seconds in a Benz 120-horsepower racer, and thereby won the race for the Dewar trophy at a speed of 109.09 miles an hour. Strang, on a 30-horse-power Buick stock car, won the 100-mile race for such machines in 1 hour, 34 minutes, 1 1-5 seconds, at the rate of 63.81 miles an hour. The following day, in the 10-mile free-for-all race, Mr. Brown made considerably faster speed over the longer distance, as he covered the 10 miles in 5 minutes 14 2-5 seconds, at a speed of 114.5 miles an hour. Ralph De Palma on his Fiat "Cyclone," was second in 5:29 2-5. The previous record in this race was 6:15, made in 1905 by McDonald with a Napier machine. In the 5-mile invitation race, the German Benz driven by Robertson, beat De Palma's Italian Fiat. The Benz covered the distance in 2 minutes 45 1-5 seconds, or at the rate of 108.95 miles an hour, and thereby beat Lancia's record of 2:54 3-5, made in 1906 with a Fiat racer.

The last event of the second day was for stock cars of various piston displacements up to 400 cubic inches and over. The distance set for this race was 100 miles. Three of the six starters covered this distance, and one ran 120 miles, when the race was called off on account of rising tide. The 120 miles were covered by De Palma's Fiat, of over 400 cubic inches piston displacement, in 1 hour, 33 minutes, 44 3-5 seconds, at an average speed of 76.8 miles an hour. It covered 100 miles in 1:16:55, while the second car at this point—Strang's Buick—took 1:30:24, which corresponds to an average speed of 65.5 miles an hour. The Benz racer, the third car of the trio having over 400 cubic inches piston displacement, stopped early in the race on account of a seized piston.

On the last day of the meet the Fiat racer had a walkover in a 100-mile race, and thus secured for the third time—and therefore finally—the Minneapolis trophy. This trophy was won twice by Mercedes machines and twice by Napier racers, and its third winning by the Fiat car places Italy ahead of both Germany and England. The Fiat "Cyclone," which won it, is only a 60-horse-power machine, and yet it covered a mile in 36 seconds, as against the 33 seconds scored by the Benz 120-horse-power racer. The new record of 2 minutes 45 1-5 seconds made by the latter machine in the 5-mile race supplants that of 2:47 1-5 made three years ago by Marriott in a special Stanley steam racer.

Bicycles and motorcycles were in evidence more than ever this year at Ormond, and a new mile record of 43 2-5 seconds was made by Robert Stubbs, while 43 4-5 was scored by A. G. Chapple. The best previous record for this event was 45 1-5 seconds. A new kilometer record of 27 4-5 seconds was scored by Walter Goerke, who also won the 69-mile race for amateurs with motorcycles having a piston displacement of not over 61 cubic inches. Goerke's time in this race was 58 minutes 25 4-5 seconds, an average speed of 73.7 miles an hour. The best previous record was 68 miles 1,380 yards in 60 minutes, made on the Brooklands track in England. The 20-mile motor-cycle race was won by A. G. Chapple in 17 minutes and 25 1-5 seconds.

The $500 prize that was offered for a mile flight by an aeroplane was not won. Carl Bates, of Chicago, had a small aeroplane with a 10-horse-power motor at Daytona, but he did not succeed in making any flights, even under the nearly perfect conditions obtaining there.