ing the engineering data, and we are free to admit that the plans, profiles, maps, shop drawings, records, etc., are as complete as the most fastidious could ask for.

The new company has evidently laid the lesson of the first failure to heart; but, in order to give further weight to the findings of the engineers, it asked for the appointment of a Technical Commission composed of eminent engineers of different nationalities, whose experience in similar work gave them special qualifications for passing upon the new surveys and plans. The International Commission included such men as Brig.-Gen. H. L. Abbot, Corps of Engineers, U. S. A.; Mr. Fulscher, formerly Engineering Director of the Kiel Canal; Mr. Koch, engineering member of the same canal; Mr. W. Henry Hunter, Chief Engineer of the Manchester Canal Company; Mr. A. Fteley, Chief Engineer Aqueduct Commissioners, New York City; Mr. C. Skalkowski, formerly Director of Mines, Russia; and four of the former General Inspectors of Roads and Bridges, France.

This commission, organized in 1896, through some of its members has made personal inspection of the canal on the Isthmus and in addition to having at its disposal the local records of rainfall and floods for the last 15 years, for two years has made its own elaborate records of rainfall and of the flow and floods of the Chagres, and has held over 100 sessions. It presented a unanimous report on December 2, 1898, which, considering the standing and experience of the members, is perhaps the most representative and authoritative document of the kind ever drawn up.

The report fully indorses the plans and estimates of cost of the new canal.

THE NEW PANAMA CANAL.—The International Commission find that the work on the canal is at present two-fifths completed, that the cost to complete the work under the new plans will be $87,000,000. If 20 per cent be added for contingencies, the total cost is $102,400,000, and the time for completion, not allowing for improvements in methods of working and plant, is from eight to ten years.

The canal is forty-six miles in length. The map (Fig. 9) shows its location, and the profile (Fig. 10) shows by a dotted line the amount of excavation that has been done and by a full line and shaded portions, the excavation remaining to be done. The engineers drew up three designs for a canal with locks. In the first the summit level was to be 96¾ feet; in the second, 68·08 feet; and in the third, 32¾ feet above the sea level. The technical commission recommends the second, which is the one shown in the map and profile.

As the determination of the levels and number of locks is dependent upon the means taken to control and utilize the Chagres River, it will be well to explain that this control is secured by constructing two large dams, one at Alhajuela, in the upper Chagres, about nine and one-third miles above the canal (see map), and the other at Bohio, at the end of the sea level length of the canal on the Atlantic side. The Bohio dam will be thrown across the Chagres valley at a point about half a mile to the left of the canal at Obispo. It will be of earth, upon a bed of compact clay. The general features are shown in the cross-section, Fig. 12. The crest is 1,286 feet long, and the extreme height above the bed of the river is 75½ feet, and above the foundation 93½ feet. This dam will create a vast artificial lake, which will extend thirteen and a half miles to Obispo. Its lowest level will be 52·5 feet and its highest level, when the river is in flood, 65·5 feet. The channel of the canal will lie in the bed of this lake, which will not only take care of a large part of the flood waters, but will greatly reduce the amount of excavation necessary for the canal. The other dam, at Alhajuela, will be built everywhere upon solid rock, and will consist of concrete masonry. Its crest, 936·75 feet long, will be 134·5 feet above the river bed, and 164 feet above the lowest foundation.

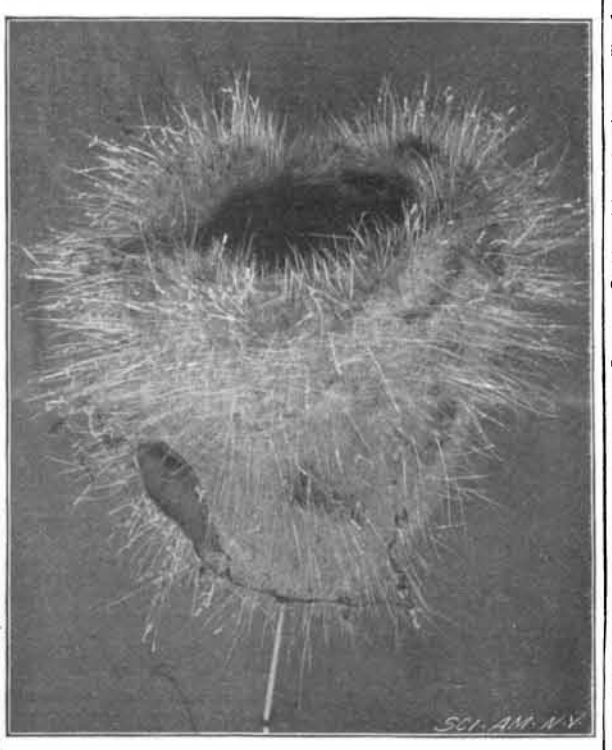
This dam will be connected with the summit level by a feeder with a capacity of 6,605 gallons per second. The dam will also furnish energy for the electric lighting of the canal and the electric operation of the locks, etc.

The storage capacity of the two artificial lakes thus formed will be 66 billion gallons, which provides a wide margin of safety, as shown by careful records, over any possible flood discharges of the river. The records of the flow of the upper Chagres have demonstrated that the surplus quantity of water impounded during the rainy season by the Alhajuela dam will be many times as great as will be necessary to supply the summit level during the dry season.

Commencing at Colon on the Atlantic, the first section of the canal, 15 miles in length, is tidal up to the two double locks at Bohio, by which vessels will pass into the Chagres River lake. These locks are of masonry and will be built upon rock foundations, as will all the locks of the canal. The deep cut shown in Fig. 3 is the site of the Bohio locks. The Obispo dam will be half a mile to the left of the locks in the bend of the Chagres River, which river is seen in the foreground of this same illustration. The working length of the locks will be 738·22 feet, the width of one of the twin locks being 82·02 feet and of the other 59·05 feet. Of this sea level stretch of the canal, the first 11·8 miles are navigable, the depth varying from 16·4 feet to 29·5 feet, the finished depth. It has been excavated to the original width (see Fig. 5), and not much dredging will be necessary to complete it for the whole 15 miles to Bohio. After passing the locks the canal channel extends for about 13½ miles along the bed of the lake to Obispo, where two double locks (built like all the other locks of the company upon a rock foundation) will admit vessels to the summit level 5 miles in length, where the bottom of the canal is 68·08 feet above mean sea level. On the Pacific slope admission is gained at Paraiso by one double lock to a level 7,963 feet in length, and at Pedro-Miguel two double locks lead down to a level 7,930 feet long, from which at Miraflores one double lock will admit vessels to the tide level of the Pacific. This portion of the canal is 7½ miles in length. The depth of water in the locks will be 29·5 feet and will not exceed 32·8 feet.

It should be noted that the slopes of the canal, particularly in the Culebra cut, are to be reveted with stone, and that the curvature of the canal is easy throughout, the smallest radius being 8,200 feet and the prevailing radius 9,843 feet.

THE QUESTION OF HEALTH.—The Technical Commission examined carefully into the question of mortality and concluded that the climatic dangers have been exaggerated. It is true that, during the first years of operation, owing to carelessness as to sanitation, the employment of races not used to hard labor in the tropics, and the fact that surface ground full of fever germs was being opened, the loss of life was serious. Of late years, however, owing to the employment of negroes from the British Antilles who are used to the climatic conditions, and as a result of the fact that the excavation is in the deeper rock formations, the amount of sickness is not abnormal.



GLASS SPONGE FROM SANTA CATALINA ISLAND, CAL.

RELATIONS OF THE NEW TO THE OLD CANAL COMPANY.—In conclusion, answering the inevitable question as to the relation of the new company to the financial burdens of the old company, we can say briefly that the old bondholders have no control over the new company, the receiver turning the property over to the latter upon the condition that the old bondholders were to have an interest in the profits (after the payment of operating expenses, depreciation, interest on construction bonds and dividend on new capital) to the extent of 60 per cent.

GLASS SPONGES.

BY PROF. CHARLES FREDERICK HOLDER.

It is not generally known that the beautiful animals known as glass sponges are found within the borders of the United States, yet one species at least is common, though rarely taken, off the coast of the Southern Californian islands, especially on the so-called grouper banks of Santa Catalina, where fishing is carried on in water five hundred or six hundred feet deep.

It was here that the attractive specimen shown in the accompanying illustration was found, being brought up on a fish hook. The sponge was a species of Holtenia, probably Holtenia Carpenteria, about twelve inches in height and nearly six in diameter; the long glass-like roots had been torn off when it was brought up. In appearance the sponge was a veritable porcupine; long needle-like spicules standing out all over it, the longest three inches in length, needles so sharp and brittle that it was difficult to hold or touch the sponge, and at a glance it resembled some odd or fanciful cactus.

The sponge was vase shaped, and would hold three pints of fluid, bulging out in the center, with an opening at the top sufficiently large to admit the closed hand. The long spicules reaching out from it presented a splendid appearance when held up to the sun, and resembled glossy hairs, gleaming and scintillating wherever the sun flashed along their surfaces. Many of the spicules were overgrown with an attractive coralline, so that they appeared branched like the limbs of a tree. In these mimic branches hung pendent many miniature pink-hued star fishes and shrimps, while fastened to them, coiled and interlaced, were the barrow-like egg cases of a skate. These are shown in the illustration.

That these sponges are fairly common in deep water offshore is evident by the small specimens often brought up and the pieces found on the outer islands, especially San Nicolas; but never before has so large and perfect a specimen been seen.

The glass sponges are so called because their skeleton, or the spicules, resemble glass, being formed of silica instead of lime, and closely resembling spun glass.

The most beautiful of the group is the Venus flower basket, or Euplectella aspergillum, which represents a vase of spun glass of the most beautiful description. When the first specimen was found it was sold at a fabulous price, and its true nature was not suspected. But finally a specimen was taken by a naturalist, who made the interesting discovery that the delicate and fragile glass-like vase, that seemed to be the work of some cunning East Indian, was nothing more nor less than the skeleton of a sponge whose spicules were silicious. In the water and alive the sponge is not an attractive object, being of a gray color and half buried in the mud, anchored by long glass-like streamers. But once dead and relieved of its covering, it becomes one of the most resplendent objects of the sea—a fairy vase, that might well have been modeled by the sea gods as a gift to Venus.

This sponge has the spicules so arranged that they present the appearance of squares. It is closed at the top and sides, hollow in the interior, and is occasionally the prison of small crustaceans, which enter the interstices when very young and unable to escape become prisoners for life, and in the skeleton may be seen with their claws protruding through the opening, creating much wonder among the uninitiated as to how they obtained ingress into the glassy prison.

Another interesting glass sponge is Hyalonema, which resembles a glass rope. The sponge itself is a small cup, perched upon a long series of glass-like stems, which is buried in the mud. This was for a long time sold as the skeleton of the little coral polyps which are parasites on its stems.

AN INSECT BREEDING IN CRUDE PETROLEUM.

BY L. O. HOWARD.

In view of the extensive use of petroleum products for insecticidal purposes, the title of this article would seem paradoxical. That such a case should be found seems, in fact, more remarkable than the breeding of the cigarette beetle, Lasioderma serricorne, in pyrethrum powder, recorded by the writer in the Proceedings of the Entomological Society of Washington, volume i., page 37.

At the meeting of the Boston Society of Natural History, January 22, 1879 (Proc. B. S. N. H., volume xx., page 134) Dr. Hagen read a letter from a Mr. Dean to Henry Edwards, of Santa Cruz County, Cal., describing a small alkaline lake in the southeastern corner of Santa Cruz County, of 20 to 30 acres area, into which copious petroleum springs continually poured their contents, which, drying, formed masses of asphaltum overlying the soil and running down to the lake. The petroleum had forced passages through the asphaltum, forming little pools of about the consistence of molasses. Mr. Dean sent with the letter a number of flies of the genus Ephydra, which he had found sitting upon the petroleum and piled up upon one another in vast numbers just like flies upon molasses, those underneath dying and becoming embedded in the petroleum and being succeeded by others, which, in turn, were pressed down into the liquid tar by those above. On approaching they would rise in a cloud about 2 feet above the petroleum, and, on being unmolested, would return and settle upon it. The dead flies were said to rise several inches deep above the liquid petroleum. Mr. Dean further stated that the flies appear to breed upon the water plants covering the surface of the lake, which are left incrusted with the salt and covered with the empty shells of the insects.

This is the only published note with which the writer is familiar which approaches in any way or is related to the case which he is about to describe. There seems no doubt, however, that in this case the insect was a true Ephydra, possibly E. californica of Packard, which breeds upon water plants in the alkaline lakes of the far Western States.

On May 20 of the past year the writer received a letter from Mr. C. G. Kellogg, Secretary of the Board of Horticultural Commissioners for Los Angeles County, of Los Angeles, Cal., transmitting in alcohol some small maggots, the natural habitat of which he wrote was "in the old pools of crude petroleum oil that is