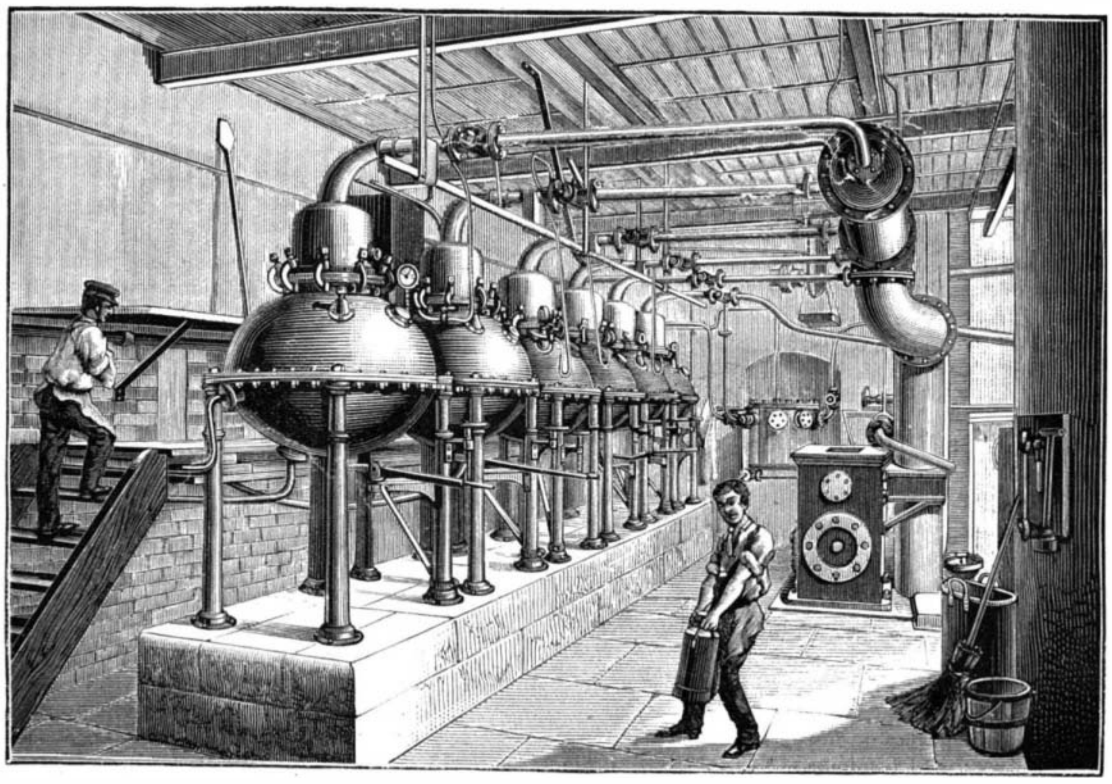
MANUFACTURE OF CONDENSED MILK IN SWITZERLAND.

Switzerland, says *La Nature*, to which we are indebted for the accompanying engraving and article, stands at the head of the condensed milk industry. The milk manufactured in this country is unsurpassed. Although other countries may produce milk which produces better butter, as for example Normandy and Holland, none of them can rival Switzerland in the delicious flavor, the delicate aroma, and excellence of quality of condensed milk. This is due, no doubt, to the richness of the flora of that country.

The milk industry, which during the past few years has developed abnormally in Switzerland, is conducted principally by three companies or firms—the Anglo-Swiss Company, with factories at Cham and Guin; the Lapp Factory, at Epagny; the Henri Nestle Company, with factories at Vevey, Bercher and Payerne.

The milk export (and here the amount of export is equal to the amount manufactured, as the home consumption is very slight) has increased, according to the figures of the federal bureau of customs, in 1887 to 111,312 metric quintals, or 494,720 cases of 48 boxes each, in 1888 to 117,700 metric quintals, or 520,000 cases, which represent the milk of 15,000 cows and of 250 villages. In 1888 the export of Swiss cheese amounted to 238,390 metric quintals, which represented a value of 30,450,000 francs. We mention these figures to let every one comprehend the importance of this new industry, whose exports are already one-half as great as the much older industry of cheese making.



THE SWISS METHOD OF CONDENSING MILK.

Condensed milk is manufactured as follows: The milk, as soon as drawn, is taken by the farmers to the dairies, which are established in each village or group of villages. The dairies are run by a syndicate with which the manufacturers deal, and establish the fixed prices. Here the milk is cooled. On reaching the factory the milk is warmed for the first time in a water bath, and a second time in copper vessels, where the temperature reaches 80° C. It is then sweetened by adding the best quality of sugar in the proportion of 13 to 100 in weight, the sugar being forced into vacuum pans by means of a pump. These vacuum pans are for condensing the milk, and are similar to those for condensing the juice of the beet root, having a double bottom and spiral pans in which the steam circulates. The water contained in the milk is removed in the form of vapor by means of a jet which is connected with the top of the vacuum pan and which is operated by means of a pneumatic pump. When the milk has been sufficiently condensed it is removed from the vacuum pans and cooled in vessels placed in reservoirs of running cold water. It is only necessary now to pack the milk into tin boxes cylindrical in shape, and hermetically sealed, the box and contents weighing one English pound, and being in condition for shipment to any part of the world.

In the preparation of the condensed milk it may be observed that the milk, as taken directly from the cow, has on the one hand simply been deprived of the water it contained, while on the other hand the only addition consisted of pure sugar, which is designed to preserve the milk better. It contains all the elements of the fresh milk, which has practically undergone no modification, the boiling of the milk under slight pressure having never passed 80° C. It can be affirmed, therefore, that the condensed milk possesses all the nutritive qualities of fresh milk. The following analyses, one by Prof. Soxlet, of the University of Vienna, and the other by Mr. Otto Hehner, the distinguished chemist of St. Thomas' Hospital, London, show the chemical composition of the Swiss milks:

	Milk Nestle.			Milk of the Anglo-Suisse Co.		
	Dr. Hehner.	Dr. Hehner.	Soxlet.	Dr. Hehner.	Dr. Hehner.	Soxlet.
Water	23 59	25 04	25 28	24 21	26 44	24 70
Fatty matter	11 58	11 12	8 62	9 95	10 52	6 02
Caseine	9 60	8 18	10 25	8 72	8 22	9 77
Sugar	53 21	53 78	53 82	55 18	52 86	57 40
Salt	2 02	1 88	2 03	1 94	1 96	2 11
	100 00	100 00	100 00	100 00	100 00	100 00

These analyses are confirmed by analyses by Dr. Brunner, Professor of Chemistry at the University of Lausanne, and Dr. Christen, of Paris.

The problem of preserving milk is solved. The milk may be preserved for several months, and the flavor is very agreeable. We do not need to mention the various uses to which it may be put, nor how extensively it is used in all extensive communities, on board ship, in our colonies, and in all countries where fresh milk cannot be obtained.

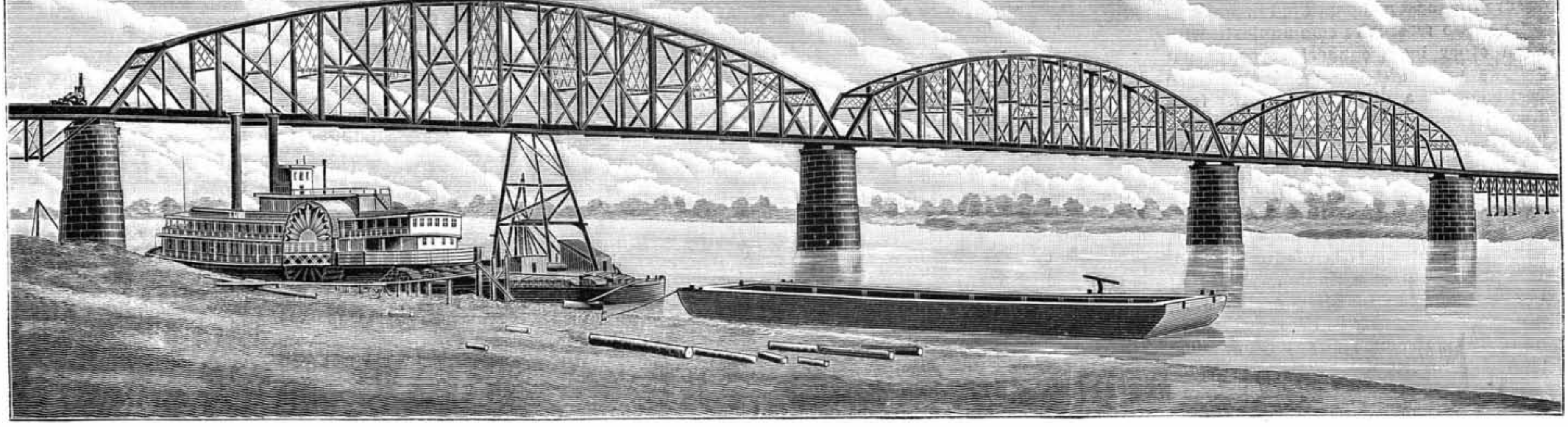
NOTE.—It should be borne in mind that the manufacture of condensed milk was first introduced in America, and was the result of American invention. Mr. Gail Borden, the original inventor of the process of condensing milk *in vacuo*, procured his basic patent in 1856. An enormous industry has been founded upon his patents, and although we do not question that Switzerland may excel in this manufacture in Europe, we believe that the United States, both in respect to volume of manufacture and excellence of quality, distances all competitors.—ED.]

THE NEW MERCHANTS' BRIDGE AT ST. LOUIS.

The accompanying illustration is a reproduction from a photograph of the Merchants' bridge at St. Louis, which was completed and dedicated with considerable ceremony on May 3. The main superstructure of the bridge consists of three spans, each of which is 517 feet 6 inches in length. It is of the Pratt truss form and divided into 18 panels. These trusses are 75 feet high in the center, and are placed 30 feet apart from center to center transversely, thus providing room for two tracks which are placed 12 feet apart. The system of lateral bracing is carried down the post to within 21 feet of the railroad track. The east approach to the bridge consists of 3 deck spans, each 125 feet in length. These rest upon piers composed of 4 cylindrical columns. Beyond this iron work there is about three-fifths of a mile of wooden trestle work. Where the approach passes over the Alton, Big Four, and Wabash railroads, there is a steel span 175 feet in length, resting upon masonry abutments. The trestle work will, doubtless, be filled in at a later period. At the west end the approach also consists of three spans, each 125 feet in length. Beyond this portion of the bridge there is a steel girder spanning one of the streets of the city, and about one-quarter of a mile of trestle work, which also will be filled in to make a solid embankment. The bridge track is laid with steel rails weighing 67 pounds to the yard, secured to the ties by Bush interlocking nuts to prevent the creeping of the rails. The superstructure of the bridge consists of four piers, composed of granite from a point 3 feet below the low water line to 2 feet above the high water line. Above this the material used is limestone, and between the granite and the caissons is the usual crib work, except in the case of the second and third piers, where the masonry had been started from a caisson.

The first soundings for this bridge were made in September and October, 1887, and the report and plans of the engineers, Messrs. Morison & Corthell, were submitted on November 2, 1887. The first caisson started was that for pier No. 4 on the west end. This caisson was built on the site and lowered in position. Work upon it was commenced January 24, 1889, and the pier was completed early in July. The caissons for the piers 1, 2, and 3 were built upon the banks and floated into position. No. 1 was launched April 26 and the pier was finished August 24. Caisson for pier number 2 was launched May 23, and that for number 3 on June 6. The location of pier number 3 is such as to expose it to the strongest current in the river, and the only difficulty of moment experienced in the work upon the substructure was at this point. The caisson was placed in position September 9 and the pier finished November 1. When towed into position the depth of the water at this point was 18 feet, but before the work was completed a rise in the river increased the depth to 42 feet, and the strength of the current was such as to tear away the anchorages twice.

In erecting the superstructure, some very quick work was done. The false work for the west span was begun,



THE NEW MERCHANTS' BRIDGE AT ST. LOUIS.

early in October and finished November 1. The building of the span was begun November 9 and completed on the 17th. The second span was erected between December 5 and 11. The false work for the three spans was completed December 22, and the span itself was started December 23, and made self-supporting December 30; but 60 working hours were employed in the erection of this last span.

The bridge was dedicated on May 3, with imposing ceremonies. St. Louis took a half holiday, and the river was crowded with large steamers which had been chartered for the occasion, each of which carried many to the scene. At 2:30 P. M. trains started from the Illinois and the St. Louis ends of the bridge, each bear-

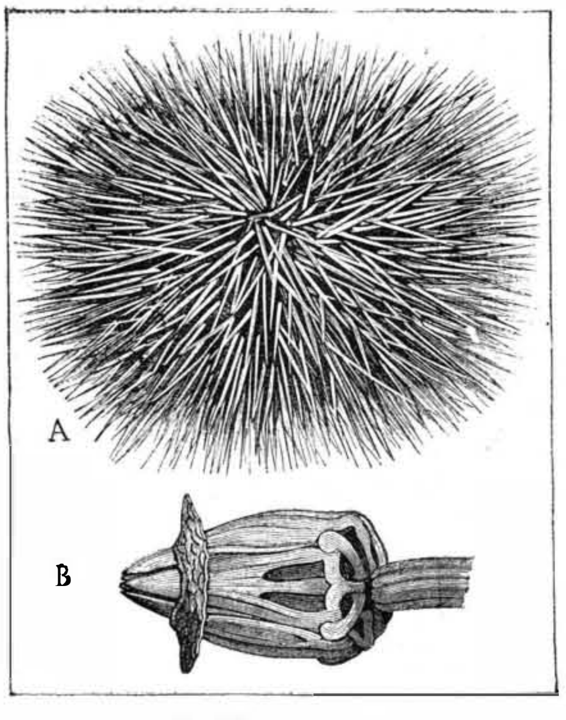


Fig. 1.—A. SEA URCHIN. B. BUCCAL APPARATUS.

ing the governors of the respective States. They met in the middle of the bridge and exchanged courtesies. The bottle of wine was broken as usual and a salute of 100 guns fired. In the evening there was a banquet at the Lindell hotel, at which several more bottles of wine were broken and numerous speeches were made. The banqueting hall was finely decorated. The guests as they entered passed under a large floral representation of the bridge. St. Louis now has a bridge which has been very much needed for a long time, and when all connections to it are completed, it will advance the interest of the city materially.—*Railway Review.*

BURROWING SEA URCHINS.

It has been known for many years that certain sea urchins form cavities in the rocks of the seashore, and are often found nestling in them. Mr. E. T. Bennett studied this fact so long ago as 1825, and made known an important point in showing that the habit under consideration is not the characteristic of any species in particular. Mr. Walter Fewkes, in the *American*

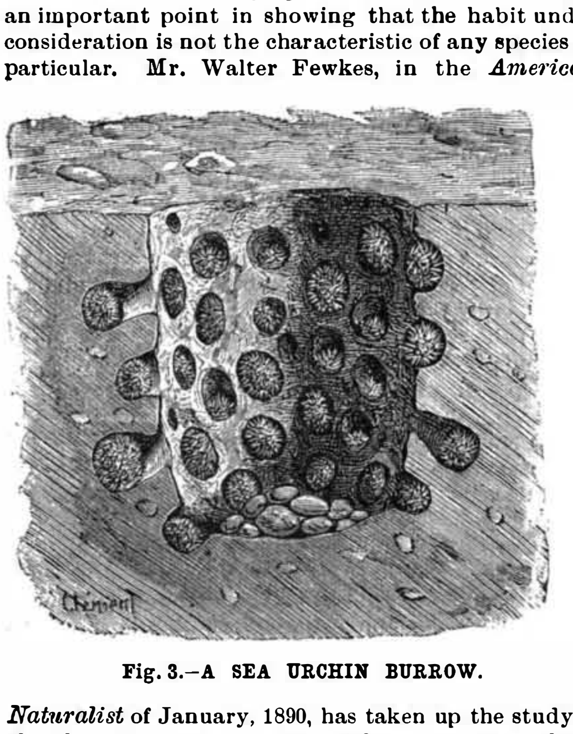


Fig. 3.—A SEA URCHIN BURROW.

Naturalist of January, 1890, has taken up the study of the phenomenon in question, and appears to us to have made a very good *resume* of it. Our readers will, perhaps, be glad to know the conclusions that the American writer has reached.

According to Bennett, a number of authors (cited by Mr. Fewkes) have in turn touched upon the matter. They have found that the excavation in question may be observed in the most diverse rocks—granite, lava, gneiss, limestone, chalk, etc.—and in all parts of the globe. Where the sea urchins abound, the excavations are so numerous that the ground is riddled with them. They are sometimes found in the horizontal masses of the rock and sometimes in the more or less vertical sides of the latter, and are of sufficient dimensions to allow the animal to move abont a little. They are often carpeted in part, at least around their orifice, with different calcareous algæ. It was believed for a long time that these algæ might play a part in the production of the excavation. It was thought that they might, like other plants, moreover, exert a chemical action upon the rock and progressively dissolve it. In reality, there is nothing in this, as appears from a number of facts, and the sea urchins are the sole makers of the cavities in which they are found. It is well to say, however, that a sea urchin discovered in such a cavity is not necessarily the architect of the dwelling place in which it is found. It often happens that a sea urchin, in search of a domicile, meets with an empty cavity, the owner being dead, or perhaps wandering around the vicinity, no matter which—the new comer does not bother itself about that, but at once takes possession and makes itself at home. It is not really known whether or not the sea urchin sometimes leaves its cavity in order to explore the vicinity, and afterward returns to its dwelling after its curiosity or its hunger is once satisfied. It would not be impossible to find out, however; but we know with certainty that the animal, in the course of its peregrinations, seizes upon any such empty lodging as it may find to its convenience. That is to say that, among the tenants, there are some that construct their own abode, and there are still sharper ones that know how to take advantage of the labor of others. However, it is doubtless necessary for them to work a little, for we often meet with sea urchins in cavities whose orifice is too small to have allowed them to pass through it. These have entered when small, and, in growing, have enlarged their domicile (Fig. 4).

How is the excavation made in the rock, and how does the animal enlarge its abode? Here, as is not rarely the case in scientific matters, opinions differ. One observer will have it that the sea urchin, in moving about, wears away the rock with its spines, which act after the manner of files. Another believes that the animal burrows into the rock by means of its teeth, which are very curious and powerful, and which the muscles of the lantern of Aristotle (such is the name of the dental apparatus of sea urchins) set in motion. A third observer comes to the front and, deciding both for and against his predecessors, admits a portion of the two hypotheses, or rather combines them. In his opinion the teeth and spines must act together. It seems, however, that the greater part of the work falls to the teeth. This appears to be shown by the following fact (pointed out by John), of the presence of fragments of rock in the sea urchin's intestine. We know, moreover, that all the sea urchins swallow much sand and rocky debris, although the utility of this habit is not very clear to us.

On another hand the spines may act as follows: We know that water in motion often excavates pretty large cavities (such as the large pot holes of Switzerland and the Jura) by means of the grinding action that it communicates to stones. These latter, continuously rubbed against the same part of a rock by the current, wear away the rock and become worn themselves. The rock is gradually hollowed out into a cavity of variable dimensions, and at the bottom of this we often find the round, smooth stone that has served to form it. The body of the sea urchin, slightly agitated by the waves, may act upon the rock to which it is attached and gradually hollow out the latter; and what seems to show that such a thing occurs is the polish and evenness of the cavity occupied by the animal. It would be difficult for the teeth to act with such uniformity. It is probable that this is what occurs: The sea urchin naturally tends to search for depressions in order to protect itself against currents. These it enlarges with its teeth, and the motions of its body wear away the rock at the points where it comes into contact with it.

Some naturalists have thought that the animal might be aided in its work by acid secretions furnished by the mouth, ambulacra, etc. But the existence of the latter has not been ascertained, and their nature at the most would be pretty difficult to conceive of by reason of the variety of the rock that they would have to act upon.

Mr. Jules Marcou, of Cambridge, furnished Mr. Fewkes with a very interesting note, in which he narrates some facts observed by him at Biarritz, where he saw a number of cavities formed by the usual mechanism (wear of the rock by stones set in motion by waves and currents), and in the sides of these he observed large numbers of sea urchin dwellings. In certain cases, the cavity exhibits a central column, which starts from the bottom (Fig. 4). This may be supposed to be due to the fact that the stones have had a very rapid motion that has kept them constantly at the periphery. As the central part of the depression has not been worn away by the stone, it remains in the form of a column. In measure as the excavation becomes deeper, however, it diminishes in diameter, and the column does the same, and finally breaks off. The figures given by Mr. Marcou make the mechanism of the phenomenon well understood. In these excavations, whether they are or are not provided with a central column, the sea urchins abound, each having its lodging, and the excavations being sometimes so close together that it is impossible to find a surface in which to form a new cavity. It would seem that the sea urchins play a very active part in the production of the burrows, and Mr. Marcou thinks that the animals sometimes begin these by excavating their niches along-side of each other. And now, why do the sea urchins excavate niches? If we take account of the very interesting fact that the habitude is scarcely found except among littoral sea urchins at points where the currents are strong, the tides powerful, and the waves numerous, it will be seen that there are two principal reasons to be invoked. Where the sea is rough (and there the animals are generally abundant, the surroundings

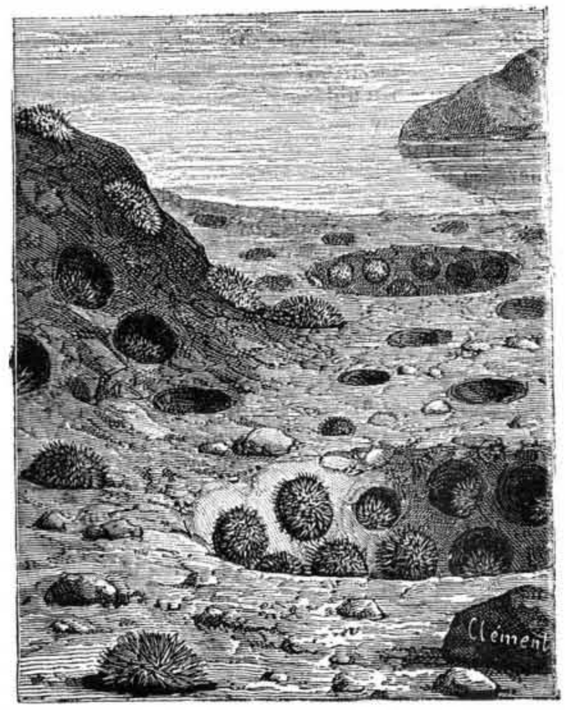


Fig. 2.—BURROWS OF SEA URCHINS.

being favorable to life), the sea urchin excavates in order to protect itself against the motion of the sea. Moreover, where the tide runs high, another motive comes in play. The sea, on retiring, leaves the animal high and dry for a few hours, and this is not advantageous to it. It therefore excavates a niche wherein the water can remain between tides. It makes for itself a little sea which guarantees it against drying, and, when it works in community, and installs itself in a burrow, it finds itself in still more advantageous conditions, the quantity of water that remains in the burrow, and that laves the niches of the animals, being still greater. The fact that the sea urchins protected against the action of the waves, currents, and tides, and living at a certain depth, do not form cavities in rocks, renders the explanation just given very likely. The facts so well interpreted by Mr. Fewkes might be verified by a new observation, and this would not be difficult to make. In the course of such a study it would be interesting to observe the relations of the sea urchins to the algæ growing around the orifice of

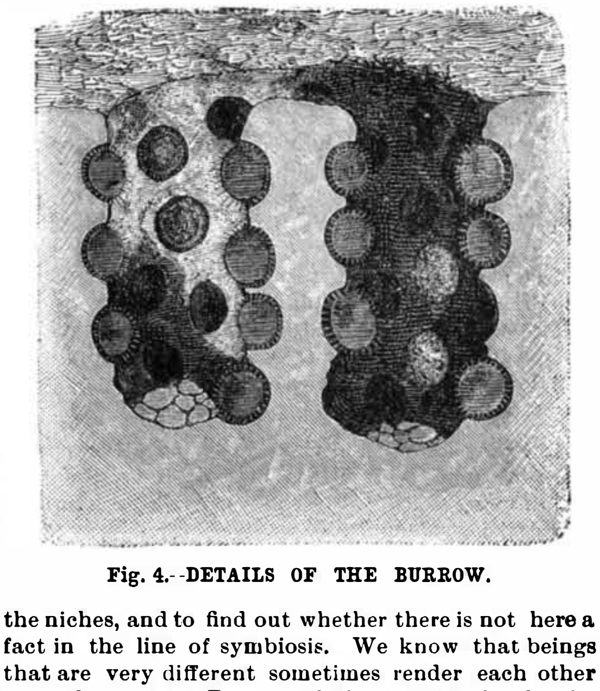


Fig. 4.—DETAILS OF THE BURROW.

the niches, and to find out whether there is not here a fact in the line of symbiosis. We know that beings that are very different sometimes render each other mutual services. Does a relation of this kind exist in the present case, and what is it?—*La Nature.*

ACCORDING to *La Nature*, the *Histoire de l'Academie des Sciences*, of Paris, of the year 1752, records the fact that the property possessed by India rubber of erasing pencil marks was discovered at about that epoch by Mr. Magellan, a descendant of the famous navigator whose name is perpetuated in the strait discovered by him at the southern extremity of South America. Previous to this, bread crumbs had been used as a pencil mark eraser.