hauled to chutes built out from the shore line, where the water is sufficiently deep to float a 10,000-ton steamship. The usual method is to run the cars out upon the trestle extending along the top of the chute, and dump directly into the hold. It may be added that the tramway from the mines to the water side is so inclined that but little power is required to transfer the loaded cars to the chutes. From 4,000 to 10,000 tons daily can be loaded at this point, and during the shipping season, which covers about five months of the year when the bay is ice free, a fleet of ten or twelve ore carriers is continually plying between Belle Isle and Sydney.

The ore at Belle Isle contains from 48 to 56 per cent of pure metal, and yields a pig iron especially suitable for rail and structural steel, into which much of it is manufactured. The furnaces of the Dominion Company which are of modern design will smelt from 1,200 to 1,500 tons of ore daily.

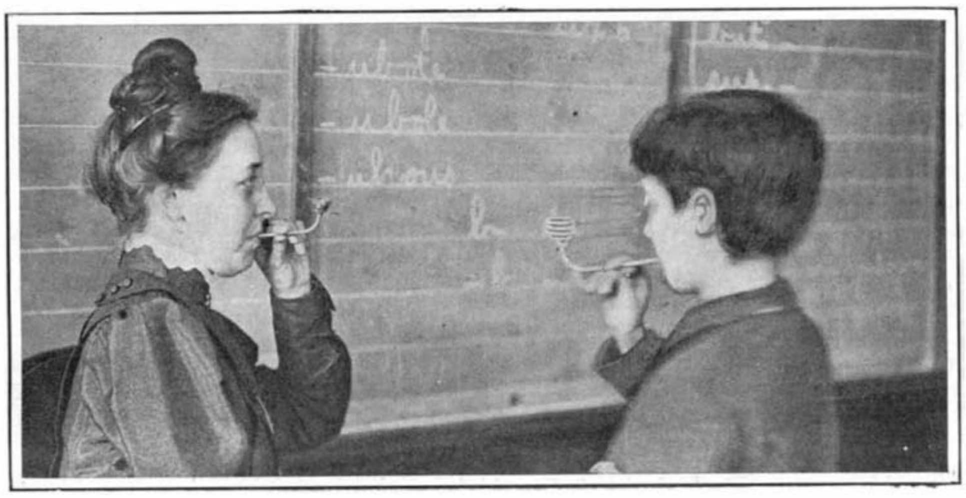
The mining of iron pyrites is conducted on an extensive scale at Pilley's Island in Exploits Bay. As the photograph shows, the deposits outcrop on the shore of the bay so extensively that most of the mining is done with hand tools, the formation being very soft. In a few places lateral galleries have been driven into the beds, but a very large tonnage is situated directly on the surface. At present Pilley's Island is yielding nearly 75,000 tons yearly, most of which is carried to the United States for reduction. An analysis of the ore shows that it contains between 50 and 60 per cent of sulphur, which is secured in the treatment, while the metallic iron is utilized in the composition of a high grade of steel.

As in the case of the copper deposits, the iron ore beds, especially in the eastern section of Newfoundland, are undoubtedly very extensive, for veins have been traced along the shore of Conception Bay a distance of over fifty miles. The quantity and accessibility of the Belle Isle deposit, however, has caused the industry to be principally confined to this place.

Experiments were recently made with the explosion of fixed torpedoes at a distance by means of Hertzian waves. The apparatus employed is the invention of Señor Balsera, a telegraph official. The results of the trials are declared to have been satisfactory. The inventor has asked for facilities to study the application of his system to the working of torpedoes.

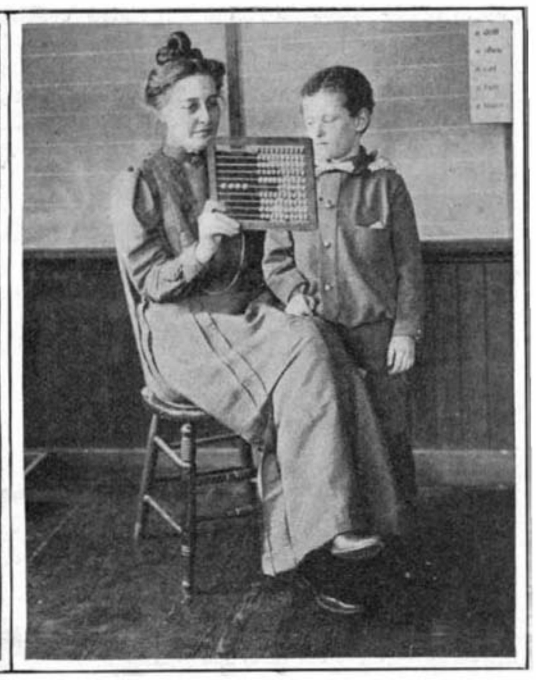
TEACHING DEAF-MUTES TO SPEAK.

It is a misnomer to refer to anyone as "deaf and dumb." Except in rare instances a child is mute, not on account of any malformation of the vocal organs, but because it is deaf and has never heard a spoken language. The loss of the sense of hearing should, therefore, not necessarily mean deprivation of the power of speech also. It is only within recent years that we have come to realize this fact, and in up-to-date institutions the old-fashioned finger alphabet is now unknown. Every child is taught to speak in the natural way by means of the vocal organs.



How the Sound of "wh" is Taught.

Demonstrating the Value of Vibratory Sounds.

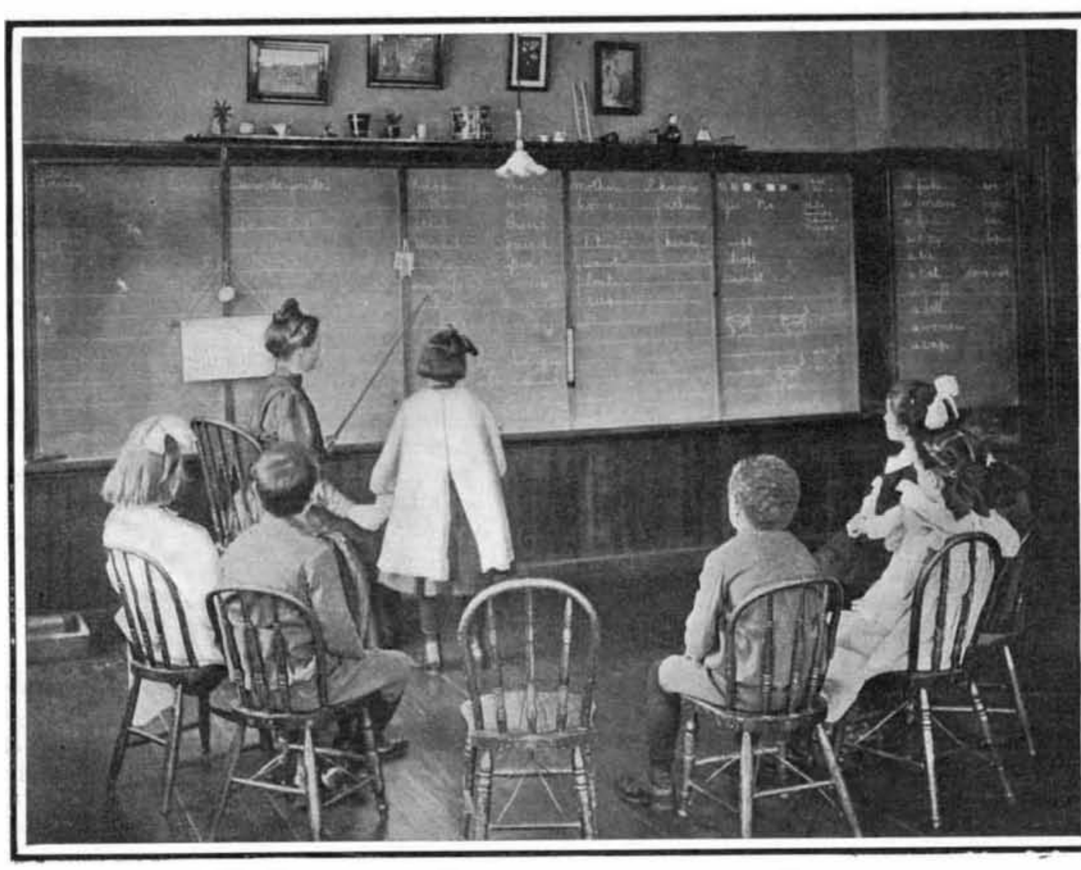


Teaching a Pupil How to Count.

Odd as it may seem, the oral method of teaching deaf-mutes antedates the finger alphabet by over a century. In 1580 a Spanish monk, Pedro Ponce de Leon, taught congenital mutes to speak simply by instructing them first to write in characters the names of objects pointed out to them, and then to enunciate the sounds corresponding to the characters. But so little did the world value his discovery, that in less than forty years after his death he was forgotten, and Juan Pablo Bonet became the recognized founder of that method of instruction which Ponce had begun. This man, who was also a priest, published at Madrid in 1620 the first manual for teachers of the deaf, and which is in some respects still one of the best. The advantage of the articulate over the manual method of instruction was very slow to make itself felt. In 1850 several schools in the United States which had previously taught the sign method adopted a combination of the two. But not until 1867 was a school established which used the method of articulation only.

The articulate or oral system of teaching is based partially upon the imitative nature of the pupil. He has to rely much upon the observation of the movements of the teacher's vocal organs, and he endeavors to produce the same sounds by forming his lips and tongue in a similar fashion. A little instrument somewhat like a paper folder is sometimes used to bring the tongue into the proper position. It is of prime importance that the pupil perceive the difference between his own silent and the vocalized breath. This perception has been styled "the hearing of the deaf," and to produce it is the first aim of the instruction in labial reading. In the elementary classes the boys and girls are drilled into the A B C of articulation by being taken, one at a time, before a mirror and taught to imitate the movements of the teacher in making the sounds. Diagrams are also used to indicate the position of the palate or tongue in producing certain sounds. The whistling sound of *wh* is conveyed to the mind of the child by the aid of a pipe in the bowl of which is a little ball that is blown up and down as the sound is formed. In this way the children are taught to understand the value of various lip and palate formations in combination with the use of the lungs.

It is a strange experience to visit one of these schools, and see the teacher talking gravely to the classes of deaf-mutes and the children responding as quickly as though they could hear all that was said. The only indication of their affliction is found in the flat tone of their voices. Hearing nothing, the children



Teaching Pronunciation by Means of Phonetic Spelling.

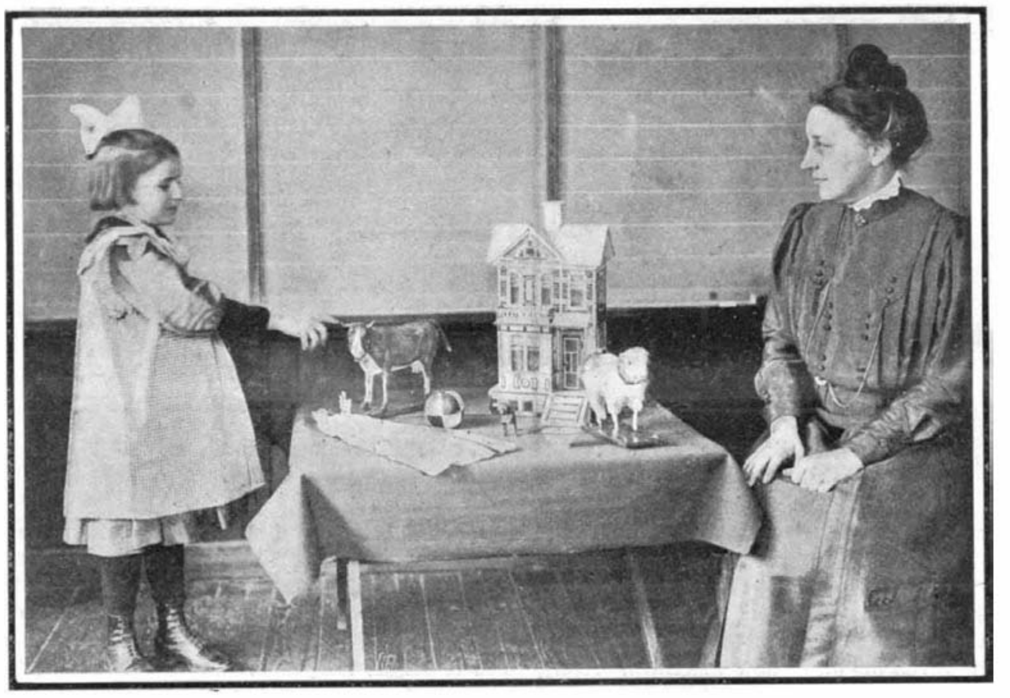
Correcting Wrong Breathing in Articulation.

TEACHING DEAF-MUTES TO SPEAK.

do not know the value of inflection, and hence speak with a dead tone which is quite pathetic. But there is nothing else to excite sympathy, for the children seem very happy. Every room has its corner filled with toys, which are used in explaining the names of objects. A child born deaf knows a cow by sight, but does not know that it is called a cow. Therefore, after the rudiments of articulation have been imparted to him, the next step is to teach the child to speak the names of the various objects about him. The teacher points to the toy cow, and makes the facial contortion necessary to articulate the word. The child imitates, and soon has the word correctly spoken. Then he is sent to the blackboard, and is taught to write the name of the animal. Thus he is able to connect the written and spoken language. Simple sentences are taught in a similar manner. A child is given a ball. He knows perhaps by this time how to pronounce the word *ball*, but he must be taught to use the word in a sentence. Another child is called up, and the first child is told to throw the ball into the hands of the second pupil. The teacher explains that the action is expressed by the word *throw*. Then the class is taught that the way to express that action is to say, "I threw the ball." Having learned that much, the thrower writes the sentence down on the blackboard, and the class repeats the line over and over again, a tendency to wrong accentuation being corrected in each one, as is necessary.

The development of language follows a clearly defined arrangement of grammatical principles. These principles, however, are not given the child as such, but serve as an aid to the teacher in the selection and arrangement of exercises in simple English—such natural English as will most readily lend itself to the needs of the child's daily life. Thus, language is at first interpreted to him by the use of objects, actions, and pictures. The four or five years of the primary course are devoted almost exclusively to the acquirement of language and numbers, with introductory lessons in geography. In the grammar school department arithmetic, geography, history, and natural sciences are taught as nearly as possible according to the best methods employed in an ordinary school. The formation of the speech habit and the reading habit is considered of paramount importance. As soon as the child has been taught spontaneously to express himself in spoken language, and to look for such expression in others, he is shown the delightful things that are to be found on the printed page.

In the modern schools for the deaf, the pupils are not only taught intelligible speech, but trades as well. The older girls are taught wood carving, drawing, cooking, and sewing; the boys are taught printing, cabinet making, drawing, tailoring, etc. The perfection of the oral method of instruction is strikingly noted by the fact that congenital mutes are, at the time of the completion of their course, able to speak so perfectly, that it is difficult to distinguish their voices from those of normal persons. After graduation many pupils enter high schools, and sometimes colleges. Thus the transformation is accomplished, and the once considered unteachable deaf-mute is changed into an intelligent and respected citizen, and the deaf as a class are being highly elevated in public estimation.



Explaining the Names of Familiar Objects by Means of Toys.

TEACHING DEAF-MUTES TO SPEAK.

Stamp Machines for the Postal Service.

Exhaustive tests are to be made of several types of automatic stamp-vending machines adapted to receive one-cent and five-cent pieces for the purchase of one-cent and five-cent stamps and postal cards. Two years ago experiments were made of such devices by the Post Office Department. The committee of experts reported that the machines were somewhat crude, and, while they accomplished the purposes for which they were invented, it was found that they could not be utilized to the advantage of the department.

While department stores, hotels, drug stores, news stands, etc., usually want the privilege of selling stamps, under the regulations of the department or upon their own responsibility, there is certainly no great amount of zeal or alacrity displayed by the persons vending the stamps. The purchaser at times feels that he should apologize for imposing upon the seller, because there is no direct profit in the sale, the privilege of selling stamps being desirable for the purpose of attracting other custom. Stamp vending machines in such places would be of great convenience to the public and no inconvenience to the proprietor of a department store, drug store or news stand, who might be glad to have the business done by machinery instead of being compelled to give personal attention to stamp sales.

The Dulac System of Concrete Pile Foundation.

One of the most interesting of the newer methods of establishing firm foundations for buildings in soft ground was invented by the French engineer Dulac, and was first used on a large scale in the construction of the buildings of the Paris Exposition of 1900, where much time and money were saved by the employment of this novel system.

The compression and stiffening of the ground which are effected by wooden piling are caused by the lateral displacement of earth as the piles are driven in. Dulac produces the same result by omitting the wooden pile and allowing a conical weight, raised by the pile driver, to fall directly on the earth in which it makes a vertical cylindrical hole which is deepened by each successive impact of the weight. After the desired depth has been reached the hole is filled with concrete which is rammed very tightly.

The concrete piling thus formed possesses the great advantage of being independent of the height of the ground water. Wooden piles, on the other hand, must be driven entirely below the lowest water level in order to prevent decay.

The Dulac apparatus consists of a pile driver of the usual construction, 30 or 40 feet high, and three weights of a horizontal diameter of about 30 inches. The weight used in the beginning of the operation is conical, sharply pointed, and weighs two tons. When the hole has attained a depth of a few yards, a weight of parabolic or sugar loaf form, also weighing two tons, is substituted and used until the desired depth is reached. The entrance of water can be prevented by throwing into the hole a quantity of clay which is plastered on the side of the hole by the falling weight. The diameter of the hole, before it is filled with concrete, is only a few inches greater than that of the weights. Holes nearly 40 feet deep have been made by this method.

The filling is commenced by throwing in a quantity of stones and ramming them down with the third weight, which is flat on the bottom and weighs one ton. The effect of the ramming is to broaden as well as solidify the successive layers and thus form a very firm base for the concrete filler. The concrete is then introduced in small portions, each of which is well rammed with both the flat-bottomed and the round-bottomed weights, and the process is continued until no more concrete can be forced into the hole. The compression and lateral distension effected by this method are so great that the volume of stones and concrete employed is about five times the cubic capacity of the original hole. Thus two desirable results are produced. In the first place a number of very strong concrete pillars are formed and, in the second, the soil between these pillars is compressed very forcibly so that it becomes capable of aiding materially in the support of the building.

Hardening an ordinary drill in sulphuric acid, states the English Mechanic, makes an edge that will cut tempered steel or facilitate cutting hard rock. The acid should be poured into a flat-bottomed vessel to a depth of about ⅛ inch. The point of the drill is heated to a dull cherry red, and dipped in the acid to that depth. This makes the point extremely hard, while the remainder remains soft. If the point breaks, re-harden, but with a little less acid in the vessel.

NATURE'S TOUCH-ME-NOTS.

BY PERCY COLLINS.

Nature is no haphazard experimenter. She is striving to promote the strength and fitness of her children, and by the process which we term "natural selection" is constantly weeding out the weaklings and evolving more perfect types. But Nature is not needlessly changeful. When she has discovered a good device she repeats it over and over again.

A striking example of this is seen in protective prickles. Nature seems to have proved that under certain conditions prickles form the best possible protective armament, and she has emphasized her discovery by an enormous number of instances, each brought through a different channel of development to the same conclusion. In the plant world, as every-one knows, prickles are common in the extreme; while, with the exception of birds, every important group of animals possesses its spiny representatives.

The common hedgehog is a well-known type of protective prickliness and its habit of rolling itself into a ball when alarmed must be familiar to all. This action is made possible by its thick layer of subcutaneous muscle, the *panniculum canosus*, which is more developed than in the case of any other animal. The young of the hedgehog, when born, have the prickles soft and white; but soon after exposure to the air they harden and become effective weapons.

The widely distributed porcupines, which get their name from the French *porc-épin*, or "spiny pig," form another interesting group of prickly mammals. The porcupine is a formidable antagonist, rattling its quills and running backward at the enemy, and will often succeed in driving off a jaguar intent upon its destruction. Mammalian prickles are really tightly packed masses of hair. This is well shown in the accompanying photograph of a series of specimens selected from a porcupine skin, showing the complete gradation from an ordinary hair to a perfect, sharp-pointed quill. (Fig. 8.)

Passing over the birds, whose marvelous powers of flight and diving seem to render any highly specialized protective devices unnecessary, we come to the reptiles. Of these, the armor plating of the tortoises and turtles, and the venomous means of the snakes are all-sufficient safeguards. But among the more vulnerable lizards we find numerous examples of protective prickliness. One of the most striking is the Australian moloch, termed the "thorny devil" by the early settlers. This remarkable creature is about eight inches in length, and its skin is studded all over with sharp, conical thorns. The moloch is very sluggish in its habits, feeding mainly upon ants, for which it lies in wait. One would imagine it to be exposed to continual attack from birds and rapacious animals; yet no animal is more perfectly immune. Its prickles are its safeguard. Equally well protected but perfectly harmless lizards are the so-called "horned toads" of California and Mexico. About twelve species of these quaint-looking creatures are known, all being alike in the possession of a formidable array of spines—several long ones at the back of the head, and a vast number of lesser prickles all over the back and limbs. (Fig. 12.)

Of fishes, a large number are protected from hostile attack by a covering of prickles. By far the most curious examples are the globe fishes, or "sea hedgehogs" of the Atlantic and Indo-Pacific oceans. The extreme length of the globe fish is something less than two feet. It has thick lips and goggle eyes which give it the appearance of a good-natured countryman. Courage it seems to lack, and one might suppose that such a simpleton would fall an easy prey to the first shark or dogfish it encountered. Yet the globe fish is able to take care of itself. It never, under any circumstances, attacks the enemy, yet is always ready to receive him in a suitable manner should he provoke hostilities. Let us suppose that a shoal of globe fishes is swimming tranquilly in the clear waters when it is suddenly surprised by a hungry shark. Of course the little fellows scuttle hither and thither in uncontrollable alarm. But the shark, poising himself upon his powerful tail, leisurely singles out one of the fleeing globe fishes, and sets out in pursuit. Now although the globe fish is a good swimmer, it is no match for the shark. The chase is in every way unequal and can have but one ending. Within a few minutes of its commencement the shark must overtake the globe fish. But the quarry is well aware of its danger. It makes a bee-line for the surface, and as soon as it gets there begins to take in great gulps of air. Then a strange thing happens. The fish that only a moment