air. To prevent the shot from catching in the valve, the opening should be above the center of the diaphragm. The position of the opening depends on that of the outlet or injector tube, so that in making it care must be taken to have this tube point to the right place.

The apparatus illustrates very well the principle of the injector. The loss of air represents, besides waste, the condensation of steam that is the actuating force in the injector. Were it worth while, there would be no trouble in carrying out, on a similar plan, the experiment of causing a blast of air of low pressure to drive shot into a vessel of air of much higher pressure.

Natural History Notes.

Diseases of Animals.—According to Dr. J. B. Sutton, animals are not free from certain diseases thought to be referable in man to his erect position. One-fourth of the female monkeys that die in the London Zoological Gardens have displacement of the uterus, and the same disease occurs in the lioness, tapir, Cape hunting dog, pygmy hog, antelope, etc., and in domesticated mammals. Two cases of inguinal hernia in monkeys are recorded, and the disease is said to be common in horses.

Modification of Habits in Ants through Fear of Enemies.—Dr. H. C. McCook gives an account of an unsuccessful raid which he witnessed of *Formica sanguinea* on a nest of *F. fusca*. The instinct for kidnapping has appeared to develop, on the part of those that are the victims, a corresponding strengthening of instinct in the way of concealment. When the latter are not exposed to the acts of the former, they raise above the surface of the ground a mound of more or less considerable size, and over its summit and at the base the gates are scattered without the least attempt at concealment. But when a colony of their enemy is near, they omit or diminish elevations above the surface, their gates are few and cunningly concealed, and quantities of rubbish are scattered around, with the evident intention of hiding the locality of their nest or making the approach to it more difficult. A similar faculty has been observed in *Formica schaufussi*.

Action of the Ultra-Violet Rays in the Formation of Flowers.—Prof. J. Sachs gives details of the experiments from which he has come to the conclusion that the ultra-violet and invisible rays of the solar spectrum are especially efficacious in the development of flowers. The experiments were all made upon the nasturtium (*Tropœolum majus*). If the rays of the sun are made to pass through a solution of sulphate of quinine, the ultra-violet rays are entirely absorbed or transformed into rays of less refrangibility, and which are visible and of a light blue color. If a plant is made to grow behind a screen of sulphate of quinine, the vegetative organs are normally and luxuriantly developed, but the flowers are almost entirely suppressed. Twenty-six plants thus grown produced only a single feeble flower, while twenty-six plants grown under similar conditions behind a screen of water of the same thickness produced fifty-six flowers.

Prof. Sachs believes that extremely small quantities of one or more substances formed in the leaves cause the formative materials which are conveyed to the growing points to take the form of flowers. Acting like ferments, an extremely small quantity of these flower-forming principles may act upon large quantities of plastic substances. It may be assumed, then, that there are three distinct regions of the solar spectrum, differing in their physiological action: the yellow rays and those near them cause the decomposition of carbonic dioxide, and are active in assimilation; the visible violet and the blue rays are the agents in movements of irritation; and the ultra-violet rays are those which produce in the green leaves the substances out of which the flowers are developed.

Sheaths of Algæ.—Some important observations have recently been made on the substance of which the sheath that invests the filaments of some algæ is composed. Herr G. Klebs maintains that it is not formed from the cell wall, but from the contents of the cell, through the cell wall. The sheath substance differs from the ordinary mucilage in not being dissolved by alkalies.

Rabbits in Australia.—Australia is overrun with rabbits, and vigorous measures are now making to reduce their numbers. Notwithstanding that eighteen millions of these animals have been destroyed in less than three years, their number is still so great that sheep can find nothing to browse upon and are obliged to abandon their fields before this invasion. In the colony of Victoria, the government has already spent 24,000 pounds sterling for the destruction of the pest, and private initiative has devoted no less than 15,000 pounds in similar efforts. Land that formerly sold at high figures can now be bought for 10 shillings per acre. More than twelve million acres are overrun, and where, in 1875, 700,000 sheep were raised, no more than 100,000 are now raised. This represents an annual loss of about 480,000,000 pounds sterling.

Root Buds.—One of the distinctions between roots and stems was formerly stated to be the appearance of leaf buds on the latter and their absence from the former. The *Gardeners' Chronicle* illustrates the formation of leaf buds on the fibrous roots of a fern (*Diplazium malabaricum*) and suggests that it will ultimately be found that buds and sporangia of all kinds are variants from a common type.

Tubercles on the Roots of the Leguminosæ.—Mr. H. M. Ward finds that the tubercles on the roots of leguminous plants are due to a parasitic fungus. He claims to have found the infecting agent and to have produced the tubercles by infection from without. When the tubercles decay, the germ like bodies pass into the soil and infect other roots. On the other hand, Mr. Tschirsh maintains that these tubercular bodies are the natural storage organs for nitrogenous substances previous to the ripening of the seeds, and attain their fullest development while the plant is in flower.

TALCOTT'S COMBINATION BELT HOOKS.

The annoyance and delay incidental to the old process of lacing belts is one of the time-honored traditions of engineering.

In the Talcott belt hook there are three rows of points—a single row on one side, termed the clinch points (Fig. 1), and a double row of points on the other

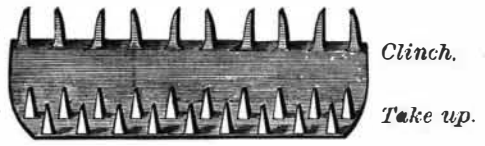

Fig. 1.—TALCOTT'S BELT HOOK.

side of the hook, which hold in the belt by wedging it against each other, and they are not as long as the belt is thick. But the clinch points, being longer than the belt is thick, are riveted down as shown in Fig. 2.

Whenever the belt becomes slack and requires to be shortened, it can be pulled away from the double row of points, marked "take up," and, after cutting to the right length, the belt can be quickly replaced on the same points. The fastener is light and narrow and the edges rounded and beveled, so they will be perfectly smooth when the belts are slipped by hand. This belt

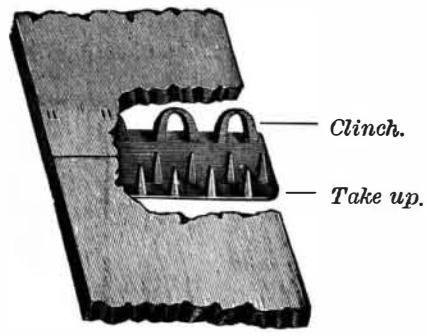

Fig. 2.—AS APPLIED TO BELT.

hook is extensively used and gives much satisfaction. W. O. Talcott, of Providence, R. I., sole manufacturer, will send samples free.

Progress in Telephony.

Few inventions of modern times took the public more by surprise than did the telephone, a result due not more to the marvelousness of the thing done—namely, the transmission of spoken words along a telegraph wire—than to the simplicity of the means by which it was accomplished. Seldom, also, has an invention given rise so soon to an important industry. Five years ago the telephone was being viewed by the *savants* of the British Association with the interest attaching to the very latest novelty in scientific toys. It is now employing in the United Kingdom alone more than ten millions of capital, and earning over $750,000 in dividends. The practical instrument of to-day, however, differs considerably from the scientific toy patented by Professor Bell.

For communicating over short distances, as between the various parts of a house, or between neighboring premises, the original Bell telephone is a sufficiently satisfactory instrument. Its currents, however, are too feeble for telegraphic circuits of any considerable length. Modifications have been made, with the view of adding to the volume of sound. Edison was the first to effect this, by causing the diaphragm spoken against to press upon a carbon button; and Professor Hughes carried the use of carbon still further in his invention of the microphone. By the employment of the latter, the lowest whisper was found to be loudly reproduced in the telephone.

The original Bell receiver has been but slightly modified, with the result, however, of giving increased loudness. It is now the opinion of competent electricians that the telephone, as a speaking instrument, is well nigh perfect, and that the difficulty of making it practically useful under all circumstances is almost wholly due to disturbing external influences.

A hundred miles is as yet the maximum distance through which speech, or indeed any definite sound, has been transmitted by submarine cable. The chief practical difficulties in working the telephone are due to the fact that when an electric current is passing along a wire it has the property of producing a current of opposite character in any wire in its vicinity. This is what is known as induction, and it is owing to this faculty that the words spoken on one wire can be overheard on an adjoining one. If the neighboring wire should be telegraphic, the feeble current of the telephone is overpowered by its stronger neighbor, and it is difficult, if not impossible, to catch the transmitted words amid the din—compared to the noise of a pot boiling—caused by the telegraph. Still more fatal to all telephonic communication is the presence of an electric lighting system in the vicinity of telephone wires, the powerful current necessary for lighting purposes causing "an incessant roar that renders speech an impossibility." Many plans have been tried for overcoming the unpleasant consequences of induction, the most successful of these being that of using an additional return wire instead of utilizing the earth for the completion of the circuit. The two wires are placed in close proximity, with the result that the disturbing influence is completely neutralized.

In no direction has telephony progressed more than in the extent to which it has been adopted as a convenient mode of communication. Already the telephone exchange system is being worked in almost all the principal cities and towns of Europe and America. Paris has its central exchange, with nearly a thousand wires converging upon, besides several branch exchanges connected with, the central one. The Parisians avoid the unsightliness and danger of a great network of overground wires by placing the telephone wires in the sewers. In Belgium there are not only exchanges for telephonic communication within the towns, but those of different localities are connected by trunk lines, a much wider area of intercommunication being thus established. Nowhere is the system better organized than in Berlin, where there are four exchanges, besides two public telephone offices, in which any person, on payment of sixpence, is permitted to have five minutes' conversation with any one whose house is connected with the central office. The Berlin Bourse is also provided with nine chambers, in which the necessary quiet for holding telephonic communication is obtained by the thick padding of the chamber walls. The telephone industry has, however, made the greatest progress in the land of its birth, there being telephone exchanges in at least 860 towns in the United States. In New York alone there are exchanges with over 7,000 subscribers, besides 2,500 private telephone wires.—*Extract from Iron and Steel Trades Journal.*

Fatal Encounter with Sharks.

James E. Hamilton, the mail carrier between Miami and Lake Worth, on the South Atlantic coast, was devoured by man eaters at Hillsboro Inlet, on October 18. He was a stout, athletic young man, and carried the mail between the two places, a distance of seventy-five miles, on his back, walking on the beach most of the way. The inlet is a dangerous crossing, the back waters of the Everglades meeting the tides and producing heavy and dangerous seas. Sharks of the most ravenous kind abound there. An old fisherman named Waring, who was within half a mile of Hamilton when he began crossing, describes the tragedy as a horrible occurrence. When Hamilton reached the middle of the inlet the sharks flocked about his boat, leaping ten feet or more out of the water in their eagerness to get at human flesh.

Hamilton fought them with his oars, but soon both were bitten off and dashed out of his hands. Then they assailed the boat, tearing huge pieces off the gunwale. Soon it began to sink, and Hamilton became stupefied with fear. Another blow on the frail boat, and he was thrown headlong into the masses of fierce sea wolves. One shriek of agony, and all was over. The sea was dyed for yards around with his life blood. Searching parties were sent out, but nothing was found. Hamilton's death was such a horrible one that no mail carrier over that route has yet been secured.

Agglomerate Leclanches.

MM. Bender and Francken give the following recipe for making agglomerate Leclanche cells:

	Per cent.
Manganese peroxide	40
Graphite	44
Gas tar	9
Sulphur	0·6
Water	6·4

These substances, says the *Revue Scientifique*, are reduced to a fine powder—gas tar and water apparently included—they are then carefully mixed, placed in a mould, and strongly compressed. The mixture is then gradually raised to a temperature of 350° C., which not only evaporates the water, but also drives off the volatile elements of the gas tar. This result is aided by the presence of the sulphur. A portion of the sulphur combines with the gases derived from the tar and disappears, while the remainder is said to combine with the solid ingredients, producing an unassailable compound, by a transformation analogous to that of the vulcanization of India rubber.