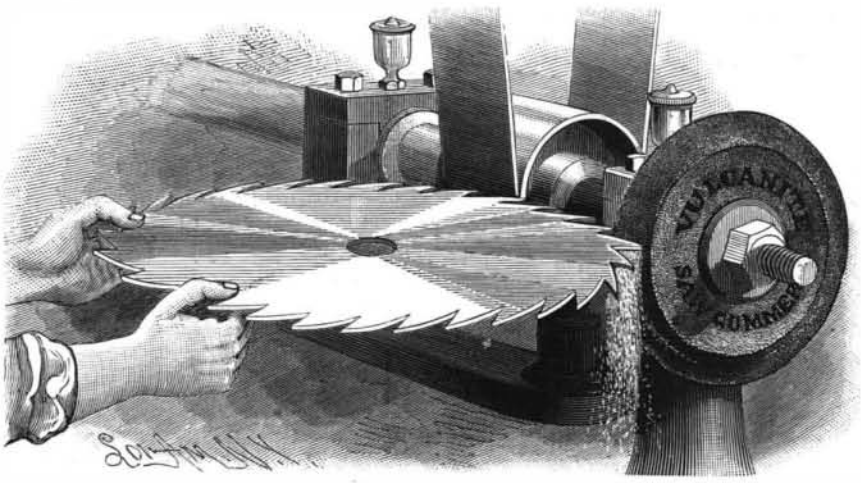
EMERY WHEELS FOR GUMMING SAWS.

In the illustration herewith, the operation of gumming saws with an emery wheel is vividly represented, the frame affording sufficient support for the side of the saw where the teeth are being ground, and the arrangement being a simple one, readily made at any work bench or machine where a shaft is run upon which an emery wheel can be placed. The operation itself involves only the simplest mechanical knowledge and but a rudimentary experience in the handling of tools, yet the desirability of this method of sharpening saws is largely dependent upon the kind of emery wheel used and the rate of speed at which it is run.



EMERY VULCANITE SAW GUMMER.

The vulcanite emery wheels made by the New York Belting and Packing Company have especial advantages for this kind of work. They are strong and safe at the highest speed at which it is desirable to run them, the company recommending that they never be run at a less rate than 6,000 feet per minute circumferential speed, and from that up to 8,000 and 10,000 feet per minute, although the lowest named speed is rather above the ordinary limit of many other kinds of emery wheels, and attempts to run other wheels at or beyond this limit have frequently resulted in serious accidents, from the breaking of the wheels. The higher rate of speed, which not only cuts faster, but, in the case of the vulcanite emery wheel, prolongs the life of the wheel, is concededly safe with the vulcanite wheel. Thus run, it is not likely to wear out of true, the operator does not have to bear on so hard, and the wheel retains its shape much better than when run at a slow speed. The nature of the wear of the working surface in the vulcanite wheel is claimed to be essentially different from that in wheels where the emery is fixed in its place by other methods, the rubber affording an elastic foundation or cushion, from which the particles of emery slightly protrude. This not only insures more efficient work from the cutting edges of the emery, as they become changed by use, but allows of more access of air to the work, thus tending to prevent casehardening of the edges of the metal being ground.

In addition to wheels with bevel shaped grinding surfaces, as represented in the engraving, the company also make wheels with round grinding surfaces, and this kind is always considered best for large saws.

THE FRILLED SHARK—THE OLDEST LIVING TYPE OF VERTEBRATES.

In technical terms this is a living species of ceadodont shark, named by Mr. Garman *Chlamydoselachus anquincus*.

The specimen here figured was found in a miscellaneous collection of fishes, etc., in alcohol, furnished the Museum of Comparative Zoology by Professor H. A. Ward, who purchased them in Japan. It was soon recognized as not only belonging to a new family, but one closely allied to certain forms supposed to have become extinct in the Carboniferous time. This discovery displaces *Ceratodus* from the position of the oldest living type of the vertebrata.

The term Chlamydoselachus is applied on account of the curious frill-like mantle that surmounts the first gill cover. The term is made up of two Greek words implying mantle and shark. Six gill openings, and certain structure of the brain, remove this form from the present known sharks. Its affinity to some of the earliest known sharks, those of the middle Devonian, render it of great interest and importance to science. The family characters which this form represents, under the term *Chlamydoselachidæ*, are: Body elongate, with a depressed head. The eyes are lateral, with no nictitating membrane. The nasal cavity is separate from that of the mouth. The mouth is situated anteriorly, like that of some fishes. The teeth have broad, backward extended bases and slender cusps. The spiracles are present. One dorsal fin, spineless, is present. There is also an anal fin, and a caudal with no pit at its root. The first gill cover is free across the isthmus. The intestine has a spiral valve.

The generic characters are: Six gill openings, opercular flap, first gill cover, broad. Teeth similar in both jaws; each with three slender, curved, subconical cusps, separated by a pair of rudimentary denticles or a broad base. There is no median upper series of teeth in front, but there is a series below, on the symphysis. The mouth is wide, and has no labial folds at the angles. The pupil is horizontally elongate; the fins are broad, the caudal without a notch.

The total length of this shark is nearly five feet. Its greatest width, across the ventrals, is seven inches. Its resemblance to a snake is very striking. Its elongated body, long, flattened head, anterior mouth, and sinister expression of the eyes are quite suggestive of the ophidians. There are fifty-one rows of teeth, and six teeth in each row; the whole number at one time in function is 306. The brain is very small.

The present state of icthyological science recognizes eliminations that have been made from its main body. Comprehensively, a fish is a cold-blooded vertebrate, adapted for life in the water, breathing by means of gills, having the limbs, if present, in the form of fins, the smaller members being represented by cartilaginous rays connected by membrane. One or more fins are developed on the median line of the body.

The lancelets, myzonts, myxinoids, hag fishes, lampreys, sharks, and rays are recognized as differing sufficiently from the true fishes to entitle them to places of class distinction.

The true fishes form one class; the elasmobranchs, sharks, and rays, another class; the marsipobranchs, myxinoid fishes, hag fishes, and lampreys, a class; and the lancelets and cirrostomes, a class. It will be seen, then, that technically there are four classes of fish-like vertebrates, where but one—fishes—has heretofore been recognized. The lancelets, as is well known, are the lowest in the scale, their structure being extremely simple. The skull in this class is undeveloped, the brain not distinctly differentiated, nor is there any heart.

The term Leptocardii, which designates this class, means thin heart, in reference to the simplicity of this portion of the arterial system.

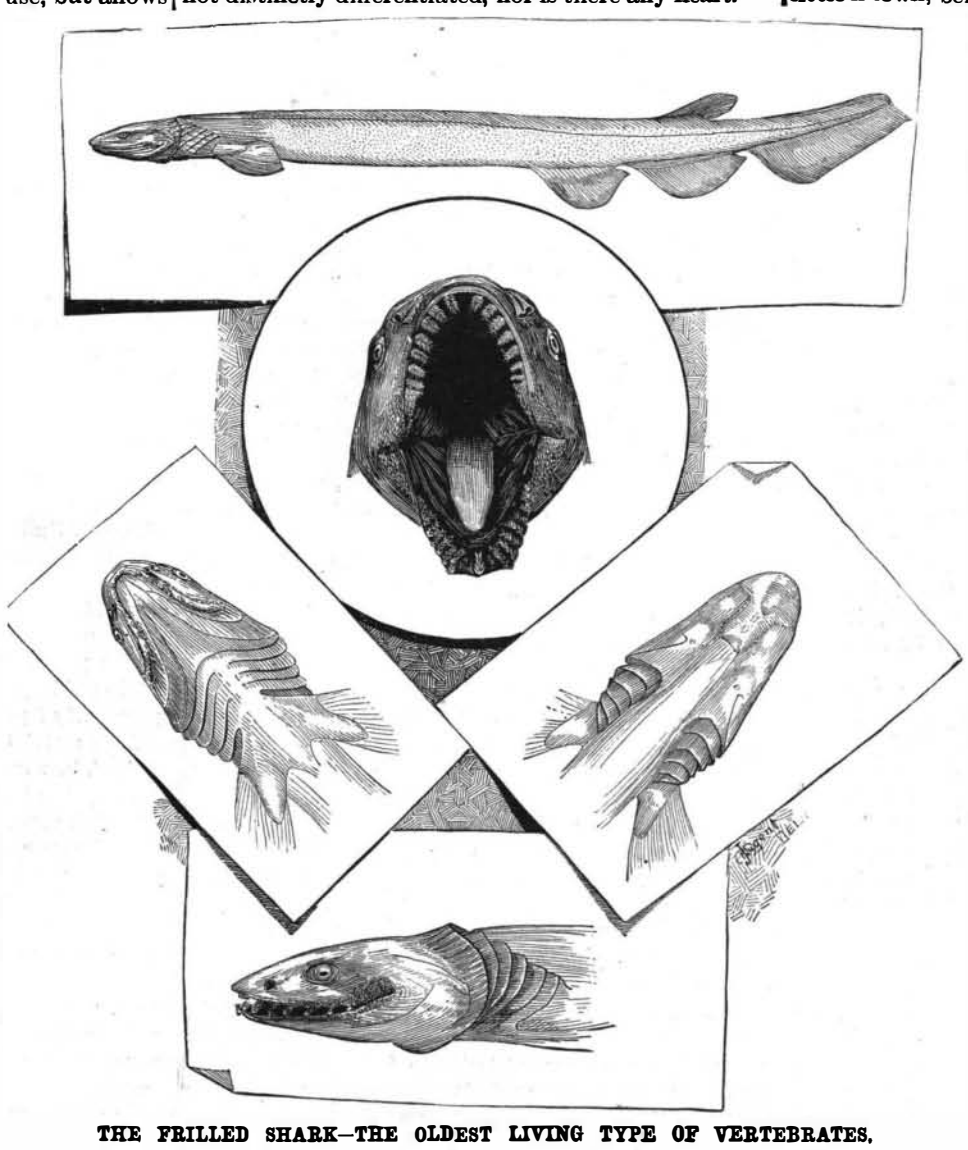
At first sight of the mouth of the frilled shark, which is figured here, the teeth have a singular and wholly unnatural appearance, appearing like indented, leaf-like organs; but it is seen that there are three fangs, serpent-like, on a base, and several rows of them give the peculiar appearance, arranged as they are consecutively from before inward.

The Port Jackson sharks, of the family *Heterodontidæ*, have long been regarded as of great interest to paleontologists, from their being closely related to some extinct sharks. Under the term Cestracion (now *Gyropleurodus*), these sharks are known to naturalists. A species, *G. francisci*, is now found off the coast of California.

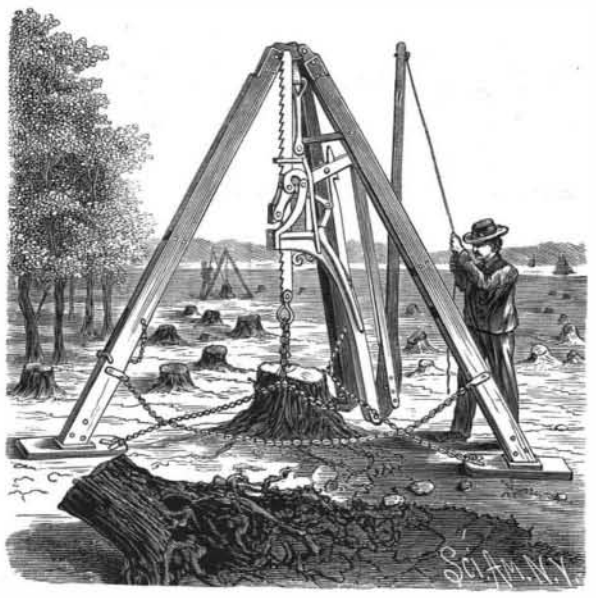
Cestracion phillipi is found in the Australian seas. The term cestracion is from the Greek *kestra*, a weapon. Many of the extinct species are known by the preservation of this spine, which being of more durable structure is preserved after all other traces of the creature have passed away.

The mouth of the frilled shark, as seen in our engraving, is peculiar appearing for a shark, as this important part is usually situated far beneath. In this respect, the anterior aspect of the mouth, there is resemblance to that of the great rhinodon, the largest living fish, measuring 70 feet in length. The general appearance of this shark is, however, extremely different from that of the frilled shark. The rhinodon is immensely bulky, the head being quite as deep and wide as any other portion. A very interesting structure, and one little known, belonging to the latter is a set of whalebone-like fringes along the gills, arranged comb-like. These frills have much the same functions of those in the whalebone or right whales. The food of the creature is mostly of sea jellies and other soft pelagic animals, which are strained into the throat by means of this adaptation. The great basking shark has this structure. This shark has been taken off Block Island measuring, according to authority, nearly seventy feet. It is the *Cetorhinus*, or bone shark, also so called. Large as these creatures are, they are harmless, most fortunately, their teeth being very small. Their food being of gelatinous animal matter, the masticating apparatus is not required to be of any considerable size or strength. The more harmful sharks are of moderate dimensions, in which the teeth are very large. In the largest species of "maneater" shark living, the teeth are about two inches in length. Some of the great carcharodon-like fossil sharks have teeth measuring five inches and a half in length. One in my possession has that measurement. Judging from the size of the shark, which has a tooth two inches in length, the extinct species here indicated must have been much over one hundred feet in length. Such enormous size can more readily be accommodated in the vast ocean than that of the great land beasts on their appropriate element. I am indebted to papers on this subject by Mr. Garman, of Cambridge, Mass., for material of this account.

J. B. H.



THE FRILLED SHARK—THE OLDEST LIVING TYPE OF VERTEBRATES.



TICHENOR & WALKER'S IMPROVED STUMP PULLER.

[FOR DESCRIPTION SEE PAGE 132.]

IMMEDIATELY after eating, a person weighs more than before it.