consists of a series of ten spots along the region of the alimentary canal and lower part of the tail, a black spot about the end of the tail and another at the tip of the lower jaw, with a few cells on the upper jaw.

Especially noteworthy is the development of enormous fang-like teeth, four pairs in each jaw. The upper decrease in length from the front backwards, while those of the lower jaw are nearly of uniform size.

When first hatched the larvæ floated vertically, near the surface, heads up, tails down. Later they assumed the horizontal position and explored all parts of the vessel in which they were contained, progressing in approved eel fashion and biting at nearly everything touched.

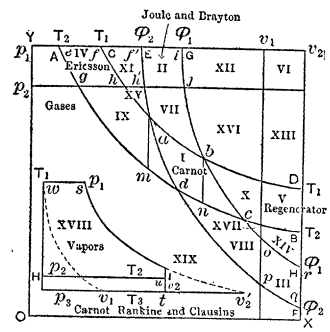
The evidence that the eggs are those of the Conger is not positive. If Grassi is right, these eggs cannot belong to the common eel. The Conger eel is the only other one abundant in the region in which the eggs were collected and was caught in numbers at the time the eggs were collected. The serious objection to referring them to the Conger is the large number of segments in front of the anus. Since, however, according to Grassi, the anus migrates to near the end of the tail during the changes to the Leptocephalus stage, the number of segments in front of the anus is probably not positively available in the identification of the larva.

Carl H. Eigenmann.
Woods Holl, Mass., August 25, 1900.

HEAT-ENGINE DIAGRAMS.

The accompanying diagram, in which are shown the possible compositions of the four standard thermodynamic lines in the formation of heat-engine diagrams or thermodynamic cycles, has been found so useful during twenty years' experience in its employment that it has seemed possible that it may prove deserving of extended publication. It has just been engraved in this particular form for illustration of a new edition of the 'Manual of the Steam-engine.' Gas-engine cycles are seen to number no less than seventeen, of which a large proportion are mechanically and kinematically practical, and a half-dozen of which have been adopted or designed by engineers.

The Carnot, or Sterling—*I, a b c d*—and its equivalent, *a b n m*, or *V*, the regenerator cycle, only, it is recognized, can yield maximum efficiency, as a thermodynamic



proposition; but the Joule, or Brayton, and the Ericsson, among the gas-engine cycles and the Rankins and Clausius among vapor-engine cycles have been found available by designers and builders, and it is probable that, among the infinite number of conceivable cycles outside the class here illustrated, many may be found capable of meeting the demand of the engineer for a practical union of thermodynamic, mechanical and kinematic closed cycles.

The production of the cycle of Carnot is not a difficult task as a matter of design but, in the case of the gas-engine, it involves too extensive a variation of volume to find place in application. It is far more practicable with vapor-engines and Cotterill long since suggested a practical approximation of which the engineers of our own day are beginning to avail themselves.

R. H. Thurston.