of *Lepidodendron, Calamites* and *Artisia*. Like the concretions, these fossils are generally considerably lighter in weight than the ordinary rock. It is interesting also to note that I found several thin veins of turquoise in the slates of the railroad cut above mentioned. The same mineral had been previously observed in thin veins in a much more highly crystalline mica schist a few miles distant from this locality. Mr. Franklin has also given me a piece of quartz showing free gold which he says he found in the same slates that carry the fossils, and indeed in the near vicinity of this find, precisely similar slates, to all appearance, carry quartz veins that have been worked for gold for many years. I collected the fossils along this belt of slates for a distance of a mile or more, and while they are not particularly abundant, I was able in the course of an hour to get fifty or more specimens.

Mr. David White, to whom the best specimens were sent, writes me as follows: "The fossils you sent me are most interesting and important on account of their bearing on the classification of the formation from which they were derived. The biological problem is hardly less interesting to me, for it is but the second lepidophytic cone fragment showing microscopical structure that has turned up in our Paleozoics, so far as I am aware. Another larger specimen in hand is from a Carboniferous limestone in the Indian Territory. Your specimens represent several fragments of large cones in which the axes, the basal, sporangiferous portions of the spirally arranged bracts, the rhomboidal compressed sporangia and the megaspores are well defined. Precise identification of the material is deferred pending the study of thin sections and the determination of certain points regarding the sporangial walls and their attachment to the basal portions of the bracts. It is clear, however, that we have here fragments of cones whose superficial features appear to represent the common *Lepidostrobus* type of the upper Paleozoic. Beds containing lepidophytic remains of this type can hardly be older than Devonian at earliest, and should not antedate the Middle Devonian.

"The general proportions and aspect of the cones are suggestive of some of the Carboniferous forms. Although the internal structure of the strobili may be found to indicate a more highly organized genus than *Lepidostrobus*, we may rest assured that the material is not older than the Upper Paleozoic lepidophytes."

We can now safely say that the Ocoee of Alabama includes the metamorphosed sediments of more than one of the Paleozoic formations, but it may be doubted if conclusive paleontological evidence of the age will be found in many cases, since the fossils will inevitably be obliterated in all the more highly crystalline of these schists.

Eugene A. Smith.

University of Alabama,
June 6, 1903.

BOTANICAL NOTES.

TWO INTERESTING PARASITIC PLANTS.

In a recent bulletin of the Kentucky Experiment Station, Professor Garman describes two parasitic plants which are considerably out of the ordinary line. They are the broomrapes of the genus *Orobanche*. They are small plants related to the figworts, but destitute of any green color. Their roots are attached to the roots of various plants, and in this way they steal the food matters which, were they honest, they would secure for themselves from the soil and air. The first species described, *O. ramosa*, is parasitic to a considerable extent on tobacco and hemp in Kentucky, doing a good deal of damage. The second is *O. ludoviciana*, a native species very common on the western plains. This is also found to be parasitic on the hemp in Kentucky. These two species have been carefully investigated by Professor Garman, and he makes some suggestions in regard to their eradication. He finds that is impracticable to remove the parasites from the growing crop of hemp, but it is practicable to remove them from the tobacco crop. It is found impracticable to remove the rape seeds from hemp seed by flotation. Soak-

ing the hemp seed in bluestone solution will kill the rape seeds, but not the hemp. Water heated to 140° F. appears not to hurt hemp seeds, but the rape seeds are destroyed by this temperature. It is found that the rape seeds maintain their vitality for at least thirteen years in the soil. Professor Garman insists upon it that by the use of improved machinery the rape seeds may be largely removed from the hemp seed. The application of lime, salt, etc., to the soil is found to have no value.

THE STUDY OF GALLS.

SOME time ago a notice was made in these columns of a book of Edward Connold, of England, entitled 'British Vegetable Galls,' and the suggestion was made that in America this field of inquiry is practically uninvaded. We are glad to know that Professor M. T. Cook, of DePauw University, has been giving attention to these structures for some time. We have before us two bulletins issued by the Ohio State University devoted to 'Galls, and Insects Producing Them,' by Professor Cook. This article is a preliminary publication which promises a much more extended publication in the future. The article as at present published includes 'Morphology of Leaf Galls,' 'Apical Bud Galls,' 'Lateral Bud Galls,' 'Stem Galls' and 'Development of Galls.' It is the intention of Professor Cook to continue this work, enlarging the scope of his inquiries until he has material enough for an extended publication. We may, therefore, confidently expect an American volume comparable to Connold's British volume referred to above.

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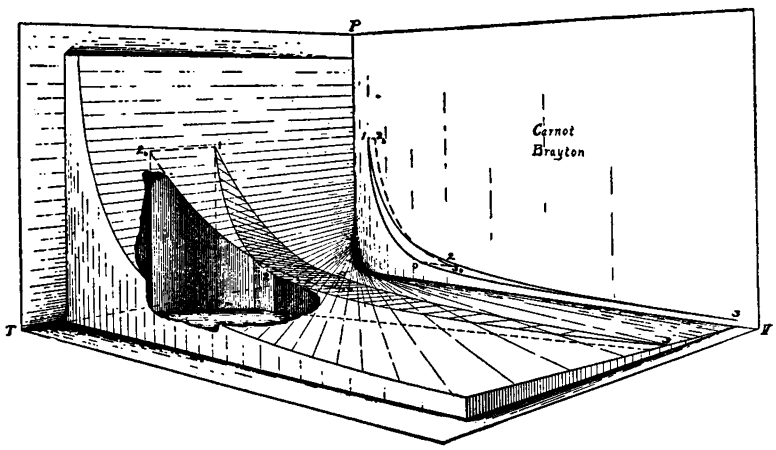
'GRAPHICS OF THERMODYNAMICS.'

MESSRS. BATES AND WELBORN, in the *Sibley Journal of Engineering*, present an interesting study of the relations of five gas-engine type-cycles and graphically exhibit their characteristics in three-dimension diagrams which strikingly illustrate the text.* A common compression line is assumed and the same amount of work is performed by each cycle; all performing similar work with similar heat-supply, under these conditions, as indicated by Röntgen's theorem.



Characteristics of Cycles.

All heat-engines employing a perfect gas as working substance, in a cycle composed of a pair of adiabatics crossed by a pair of isodia-

* *Sibley Journal of Mechanical Engineering*, June, 1903, p. 372. *Vide* 'Thermal Lines on Isometric Planes,' *Sibley Journal*, February, 1900, by R. H. T.; 'Graphic Diagrams and Glyptic Models,' *Jour. Franklin Inst.*, January, 1896, by R. H. T.