NOTES ON FRESH-WATER COPEPODA IN THE UNITED STATES NATIONAL MUSEUM.

By C. Dwight Marsh,

Of the United States Department of Agriculture, Washington.

The collections on which these notes are based have been in the United States National Museum for some years, and most of them were obtained in connection with the work of the United States Fish Commission. The Florida collections were made by Dr. W. C. Kendall, those from Sodus Bay by Mr. A. C. Weed; the Mississippi, Louisiana, and Axton, New York, material was obtained by Dr. B. W. Evermann, and the western collections by Doctor Evermann, Drs. Evermann and Meek, Meek and Alexander, and Messrs. Cox and Ulrich.

Following is a list of the localities in which copepods were found and the names of the species identified in each:

COPEPODA FOUND IN PLANKTON COLLECTIONS RECEIVED FROM UNITED STATES NATIONAL MUSEUM IN 1911.

Woods Hole, Massachusetts, fresh-water pond:
Diaptomus leptopus, var. *piscinæ* Forbes.
Cyclops viridis, var. *americanus* Marsh.
Sodus Bay, New York:
Hotel dock, Leroys Island, to sandbar—
Diaptomus reighardi Marsh.
Cyclops albidus Jurine.
Cyclops viridis, var. *brevispinosus* Herrick.
Sand bar to south end of Nub Island—
Diaptomus reighardi Marsh.
Cyclops viridis, var. *brevispinosus* Herrick.
East side, Leroys Island—
Cyclops albidus Jurine.
Cyclops serrulatus, var. *elegans* Herrick.
Cyclops leuckarti Claus.
Cyclops viridis, var. *brevispinosus* Herrick.
Diaptomus reighardi Marsh.
South end of Nub Island to hotel dock, Leroys Island—
Cyclops viridis, var. *brevispinosus* Herrick.
Cyclops albidus Jurine.
Diaptomus reighardi Marsh.

Axton, New York:
Rock Pond—
Cyclops leuckarti Claus.
Cyclops strenuus Fischer.
Pickerel Pond—
Cyclops leuckarti Claus.
Lake George, Florida:
South end—
Eurytemora affinis Poppe.
Cyclops prasinus Fischer.
Cyclops, immature, probably *leuckarti*.
Diaptomus, immature.
Four miles south of Draytons Island—
Cyclops prasinus Fischer.
Diaptomus, immature, probably *dorsalis* Marsh.
Middle of lake—
Diaptomus dorsalis Marsh.
Cyclops leuckarti Claus.
Lake Monroe, Florida:
Middle—
Diaptomus dorsalis Marsh.
Cyclops leuckarti Claus.
Upper end—
Diaptomus dorsalis Marsh.
Cyclops leuckarti Claus.
Middle, between Sanford and Enterprise—
Diaptomus dorsalis Marsh.
Cyclops leuckarti Claus.
Just below railroad wharf—
Cyclops serrulatus Fischer.
Little Lake George, Florida:
Opposite Beecher Point—
Eurytemora affinis Poppe.
Diaptomus dorsalis Marsh.
Cyclops prasinus Fischer.
Cyclops leuckarti Claus.
No locality indicated—
Eurytemora affinis Poppe.
Diaptomus dorsalis Marsh.
Cyclops leuckarti Claus.
Cyclops serrulatus Fischer.
Cyclops prasinus Fischer.
Station No. 3, at black beacon 65—
Eurytemora affinis Poppe.
Cyclops prasinus Fischer.
Diaptomus dorsalis Marsh.
Locality illegible—
Eurytemora affinis Poppe.
Cyclops prasinus Fischer.
Diaptomus dorsalis Marsh.
About middle—
Cyclops prasinus Fischer.
Station No. 1, black beacon 67—
Eurytemora affinis Poppe.
Cyclops leuckarti Claus.

St. John's River, Florida:
Opposite Palatka—
Cyclops prasinus Fischer.
Cyclops, immature, probably *leuckarti*.
Diaptomus, immature.
Fort Gates—
Eurytemora affinis Poppe.
Cyclops prasinus Fischer.
Diaptomus dorsalis Marsh.
Black Bayou, Mississippi:
Eurytemora affinis Poppe.
Cyclops albidus Jurine.
Flat Lake, Louisiana:
Cyclops albidus Jurine.
Eurytemora affinis Poppe.
San Marcos, Texas:
Cyclops albidus Jurine, immature.
Saginaw River, Michigan:
Cyclops serrulatus Fischer.
Cyclops albidus Jurine.
Gamblis Lake, Idaho:
Epischura nevadensis Lilljeborg.
Cyclops serrulatus Fischer.
Cyclops leuckarti Claus.
Cyclops albidus Jurine.
Lake Pend Oreille, Idaho:
July 6—
Cyclops bicuspidatus Claus.
Diaptomus ashlandi Marsh.
Epischura nevadensis Lilljeborg.
Mountain Creek, June 27—
Epischura nevadensis Lilljeborg.
Diaptomus ashlandi Marsh.
Alturas Lake, Idaho:
8 p. m.—
Diaptomus, no mature males, probably *tyrelli* Poppe.
Cyclops viridis Jurine.
6.30 p. m.—
Diaptomus, numerous, immature.
Cyclops viridis, var. *americanus* Marsh.
8.10 a. m.—
Diaptomus, numerous, immature, probably *tyrelli* Poppe.
Cyclops viridis, var. *americanus* Marsh.
7 p. m.—Same as above.
8 p. m.—Same as above.
Lake Washington, Washington, east side:
Diaptomus ashlandi Marsh.
Epischura nevadensis Lilljeborg.
Tsiltcoos Lake, Oregon:
Epischura nevadensis Lilljeborg.
Crater Lake, Oregon, towing from landing to island:
Diaptomus, one female, perhaps *franciscanus* Lilljeborg.
Del Monte Lake, Monterey, California:
Cyclops viridis, var. *americanus* Marsh, 2 specimens.

Hocketts Lake, California (in Kern River region):
No copepods, but from other collections from Hocketts Lake were identified—
Cyclops albidus Jurine.
Cyclops serrulatus, var. *montanus* Brady.
Diaptomus signicauda Lilljeborg.

While most of the localities are new for the species, in the majority of cases no special significance is to be attached to the new facts of distribution. *Cyclops bicuspidatus, C. leuckarti, C. albidus, C. serrulatus,* and *C. prasinus* occur not only all over the United States, but are common in Europe and Asia, while some of these species extend their range to Africa without any change of structure. *C. viridis* in its varieties *brevispinosus* and *americanus* occurs everywhere in the United States. The localities for *Epischura nevadensis, Diaptomus ashlandi,* and *D. tyrelli* are not new. The localities of the other species, however, are of particular interest and justify the more extended statement following.

DIAPTOMUS LEPTOPUS, var. PISCINÆ Forbes.

This variety was originally described from collections made in Montana. It has also been found in Manitoba, Alberta, and Colorado. *Diaptomus leptopus* has seemed to be confined largely to the Mississippi Valley, although it has been reported from Massachusetts. *Diaptomus leptopus,* var. *piscinæ* has not before been reported from the eastern United States, so that its occurrence at Woods Hole is a matter of some interest.

DIAPTOMUS DORSALIS Marsh.

This species was first found in collections made by Prof. E. A. Birge in southern Louisiana, and up to the present time this has been the only locality for the species. Its occurrence, therefore, in great numbers in the collections made in Florida is of importance as extending the range of the species, because without doubt it will be found at intervening points. It was found in Little Lake George, Lake Monroe, and in the St. Johns River as far down as Palatka.

DIAPTOMUS REIGHARDI Marsh.

Specimens of this species were found in the collections made by Mr. A. C. Weed in Sodus Bay, New York, July 26 and August 9, 1909. These specimens are of much interest. *D. reighardi* was described from material collected from a lake on Beaver Island in Lake Michigan, and from Intermediate Lake, in the northern part of the southern peninsula of Michigan. It was later found in collections made by Dr. R. H. Ward in Crooked Lake, Michigan. Although extensive collections have been made in the other lakes of Michigan and in Lake Michigan, it has never been found in any other locality, and the supposition has been that it was a rather closely localized species. From its-

occurrence in Sodus Bay it is assumed that it will eventually be found in bodies of water between Michigan and New York, and from the fact that Sodus Bay is connected with Lake Ontario it might be expected in that lake. The New York specimens correspond in every detail with those found in Michigan.

EURYTEMORA AFFINIS Poppe.

This species is found very abundantly in many places on the coast of Europe, in salt, brackish, and fresh waters. It was first reported in America by Herrick,[1] who says that it lives in the shallow bays and estuaries along the Gulf of Mexico. Foster,[2] 1904, gives definite localities near New Orleans, and Pearse,[3] 1906, records its occurrence on Nantucket Island, Massachusetts. Therefore its occurrence in great numbers, in the museum collections from the St. Johns River and Little Lake George, is no more than would be expected. Its occurrence in Flat Lake, Louisiana, and Black Bayou, Mississippi, however, is of a good deal of interest. Flat Lake is about 40 miles from the Gulf, while Black Bayou is more than 200 miles from the Gulf, and has an elevation of 144 feet. Inasmuch as *Eurytemora affinis* is commonly considered a salt-water form which is capable, after migration, of continuing its existence in brackish or fresh water, it is rather surprising to find it at a place so remote from salt water as Black Bayou.

It may be noted, in this connection, that Nordqvist [4] states that *Eurytemora lacustris* is found in lakes from 207 to 252 meters above the sea.

CYCLOPS STRENUUS Fischer.

Cyclops strenuus Fischer, Bull. Soc. Imp. Moscou, vol. 24, 1851, pp. 419–425, pl. 9, figs. 12–22.—G. O. Sars, Forh. Vid. Selsk. Christiania, 1863, p. 236.—Brady, Mon. Copepoda Brit. Isles, vol. 1, 1878, pp. 104–105, p. 119, figs. 1–7.—Herrick, 12th Ann. Rept. Geol. Nat. Hist. Surv. Minnesota, 1884, p. 147.—Daday, Math. és természettud. Közl. Vonatk. a haz. viszony., 1885, pp. 216–218.—Vosseler, Jahresh Ver. vat. Nat. Württemberg, 22 Jahrg., 1886, p. 195, pl. 14, figs. 18–22.—Richard, Rev. Sci. Bourbonnais, vol. 1, 1888, pp. 61–62.—Lande, Materyjaly do Fauny Skorupiakow Widlonogich Krolestwa Polskiego. Widlonogi Swobodnie Zyjace. I, Rodzina Cyclopy, 1890, pp. 53–55, pl. 21, figs. 156–163, 165.—Schmeil, Zeitschr. Naturw. Halle, vol. 64, 1891, p. 24.—Brady, Nat. Hist. Trans. Northumberland, Durham, and Newcastle-upon-Tyne, vol. 11, 1891, p. 73, pl. 2, figs. 1–4.—Richard, Ann. Sci. Nat. Zool., vol. 21, 1891, pp. 227–228, pl. 6, fig. 18.—Schmeil, Deutschlands freilebende Süsswasser-Copepoden, Part 1. Cyclopidæ, 1892, pp. 39–51, pl. 2, figs. 12–15.—Lande, Mem. Soc. Zool., vol. 5, 1892, p. 161.—Richard, Rev. Biol. Nord de la France, vol. 5, 1893, p. 4.—Schmeil, Abh. Naturf. Ges. Halle, vol. 19, 1893–5, pp. 20–23.—Herrick, Second Rept. State Zool. Minn., 1895, p. 99, pl. 23, figs. 12–13.—Steuer, Verh. Zool.-bot. Ges., Wien, 1897, p. 4.—Matile, Bull.

[1] Twelfth Ann. Rept. Geol. and Nat. Hist. Surv. Minn., 1884, p. 182.
[2] Second Rep. Gulf Biol. Station, pp. 73-74.
[3] Amer. Naturalist, vol. 40, p. 242.
[4] Die Calaniden Finlands, 1888, p. 57.

Soc. Natur. Moscou, 1897, No. 1, p. 122, pl. 2, fig. 6.—Lilljeborg, Kongl. Svenska Vet.-Akad. Handl., vol. 35, 1901, p. 28, pl. 2, figs. 20–25.—Græter, Rev. Suisse Zool., vol. 11, 1903, pp. 514–523, pl. 15, figs. 15 and 33.—van Douwe, Die Süsswasserfauna Deutschlands, Heft. 2, 1909, pp. 24–25, figs. 69–71.

Cyclops brevicaudatus Claus, Das genus Cyclops, 1857, pp. 34–35, fig. 12; Die frei lebenden Copepoden, 1863, p. 100.—Lubbock, Trans. Linn.Soc. London, vol. 24, 1863, pp. 200–201.—Frič, Arch. Naturw. Land. Böhmen, vol. 2, 1872, Abth. 4, p. 221, fig. 15.—Hoek, Tijdsch. Ned. Dierk. Ver., vol. 3, 1876, pp. 15–17, pl. 2, figs. 1–9.

Cyclops furcifer Claus, Arch. f. Naturg., Jahrg. 23, vol. 1, 1857, p. 208–209, pl. 11, figs. 14–16.

Cyclops scutifer G. O. Sars, Forh. Vid. Selsk. Christiania, 1863, p. 237.—Lilljeborg, Kongl. Svenska Vet.-Akad. Handl., vol. 35, 1901, p. 33, pl. 2, figs. 26–27.

Cyclops abyssorum G. O. Sars, Forh. Vid. Selsk. Christiania, 1863, p. 238.—Brady, Nat. Hist. Trans. Northumberland, Durham, and Newcastle-upon-Tyne, vol. 11, 1891, p. 73, pl. 3, figs. 1–9.

Cyclops clausii Lubbock, Trans. Linn. Soc. London, vol. 24, 1863, pp. 201–202, pl. 31, figs. 12–14.

Cyclops vicinus Uljanin, Schrift. Ges. Freunden Naturw. Moskau, vol. 11, 1875, pp. 30–31, pl. 10, figs. 1–7.—Lande, Materyjaly do Fauny Skorupiakow Widlonogich Krolestwa Polskiego. Widlonogi Swobodnie Zyjace, I, Rodzina Cyclopy, 1890, pp. 47–49, pl. 16, figs. 33–41; pl. 21, fig. 164.—Brady, Nat. Hist. Trans. Northumberland, Durham, and Newcastle-upon-Tyne, vol. 11, pt. 1, 1891, p. 12, pl. 1, figs. 6–9.—Lilljeborg, Kongl. Svenska Vet.-Akad. Handl., vol. 35, 1901, p. 26, pl. 2, figs. 16–19.

Cyclops fedtschenkoi Uljanin, Schrift. Ges. Freunden Naturw. Moskau, vol. 11, 1875, pp. 31–32, pl. 12, fig. 10.

Cyclops pulchellus Brady, Mon. Copepoda Brit. Isles, vol. 1, 1878, pp. 107–108, pl. 17, figs. 1–3.

Cyclops claudiopolitanus Daday, Math. és természettud. Közl. Vonatk. a haz. viszony, 1885, pp. 227–229, pl. 1, figs. 14–18.

Cyclops hungaricus Daday, Math. és természettud. Közl. Vonatk. a haz. viszony, 1885, pp. 230–233, pl. 2, figs. 9–12.

Cyclops bodamicus Vosseler, Jahresh. Ver. Vat. Nat. Württemberg, 22 Jahrg., 1886, p. 193, pl. 5, figs. 13–18.

Cyclops lucidulus Vosseler, Jahresh. Ver. Vat. Nat. Württemberg, 22 Jahrg., 1886, p. 196, pl. 5, figs. 1–12.—Thallwitz, Jahresb. ornith. Beobacht. Stat. Sachsen, vol. 5, 1890, p. 80.

Cyclops quadricornis Sostaric, Rad. jugoslav. akad., vol. 92, 1888, pp. 62–64, pl. 1, fig. 5.

Cyclops strenuus, var. *vicina* Frič and Vávra, Arch. Naturw. Land. Böhmen, vol. 9, 1893, pp. 57–58, figs. 44*a* and 44*b*.

Cyclops miniatus Lilljeborg, Kong. Svenska Vet.-Akad. Handl., vol. 35, 1901, p. 24, pl. 2, figs. 13–15.

Cyclops kolensis Lilljeborg, Kong. Svenska Vet.-Akad. Handl., vol. 35, 1901, p. 21, pl. 2, figs. 11–12.

Inasmuch as *Cyclops strenuus* has not before been found in America, a somewhat detailed description of the species is given.

The cephalothorax (fig. 1) is broadly oval, the posterior segments being much wider than in most of the species of *Cyclops;* the breadth is about one-half the length. The front is markedly produced. The

posterior corners of the first and second segments in the female are rounded, the third is either slightly produced backward or rounded, while the fourth and fifth are produced outward and backward in prominent points. The form of the fourth and fifth segments of the cephalothorax is a marked characteristic of this species. The fifth segment varies considerably in its form. Figures 2 and 3 show forms from specimens collected near Damascus. Specimens from Axton duplicated these forms. The fourth and fifth cephalothoracic segments of the male do not have the characteristic form of those found in the female.

The first abdominal segment about equals in length the remaining segments of the abdomen; the anterior end, while much narrower than the last cephalothoracic segment is nearly twice as wide as the posterior. The posterior margins of all the abdominal segments except the last are dentate; the last segment is armed with minute spines.

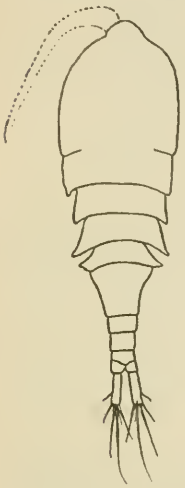
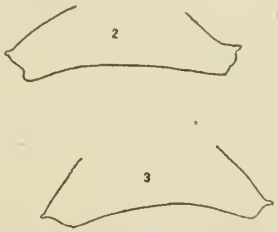
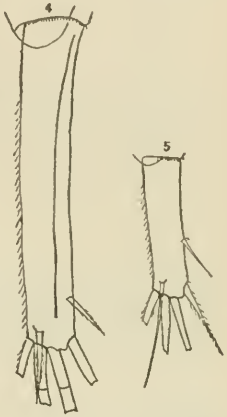


FIG. 1.—CYCLOPS STRENUUS, FEMALE. × 36.



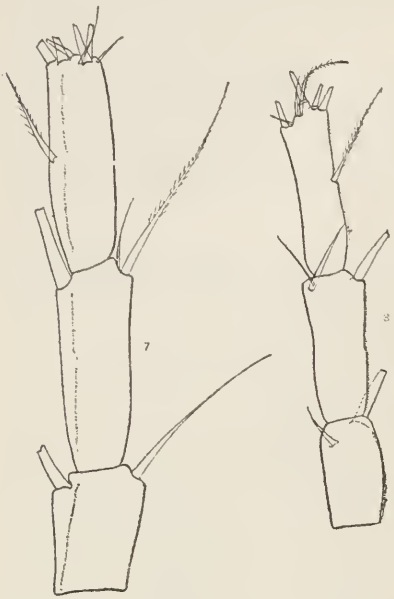
FIGS. 2-3.—CYCLOPS STRENUUS, LAST CEPHALOTHORACIC SEGMENT. × 73.



FIGS. 4-5.—CYCLOPS STRENUUS. 4, FURCA OF SPECIMEN FROM SYRIA. 5, FURCA OF SPECIMEN FROM AXTON, NEW YORK. × 148.

The branches of the furca are diverging, elongate, the length relatively to the rest of the abdomen being variable, but frequently equalling the last three abdominal segments. The inner margin is ciliate, and running the length of the dorsal surface, there is a somewhat irregular cuticular ridge; this ridge is not found in males or in immature specimens. The outer margin has an indentation at about one-third its length, and the lateral seta is set well toward the end. The terminal setæ are rather short and weak. Figure 4 shows the furca of a specimen from Syria and is typical in its structure. Figure 5 is from an Axton specimen and differs from the type in that it is shorter, the lateral seta is set well back from the end of the segment, and the cuticular ridge of the dorsal surface is lacking; inasmuch as no egg-bearing females were found in the Axton collections, it is probable that the specimens were not quite mature.

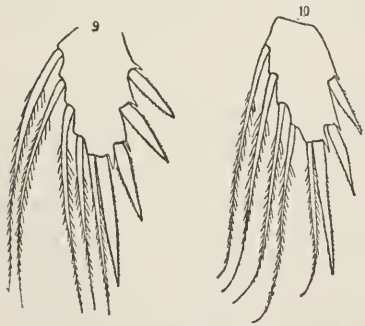
The first antennæ are 17-segmented and reach about to the third cephalothoracic segment. The twelfth segment has a sensory club. The last three antennal segments bear a hyaline lamella with a somewhat irregular row of very minute spines. This structure is shown in figures 7 and 8. Figure 7 is from a Syrian specimen and figure 8 is from a specimen collected at Axton, New York. These are drawn to the same scale and show the relative sizes from the two localities. The second antenna, shown in figure 6, has no distinctive characteristics.



FIGS. 7-8.—CYCLOPS STRENUUS. 7, TERMINAL SEGMENTS OF ANTENNA OF FEMALE FROM SYRIA. 8, TERMINAL SEGMENTS OF FEMALE FROM AXTON, NEW YORK. × 292.

FIG. 6.—CYCLOPS STRENUUS. SECOND ANTENNA. × 148.

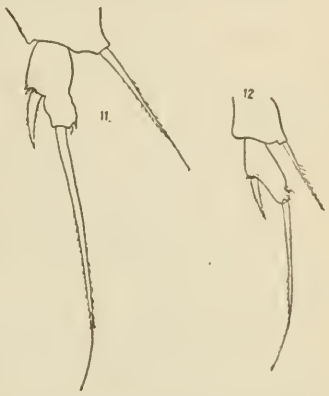
The spinous armature of the terminal segments of the exopodites of the swimming feet is represented by the formula 3, 4, 3, 3. This formula held true in all the specimens which have passed through the author's hands. Schmeil says that it may be also 2, 3, 3, 3, or 3, 3, 3, 3. Figures 9 and 10 show the structure of the terminal segments of the second and fourth feet.



FIGS. 9-10.—CYCLOPS STRENUUS. 9, TERMINAL SEGMENT OF EXOPODITE OF SECOND FOOT. 10, TERMINAL SEGMENT OF EXOPODITE OF FOURTH FOOT. × 148.

The fifth foot is composed of two segments. The basal segment is commonly broader than long, but is somewhat variable in its relative dimensions; it bears at its outer distal angle a rather short plumose seta. The second segment is about twice as long as broad; it bears at its distal extremity a long plumose seta and about midway of its inner margin a stout serrate spine; distad of the spine the segment is about half as wide as the

basal portion. There is a group of small spines at the outer distal angle of this segment and at the base of the lateral spine. Figure 11 is the fifth foot of a Syrian specimen and figure 12 the same structure from an Axton specimen, drawn to the same scale.

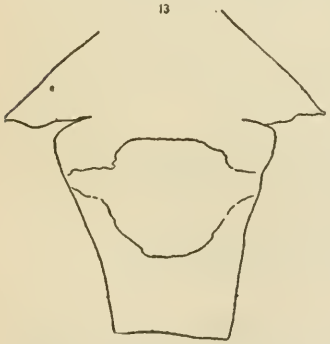


FIGS. 11-12.—CYCLOPS STRENUUS. 11, FIFTH FOOT OF SPECIMEN FROM SYRIA. 12, FIFTH FOOT OF SPECIMEN FROM AXTON, NEW YORK. × 292.

The form of the *receptaculum seminis* is shown in figure 13. The form of the labrum is shown in figure 14. The second row of teeth is very distinct. Not enough specimens were examined to make sure that this, which has not been mentioned by other authors, is a constant structure, but it is interesting to note that Brady[1] in his figure of the labrum has a line where the author has found minute teeth; the row of teeth by a lower magnification appears as a line.

In all the specimens examined there was an absence of the customary seta on the basal segment of the fourth swimming foot. This apparently has not been noted by other authors.

Schmeil gives as the average length of females 1.5 to 2.5 mm. The females of the Axton collections average 1.35 mm, the largest examined measuring 1.525 mm.



FIGS. 13-14.—CYCLOPS STRENUUS. 13, OUTLINE OF RECEPTACULUM SEMINIS. × 148. 14, LABRUM. × 292.

Cyclops strenuus is widely distributed in Europe, Asia, and northern Africa, but has not been reported before from America. It is distinctly a cold water form occurring most abundantly in the colder months.

Dr. B. W. Evermann collected it in Rock Pond, Axton, New York, on April 30. It seems strange that it has never been seen before, for it is probable that it is a form of wide distribution in America.

In the synonymy, for the most part, Schmeil has been followed. Granting the limits of variation as stated by him, the species published by Lilljeborg in 1901, *scutifer*, *vicinus*, *miniatus*, and *kolensis* should be considered as varieties, and it would be a matter of personal opinion whether or not it is worth while to recognize them under distinct names.

[1] 1878, pl. 19, fig 3.

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