

it has often happened, that Pieces of Earth of a Quarter or Half an Acre, have separated themselves all in one Piece, from the Top of a Hill, and slid down visibly on the Lands lying below.

How considerable soever this Accident may be in regard to the poor People who suffered by it, yet it was to be wished it was the only one that has befallen this Province. The Overflowings of the River *Allier*, and of the Rivers and Brooks that run into it, and the Hail that fell almost continually since, have intirely ruined above One hundred Parishes, in which they will have no Harvest this Year as for Corn and Hemp, nor any Vintage at all.

V. *A Dissertation on the Worms which destroy the Piles on the Coasts of Holland and Zealand*, by Job Baſter, M. D. F. R. S. communicated by the President of the ROYAL SOCIETY. Translated * from the Latin by T. S. M. D. F. R. S.

SECTION I.

IN the Year 1730. the Persons appointed to take care of the Dikes on our Coasts, observed that the Piles made of the hardest Oak, defending the

* This is here inserted in *English*, because a very ample Treatise hath been published in *Latin* on the same Subject, intituled, *Godofredi Sellii, J. U. D. R. S. Lond. S. Hist. Nat. Teredinis seu Xylophagi marini. Tubulo-conchoidis*, Traj. ad Rhen. 1733. 4to.

Coasts

Coasts of the *Netherlands* against the Sea, were eat through in a few Months, so as to be broken by the least external Force. Surprised at this uncommon and dangerous *Phænomenon*, they inquired into its Cause, and saw that a sort of Worms, before that time very scarce, but now increased to an incredible Number, had in so short a time eat into those Piles between the highest and lowest Water-marks, and threatened very great Damage to the Inhabitants of these Countries.

The superstitious Populace immediately persuaded themselves, that this new Genus of Animals was created by the divine Wrath for punishing the Sins of Mankind: But prying Experience has taught, that those Worms, like other Insects, were created in the Beginning; but now multiplied to an incredible degree from some unknown Cause.

S E C T. II.

If a Pile of the hardest Oak has stood six Months on the Shore, and be taken out in Summer or Autumn, there appears Mud and Filth sticking to its outward Surface; which being scraped off with a Knife, discovers a vast Number of Holes, scarcely as large as Pins Heads.

S E C T. III.

If you view this Mud (SECT. II.) through a Microscope, you will see,

1. A Number of whitish Points, not bigger than Grains of Sand.
2. Some very small Worms.

The whitish Points seem to be the Eggs of this Insect, and the Worms to be such as are already hatched from them; and these Worms gradually perforating the outward Surface of the Wood, rendered soft by lying in the Water, made the aforesaid Holes, (SECT. II.) and through them worked their way into the Substance of the Wood.

SECT. IV.

A small Style of Whalebone or Lead, thrust into these small Holes, runs strait into them for three or four Lines, so that its outer End always makes a right Angle with the Pile: But afterwards, if the Style be gently pushed forward, it does not continue in the strait Line, but runs either way, generally upward.

SECT. V.

But if one of these Piles (SECT. II.) be split lengthwise with a Hatchet or Wedge, it is found full of Passages, or hollow cylindrical Ducts, each of which contains a Worm, surrounded with a thin testaceous Substance, exactly filling the Duct, and forming its *Involucrum* or Sheath, in which Sheath it can move with Freedom. See SECT. XIX.

These Ducts, (SECT. IV.) beginning at the outward Surface by a narrow Hole, grow gradually wider, and run either strait, oblique, upward or downward. But what is most surprising is, that these Ducts never run into one another, nor communicate; but each of them continues separate for every single Worm. Over the Worm's Head there are found two or three Drops of a salt Liquor, thicker than Water, but
not

not the least Appearance of the Dust of the corroded Wood.

S E C T. VI.

Whence it appears, that all the Wood, which had before filled up the Place of the Dust, in which the Worm with its Covering is now found, was eaten and consumed by the Worm: And as it seems quite incredible, that an Animal, which appears soft, and almost as fluid as the White of an Egg, should be able to eat through such hard Wood; I offer the Description of this *Xylophagous Worm* to the ROYAL SOCIETY, in order to give them some Knowledge of this Water-Insect, which has done so many Millions Damage to these Countries.

S E C T. VII.

They are found of various Sizes and Thickness. There are some of the younger ones not above an Inch or two in Length; some of a middle Size, such as we have represented in our first and second Figures; see TAB. II. and some thirteen or fourteen Inches long.

S E C T. VIII.

But in order to a more accurate Description, we will divide the Animal into Head, Body and Tail.

The Head is of a most wonderful Structure, being covered with two hard . . . (I know not which to call them, Shells or *Hemicrania*) of a Substance neither testaceous nor ossicous, securing their softer Contents: And being viewed through a Microscope, they appear as in Figure 3. as well as I could have them drawn.

SECT. IX.

These *Hemicrania* are two white Bodies, much harder than the Substance which forms the testaceous Covering; the inner Surface hollow and smooth; the outer, convex and rough, with three Fibres running different ways; and both together perfectly represent a double Bit, of that kind of Borer, we call an Augar.

SECT. X.

The upper Part of the external convex Surface (Fig. 3. *A*.) has a very sharp Edge, in which the first Series of Fibres begins from one Point; which Fibres gradually dilating, and running lengthwise, end about the middle Part of it; and this middle Part makes a right Angle with the upper Part. In this Part the Fibres being elevated, run cross-wise (Fig. 3. *B*.). The lower Part is thicker than the upper, but softer and less compact. In this Part the Fibres are raised up and rough, first curve, then strait, and, like the others, run length-wise to the lower Edge of this Part, which is strongly fastened to the Head by various Ligaments (Fig. 3. *C*, *D*.).

SECT. XI.

The concave or inner Part of these *Hemicrania*, (SECT. IX.) which contains the softer Parts of the Head, is very smooth; but almost in the Middle has a very small and tender Eminence or Process, (in Shape much like Dr. *Rau*'s Process in the Organ of Hearing) fixed at one End, and loose at the other, running almost
the

the whole Width, and doubtless destin'd for supporting some of the inward Parts of the Head (*See Fig. 4 A.*).

S E C T. XII.

These two *Hemicrania*, connected together by strong Ligaments, and as it were by a small Hinge, (by means whereof they can dilate without separating) besides their defending the soft Head from external Injuries, are the Instruments wherewith the Animal gets its Food. For whatever way it turns its Head, the raised and rough Fibres, running either length-wise or cross-wise, always rub off some of the Wood.

S E C T. XIII.

These *Hemicrania* carefully removed, the contained Parts (*Fig. 6*) are laid open to View; but they are so soft, and of so wonderful a Structure, that the Eye, though armed with a Microscope, can neither discern their true Make or Use. First, indeed, there appears a Membrane enveloping the whole Head; in the middle and anterior Part, which is not covered by the said *Hemicrania*, it appears as if raised by a *Tubercle*, (*Fig. 6. c.*) and in that Place it is of a red Colour; but the lower ligamentous Edge firmly adheres both to the small Process (*SECT. XI.*) and to the lower Edge of the *Hemicranium*.

S E C T. XIV.

This Membrane carefully separated and removed, (*Fig. 7. A. A.*) in the middle of the subjacent Pulp you will find a small Pear-like Body, perfectly pellucid, somewhat protuberant above the other Parts,
which

which made the *Tubercle* in the Membrane (SECT. XII.). It is much harder than the other contained Parts of the Head and Body; so that it will bear cutting with the Scalpel. It is of a red Colour, as perfectly pellucid as a Drop of Water; of the Shape of a Pear, from a larger Basis terminating in a Point. I cannot better resemble it to any thing than to the Crystalline Lens of the Eye: Yet in Spirit of Wine it preserved its Transparency, but its Bulk was diminished (Fig. 7. B.).

I cannot guess its Use: It does not seem to me, as it does to some, to be the Organ of Sight; for the Worm seems to have no Occasion for an Eye, as spending its Life in perfect Darkness; besides that the investing Membrane is not transparent, and therefore would obstruct the Sight.

SECT. XV.

At the Sides, where the lower Edges of the *Hemicrania* do not touch one another, there is a sort of Cavity; and in these Sides the harder Fibres may be distinguished, disposed in such a manner, as perfectly to resemble the Gills of Fish; and through them the Worm seems to breathe.

SECT. XVI.

The extreme Softness of the other Parts of the Head prevents our coming at the Knowledge of the Use of the Membranes furnished with *Fibres* of different Tendencies, or inquiring by what Organs the Worm takes the Wood shaved off by the *Hemicrania*, or rough Shells; whether it does this by Suction, or not; by what Muscles, or how acting,
this

this wonderful Head is moved. 'Tis probable, indeed, that its Motion consists in the opening and closing these Shells (SECT. VIII.) that shave off the Wood; and that the inner Parts have a Power to move on all Sides, as the Ball does in the Socket of the Eye; and perhaps to come forth of these Shells, and re-enter after taking their Food. But of these things there can be no Certainty, because the Parts dissolve between the Fingers.

SECT. XVII.

The Body, viewed forward, (Fig. 2.) is of a reddish Colour. In the middle appears a Line, often dark-brown, often blackish, sometimes not visible, sometimes running near half the Length. The rest of the Animal is of a whitish or grey Colour.

1. If you intend to dissect it, and examine the Inside, you must first remove a thin Membrane surrounding the whole Body, which for that Reason may be called the *Cutis* or *Cuticula*. When this is removed, there appears an oblong Vessel placed in the Middle, (Fig. 2.) of a reddish Colour, from the shaved Wood, of which it is full: Hence it seems to be the Stomach, or at least the first Organ of Digestion.

2. In the lower Part you will find another Vessel, appearing like a dark-brown Line, which contains the Excrements, of which it is often found full, and discharges them at the End of the Tail.

3. At the Sides of the reddish Vessel or Stomach (SECT. XVII. 1.) is placed a white, clammy, fat Substance, sticking to the Fingers, and perhaps constituting the Flesh of the Animal.

S E C T. XVIII.

Where the Body ends, the Tail begins, thicker than the Body, and rendered stronger by circular *Fibres*. At its End it has two small hard Bodies, containing and defending the tender Extremities of the Tail.

This Tail thicker than the Body terminates in two Ends, the thickest of which certainly serves for the Discharge of the Excrements, the slenderest doubtless for Generation : And this it can stretch out to an incredible Length, so that in Worms that seemed to be in Copulation, it appeared above an Inch out of the Pile.

The two small Bodies, that contain these Ends of the Tail, are of a harder Substance than even the *Hemicrania*. The outer Part is gibbous, the inner hollowed. The lower End is bifid ; whence I conjecture, that they serve the Animal for Feet, when it is mounting upright, or corroding the Wood ; by leaning on them as on a Prop (Fig. 8.).

S E C T. XIX.

The above-described Worm dwells now very securely in a testaceous Tube of a white Colour, which it exactly fills, yet so as to be able to move with Freedom. That Tube, like the Coverings of Snails, &c. daily grows with the Animal, from the Matter which perspires from its Body ; whence it is sometimes found strait, sometimes bent, according to the Course which the Worm steered in corroding.

S E C T. XX.

As to their Generation, it is probable enough, that, analogous to that of other Insects, it is performed by Copulation of Male and Female: For they can so lengthen one End of their Tail, and thrust it out of the Pile, that they may copulate by that means. Then they lay their Eggs in the Water close to the Piles, to which they stick by their clammy viscid Matter, (such, for Example, as Frog's Spawn) and afterwards, by the Heat of the Sun, hatch the Worm, which immediately endeavours to get into the Pile (See SECT. II. and III.).

I could not observe the Difference of Sex, either with my Eye, or a Microscope. Some think them Hermaphrodites, as Snails, and that they copulate in the same Manner: But these Conjectures are not very probable.

S E C T. XXI.

Many Remedies and Secrets for destroying these dangerous Enemies were immediately boasted of, which for the most part were Preparations of *Arsenic* or *Mercury*, and are not worth enumerating: I will only give the Receipt of one, which is the best and surest of all.

Take an Iron Plate of an oblong Figure, and of the Width of the Pile, with a strong Handle at each End. One End of this Plate must be armed with thick Nails half an Inch long, and about an Inch asunder. The Nails of this Plate must be driven into a Pile of any slight Wood, with a Hammer, and then the Plate pulled off by means of its Handles.

And this is to be so often repeated until the Pile is perforated every-where with small Holes: Then it must be dawbed over with *Varnish* in the hottest Sun (the *Varnish* is imbibed by the soft Wood with so many Holes in it); and while the *Varnish* is yet hot, let it be strewed over with *Brick-dust*: And this is to be repeated three or four times, after the preceding *Varnish* is thorough dry, till the Pile is intirely furrounded with a stony Crust, which will be impenetrable to all Insects, and last many Years.

But the Divine Clemency has already so far destroyed these pernicious Insects, which multiplied so prodigiously for eight or nine Years past, that there is great room for Hope, that our Country will in a short time be intirely freed from them.

An Explanation of TAB. II.

Fig. 1. The Pile-worm of its natural Size, lying on its Belly.

Fig. 2. The same lying on its Back.

See SECTION XVII.

A. The Stomach.

B. The Duct full of Excrements.

C. The Tail, with its Defences *dd*, and its Point *e*, which it can stretch out.

The Six following Figures are represented much larger than Life.

SECTION X.

Fig. 3. *AA*. The first Series of Fibres running strait down.

BB.

BB. The second Series running transversely.

CC. The third taking a different Course.

DD. The lower Edge, which is infixed to the Head.

S E C T. XI.

Fig. 4. The Shell or *Hemicranium* seen on the Inside with the Process running cross it, one End of which *A* is fix'd, the other *a* is moveable.

S E C T. XII.

Fig. 5. *A.B.C.D.* The same as in Fig. 3.

E. The Hinge, whereby these are connected, and may easily dilate or open.

S E C T. XIII.

Fig. 6. *AA.* The Membrane covering the Head freed from the *Hemicrania*, which were attach'd to this Membrane.

B. The Place, where the *Hemicrania* were connected.

c. The middle anterior Part, in which the *Tubercle* was prominent.

S E C T. XIV.

Fig. 7. *AA.* The Membrane of Fig. 6. separated and turned back.

B. The pellucid pyriform Body lying in the middle of the Head, and which formed

c. The *Tubercle*.

S E C T. XVIII.

Fig. 8. The two Defences of the Tail, of which the exterior Part *A.* is gibbous, the other or interior *B.* is, as it were, hollowed; These Extremities are bifid. *C.* By this Part they are joined to the Tail.

VI. *Two Observations of Explosions in the Air; one heard at Halsted in Essex, by the Rev. Mr. A. Vievar, Minister of that Place; the other by Sam. Shephard, Esq; of Springfield in the same County.*

ON Sunday the 12th of March 1731-2. between One and Two o'Clock in the Afternoon, walking in my Garden by the Side of a Canal, I heard as it had been a large Clap of Thunder from the North-East, being a very clear Day, and no Clouds appearing. While I was looking into the Air, the Noise was repeated very loud, but seemed more like the violent Fall of a House, insomuch that I expected every Moment an Out-cry from the Town: But I was soon undeceived, when it began again, and I found it made towards me, with a different Noise from what I had heard, that is, like the Grinding of Flint-stones, but very loud: The Dimensions of it seem'd to be about three Foot wide. I found it sink in the Air, and as it seem'd to point directly at my Head, I laid myself down upon a Grass-slope, to let it pass over me. However, at the upper End
of

TAB. I.

Fig. 1.

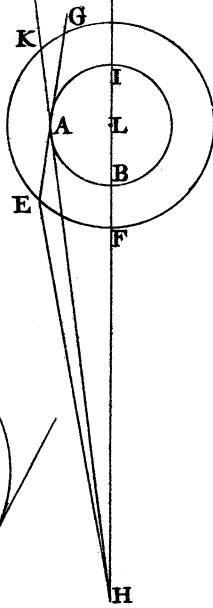


Fig. 2.

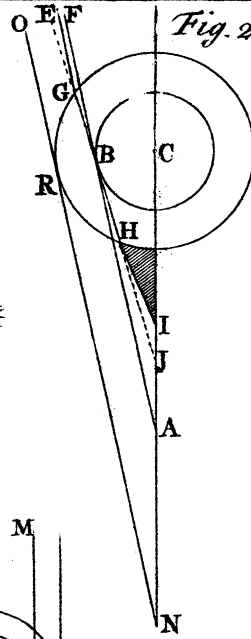


Fig. 3.

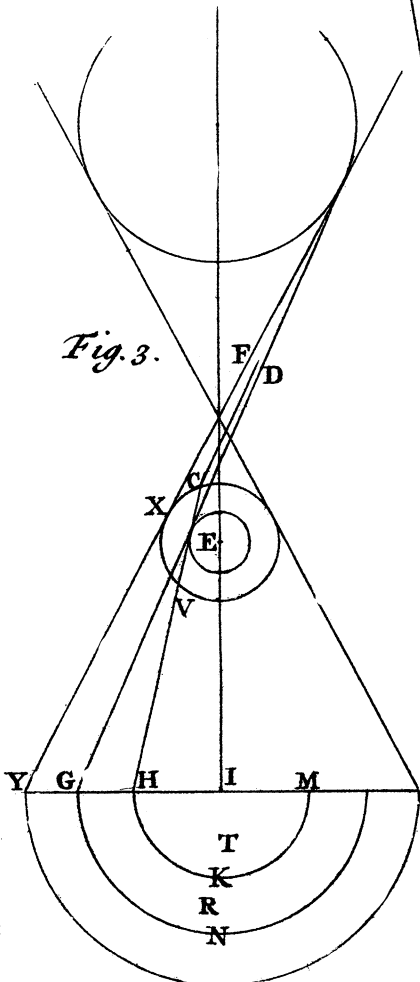
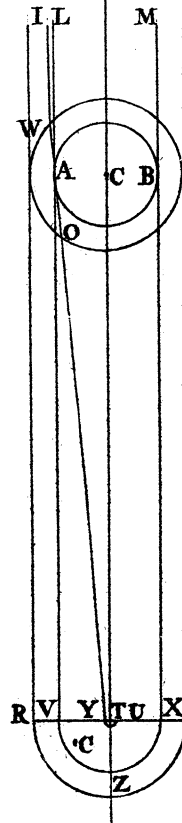


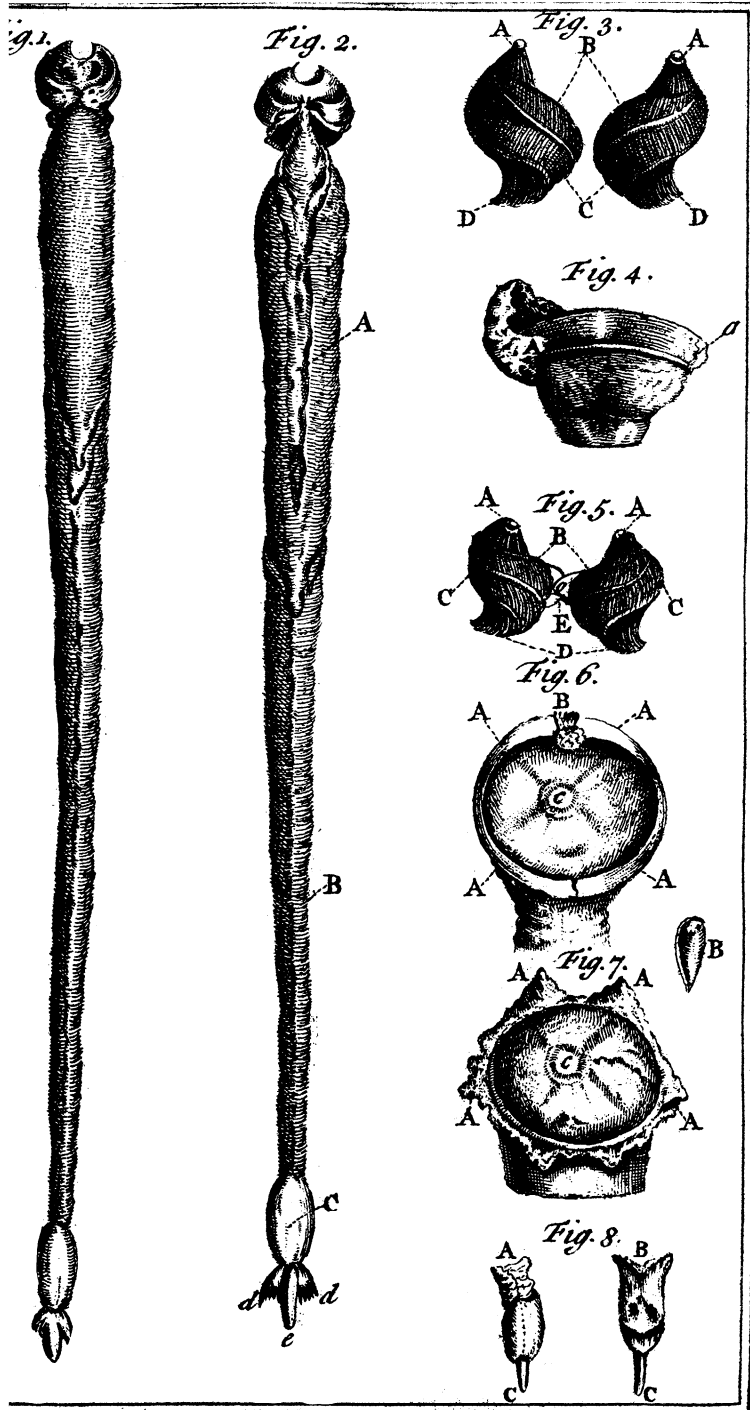
Fig. 4.



TAB. II.

Fig. 1.





TAB. I.

Fig. 1.

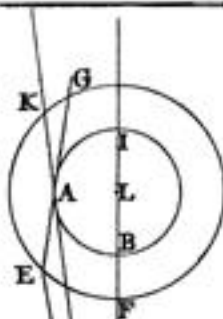


Fig. 2.

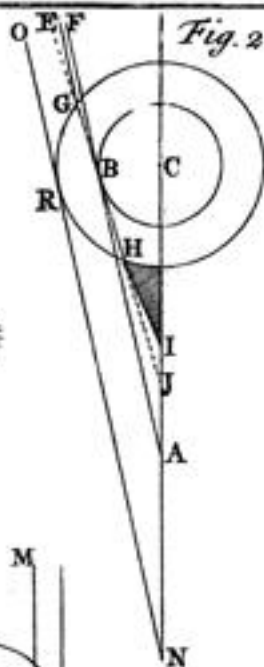


Fig. 4.

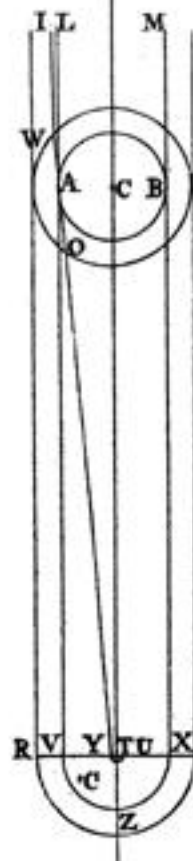
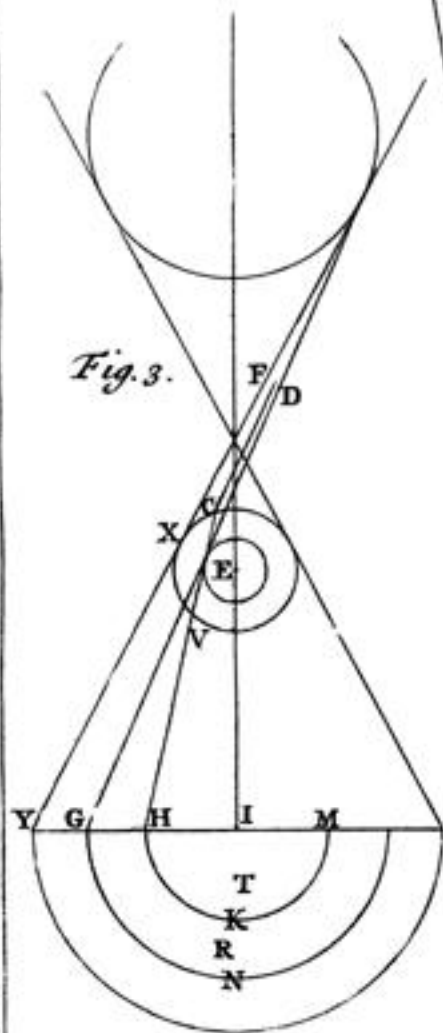


Fig. 3.



TAB. II.

Fig. 1.



Fig. 2.



Fig. 3.

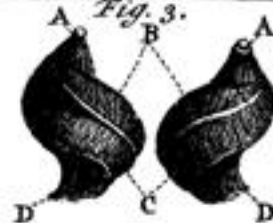


Fig. 4.



Fig. 5.



Fig. 6.

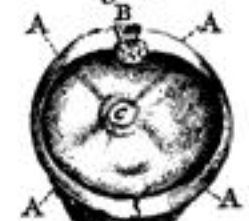


Fig. 7.



Fig. 8.

