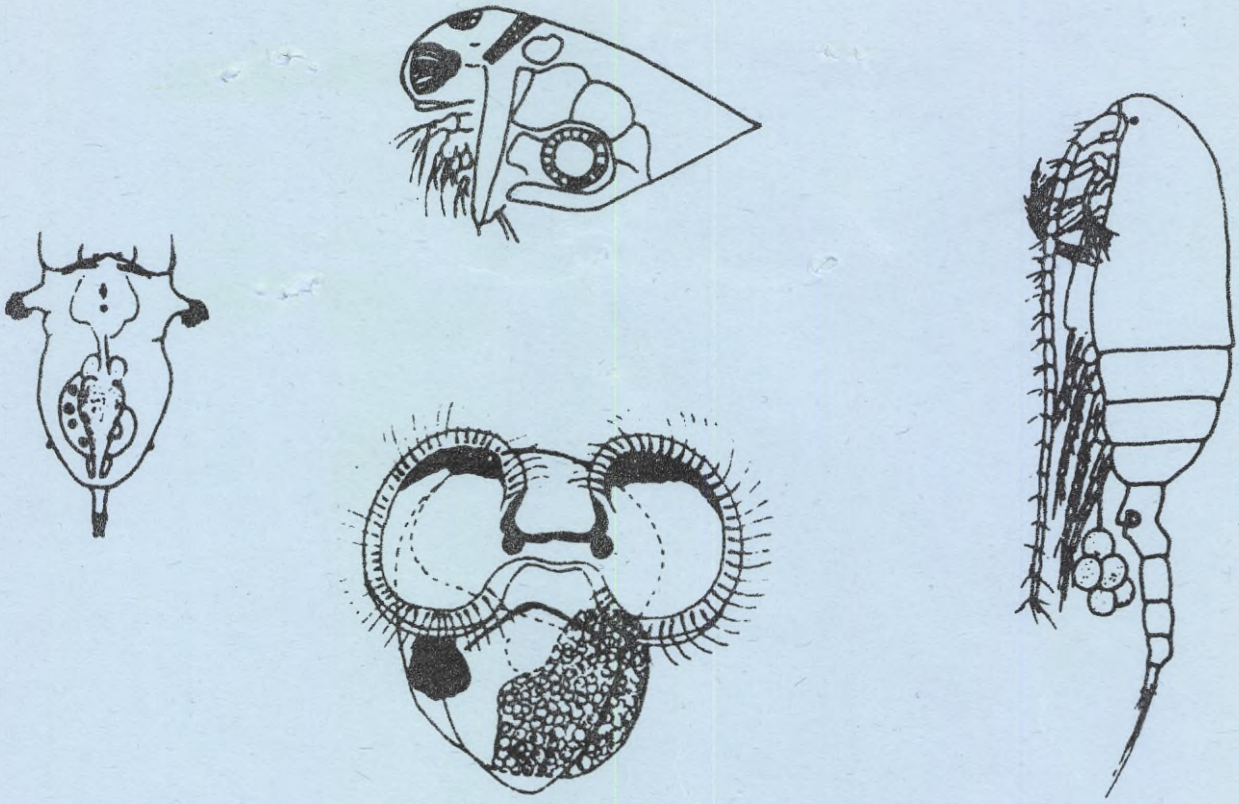

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by

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A NEW CONSTRUCTION OF A PLANKTON COLLECTING SAMPLER.

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Introduction

Most studies of zooplankton in the sea have probably been done with either vertical or horisontal plankton nets. This methcd is satisfactory in order to give an estimation of the occurrent species as well as a semi quantitative estimation of the plankton density in the investigated area. The method can also give a certain estimation of the relation between plankton and hydrographical factors as temperature, salinity, oxygen etc., if closing nets are used. In that case the vertical hauls should not be taken at standard depths 50-0 m, 100-50 m and so on but at hydrographically meaningful depths (BANSE, 1964).

That means that in the Baltic proper the hauls can be taken e.g. from bottom to secondary halocline (if there is one),(haul I) from secondary halocline to primary halocline (haul II), from primary halocline to thermocline (haul III) and from thermocline to surface (haul IV). The haul I gives animals which live in cold water, relative high salinity (more than 12 ‰) and often very low oxygen tension. Species which are caught in haul II live under nearly the same conditions but in water with somewhat lower salinity. In haul III species are caught which live in very cold water, in a salinity of 7-8 ‰ and in high oxygen tension. Finally the species in surface (haul IV) live under the same conditions except that the water is warm in summer and autumn. Of course other factors as light, turbulence, hydrostatic pressure etc. also vary in the various hauls.

The above mentioned method is too rough for detailed ecological studies of zooplankton and for the studies of vertical distribution and diurnal migration. As is evident from ACKEFORS (1966) some species of the copepods may be distributed vertically in a small range of about 15-25 metres. Each species lives in its own micro milieu (or level in the water column) at least with regard to the majority of the specimens. The only way to get comprehensive information of the ecological demands of a certain species or different developing stages of the same species is to take samples

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at fixed levels. This can only be done with a water bottle, hydrographical water sampler as a Nansen sampler or a pump. Plankton gears which are hauled horisontally in the water and provided with a depth recorder may also be satisfactory.

Ultraplankton, nannoplankton and certain microplankton may be taken with e.g. a Nansen sampler (1,3 litre) in connection with hydrographical investigations. The bigger species in the microplankton fraction as well as the mesoplankton and macroplankton must be taken with a pump or a sampler. In this case the sampler must have a bigger volume than ordinary hydrographical water samplers due to the lower density of such organisms. This is also valid for rare organisms of the micro-, nanno- and ultraplankton fraction.

The pump method is inconvenient for our purposes because it is limited to shallow waters and often rather big boats, or boats where it is possible to attach a suitable pump. The authors therefor have chosen to construct a plankton collecting sampler for the studies of the plankton problems in the Baltic proper.

The conditions precedent for the new construction of the plankton collecting sampler.

The conditions precedent for our new construction of the plankton collecting sampler were:

1. The sampler should be capable of being used both in shallow waters and in deep waters down to 200 metres depth or more.
2. The sampler should be strong enough to resist the trials at the sea off the coast in rough weather.
3. The sampler should also be light enough to handle for one man in a small boat with the help of a hand-winch.
4. As it is often shortage of time for many reasons during a sea-cruise with a research vessel there should only be time for one sample at each level (0 m, 5 m, 10 m etc.). Although the right ecological principle is many small samples from a certain habitat or a special level in a habitat it was thus necessary to construct a sampler which could take quite a big sample.
5. The volume of the sample must be big enough to give many specimens of the common copepods, cladocerans etc., which should be studied. The volume must also be big enough to give representative samples of the studied level in the water and so many organisms that statistical analysis would be possible for the common species.

6. The sampler should be so small that it is possible to take samples in a small range of the water column e.g. within a discontinuity layer.
7. The sampler should stir as little as possible the water mass where the sample will be taken.
8. The greatest attention should be devoted to the mechanical construction and especially to the closing device of the sampler.

The construction of the sampler.

The authors have been inspired by two samplers, viz. the Bergman sampler (LINDQUIST, 1961:41) and the Rodhe sampler (RODHE, 1941). ACKEFORS (1966) used the Bergman sampler. The volume of this sampler is 23 litres. It is suitable for work in the Baltic with regard to the density of the common copepods, cladocerans and rotifers. The new sampler was therefor constructed in the same size. The idea to have a bag net under the sampler (see fig. 1) is taken from the Bergman sampler too. The bag net has great advantages. The sampler gets rid of the water immediately when it comes up from the water and the sampler is therefor not heavy to lift on board. The water is also very quickly filtered through the nylon cloth in the bag net and the organisms are easily collected in the bucket.

The main appearance of the sampler is evident from fig. 1. In A the sampler is shown with the bag net and a collecting bucket of plexiglass. In this case the lower clack is with a perforated PVC-plate and ring fastener for the bag net. The construction of the bucket is described by LINDQUIST (1959:41). The bottom of the bucket is provided with a filter of nylon cloth where the organisms are accumulated. The bottom is easily loosened from the rest of the bucket.

In fig. 1 B the lower clack of the sampler is attached with a solid PVC-plate (6) provided with a tap (7). A holder with a metal filter (8) may be attached to the sampler.

The details of the construction as well as the materials in the sampler are evident from fig. 2 and 3. It is made of a PVC-tube with a wallthickness of 5 mm. The upper and lower clack is made of aluminium. The guide rail for clack closing device has been made in stainless steel to be strong and protect the whole closing mechanism from hits. Pull rods with toggle joints, catch device, upper and mounting frame, U-shaped stand and sealing rings have been made in aluminium or brass.

Fig. 2 shows the sampler open and attached with the perforated PVC-plate. (The bag net is not attached). The U-shaped stand is necessary in order to protect the sampler from hits, to enable an attachment of a 10-kilogram-weight under the sampler and to open the sampler before sampling. The clack

Legends:

Fig. 1. PLANKTON COLLECTING SAMPLER

A. The sampler is closed with a messenger (1). The sampler is provided with a bag net (4) and a collecting bucket of plexiglass (5). Lower clack (3) with a perforated PVC-plate. The volume of the sampler is 23 litres.

B. The sampler is closed and provided with a tap (7). The lower clack with a solid PVC-plate (6). A holder (8) with a metal filter may be attached. Scale 1:6.

Fig. 2 and 3. The text is found under the figures.

Figurtexter:

Fig. 1. PLANKTONHÄMTARE

A. Planktonhämtaren har stängts med ett lod (1). Hämtaren är monterad med en påse av planktonduk (4) och en planktonuppsamlingskopp i plexiglas (5). Nedre luckan är försedd med en perforerad PVC-platta (3). Planktonhämtarens volym är 23 liter.

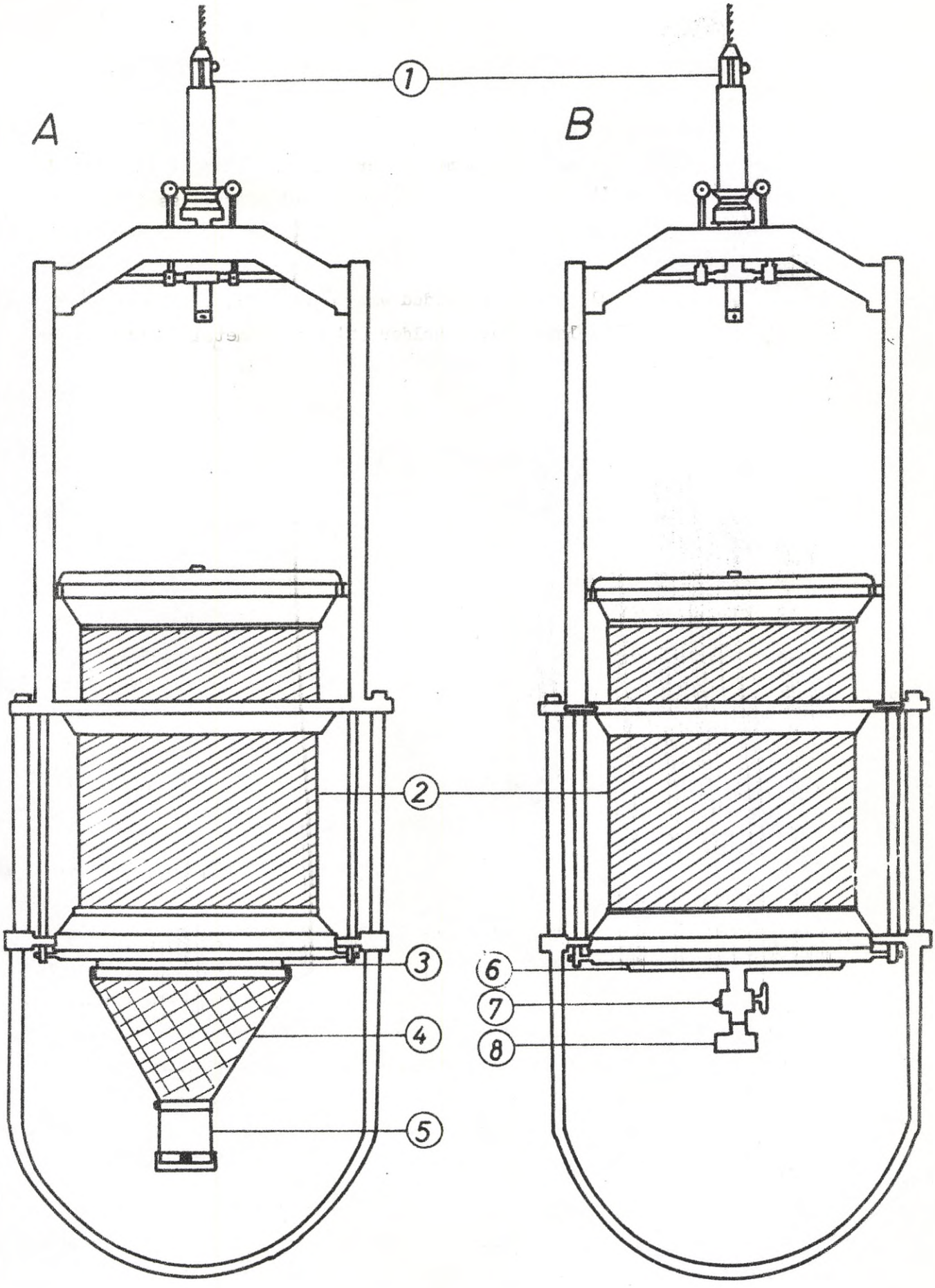
B. Planktonhämtaren är stängd och försedd med en avtappningskran (7). Nedre luckan är försedd med en solid PVC-platta (6). En hållare (8) med ett metallfilter är anbringad. Skala 1:6.

Fig. 2. PLANKTONHÄMTARENS KONSTRUKTION

1. Styrskena för luckstängningsmekanism, rostfritt stål. 2. Övre lucka med luftventil, aluminium. 3. Luckstängningsmekanism, rostfritt stål och mässing, se fig. 3. 4. Övre luckram med tätningsring, aluminium. 5. PVC-rör, väggtjocklek 5 mm., rymd 23 liter. 6. Fästram, aluminium. 7. Dragstång med knäled, mässing. 8. Regel för undre lucka, aluminium och mässing. 9. Undre luckram med tätningsring, aluminium. 10. Undre lucka med perforerad PVC-platta och fästring för håv, aluminium. 11. U-format stativ, aluminiumrör. Skala 1:6.

Fig. 3. LUCKSTÄNGNINGSMEKANISM

1. Rörformat utlösningsdon, mässing. 2. Hävarm med rulle, mässing. 3. Lyftbalk, rostfritt stål. 4. Spärrstång, rostfritt stål. 5. Tryckfjäder i skjutbar hylsa, rostfritt stål. 6. Fästbult för lyftlina med säkerhetskrok, rostfritt stål. Skala 1:3.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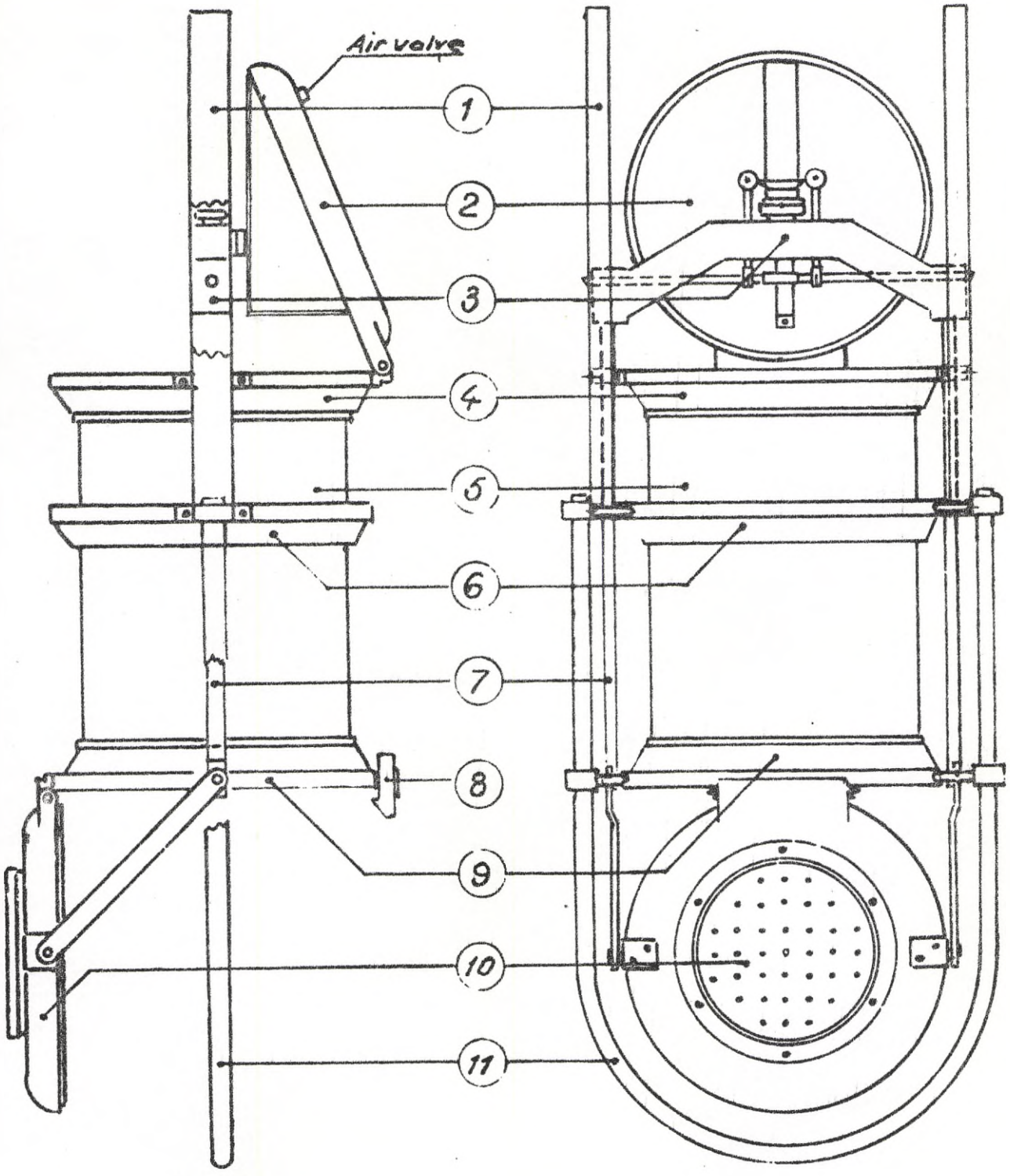

Fig. 2. THE CONSTRUCTION OF THE PLANKTON COLLECTING SAMPLER

1. Guide rail for clack closing device (stainless steel). 2. Upper clack with air valve (aluminium). 3. Clack closing device (stainless steel and brass), see fig. 3. 4. Upper frame with sealing ring (aluminium). 5. PVC-tube, wall-thickness 5 mm, capacity 23 litres. 6. Mounting frame (aluminium). 7. Pull rod with toggle joint (brass). 8. Catch device for lower clack (aluminium and brass). 9. Lower frame with sealing ring (aluminium). 10. Lower clack with perforated PVC-plate and ring fastener for bag net (aluminium). 11. U-shaped stand, (aluminium tube). Scale 1:6.

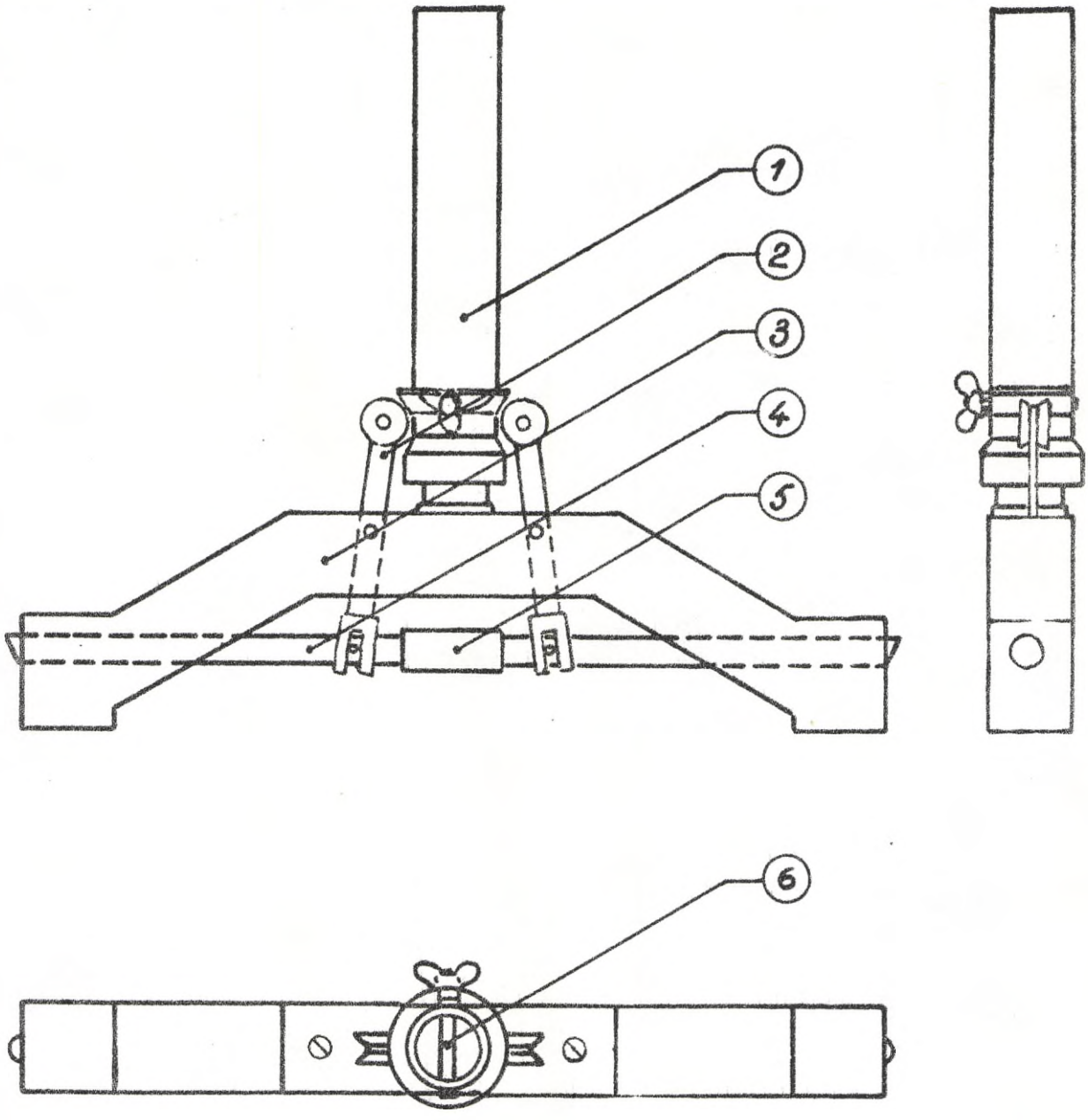

Fig. 3. CLACK CLOSING DEVICE

1. Tubular releasing part (brass). 2. Lever with roller (brass).
3. Racking balk (stainless steel). 4. Catch rod (stainless steel).
5. Compression spring in sliding sleeve (stainless steel).
6. Mounting bult for lifting cable with safety hook and winged nut (stainless steel). Scale 1:3.

closing device has been changed twice after testing the sampler from research vessels before the final construction in fig. 3 was completed. All other details in the construction are evident from the figures.
The cost for the first sampler was about 2500 Swedish kronor. Another copy will be cheaper. To get cheap clacks the authors have used the common type of clacks for rubbish-chute which is used in Sweden.

Experiences and discussions.

When the sampler is mounted with the bag net (fig. 1 A) it is suitable for ordinary sampling of meso-and macroplankton as well as bigger microplankton e.g. rotifers, copepods and cladocerans. The authors have used Nytal cloth (nylon) nr 14 with a mesh size of 0,090 mm. The same mesh size was used in the filter at the bottom of the bucket. The best way is to use two filters so that the plankton organisms in the first filter can be put in a bottle and preserved in the laboratory while the sampler is on its way down in the water with the second filter attached. In that way ACKEFORS (unpublished) has worked with the sampler for studies of the diurnal migration. It took about 50 minutes for one series from 0-100 m depth if samples were taken at 0,5,10,15,20,25,30,35,40,50,60,70,80,90 and 100 m level. The sampling was performed with a hydraulic winch. The author and one man of the crew worked at the winch and one assistent took care of the samples in the laboratory of the research vessel.
Fig. 1 B shows the sampler with the solid PVC-plate, the tap and the holder with metal filter attached at the lower clack. Without the holder the sampler may be used as an ordinary water sampler. The water may then on board be both filtered through a separate plankton net or/and used for hydrographical analysis. With the filter holder attached plankton may be sieved directly and after that the water can be used to e.g. chemical analysis. This is the way the Rodhe sampler works. However it takes too much time to work in this way for ordinary sampling at sea, because the water is filtered so slowly through the small metal filter.

Acknowledgement

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Sammanfattning

Författarna beskriver en ny konstruktion av en planktonhämtare för ekologiska studier av planktonfaunan i Östersjön. Planktonhämtaren är avsedd för provtagningar på bestämda nivåer (0,5,10 m etc.), i språngskiktet eller i andra intressanta delar av vattenpelaren. Hämtaren kan användas såväl i grunda vatten som i områden med större djup. Den är konstruerad för att motstå påfrestningar ute till havs i hårt väder samt på djupa nivåer (200 m eller mera). Genom val av lämpligt material m.m. är den tillräckligt lätt för att en man skall kunna sköta den från en liten båt med hjälp av en handvinsch.

Planktonhämtaren har konstruerats så att nedre luckan kan bytas (fig. 1). I alternativet A är den perforerad och försedd med en påse av planktonduk och en planktonuppsamlingskopp i plexiglas. I detta utförande lämpar sig hämtaren för provtagningar av planktonorganismer större än c:a 0,25 mm, t.ex. copepoder, cladocerer och rotatorier. Fördelen med denna hämtare enligt fig. 1 A är bl.a. att hela vattenvolymen silas snabbt genom planktonduken (ingen tidspillan för filtrering) och hämtaren blir förhållandevis lätt att lyfta in över bord. Efter sköljning av planktonduken är organismerna samlade i planktonkoppen. Botten i denna är försedd med ett planktonfilter, som är av samma nylonduk, som finns i planktonpåsen. Botten kan lätt lösgöras, då den fästes med hjälp av bajonettfattning i planktonkoppen.

I fig. 1 B är hämtaren försedd med hel botten och avtappningskran på vilken kan appliceras ett metallfilter för filtrering av vattnet ombord. I detta utförande kan således hämtaren användas för tillvaratagande av hela vattenvolymen (23 l) för kemiska analyser, för små mikroorganismer, som ej lämpar sig för silning genom vanlig planktonduk, samt eventuellt även för större organismer.

Planktonhämtarens konstruktion i övrigt framgår av figurerna 2 och 3.