Appendice sectionné	pl. 1 g.	pl. 2 g.	pl. 3 g.	pl. 4 g.	pl. 5 g.	pl. 1 d.	pl. 2 d.	pl. 3 d.	pl. 4 d.	pl. 5 d.
	1	2	3	4	5	6	7	8	9	10
ec. ant. g.	11	12	13	14	15	16	17	18	19	20
ec. ant. d.	21	22	23	24	25	26	27	28	29	30
exo. ur. g.	31	32	33	34	35	36	37	38	39	40
endo. ur. g.	41	42	43	44	45	46	47	48	49	50
exo. ur. d.	51	52	53	54	55	56	57	58	59	60
endo. ur. d.	61	62	63	64	65	66	67	68	69	70

Numérotation. La signification des abréviations est donnée dans le texte.

présente méthode, qui permet une désignation précise de chaque échantillon est basée sur la section partielle d'appendices dont on coupe la moitié distale à l'aide de ciseaux de Wecker. Le Tableau ci-joint résume l'ensemble de la numérotation. Le chiffre des unités est donné par la section à gauche ou à droite d'un des 10 pléopodes (pl. g., pl. d.). Le chiffre des dizaines est donné par l'une des sections suivantes: écaille antennaire gauche (ec. ant. g.), écaille antennaire droite (ec. ant. d.), exopodite de l'uropode gauche (exo. ur. g.), endopodite de l'uropode gauche (endo. ur. g.), exopodite de l'uropode droit (exo. ur. d.), endopodite de l'uropode droit (endo. ur. d.).

Cette méthode a été utilisée sur des *Crangon crangon* (Linné) et des *Palaemon serratus* (Pennant) maintenus en élevage pendant plus de 2 mois; aucun inconvénient n'a été noté; le numéro de l'animal est immédiatement repérable à la première observation. Lorsque la partie coupée commence à montrer des processus de régénération, il importe de la sectionner à nouveau.

Le principe proposé n'est pas limitatif, il peut être étendu, pour le groupement d'un plus grand nombre d'individus, par la section d'autres parties d'appendices (exopodite ou endopodite de pléopode); tel que nous l'avons présenté, il est applicable à l'ensemble des Natantia et des Astacoures; il doit être modifié pour d'autres Décapodes, les Palinoures par exemple chez lesquels il n'existe pas d'exopodite antennaire.

D'une façon plus générale, cette méthode de marquage est utile lorsqu'il est nécessaire d'analyser les réactions physiologiques individuelles d'animaux maintenus au sein d'un groupe.

Summary. A method of marking the Decapoda Crustacea is given; the numbering is founded upon the limb-removing principle.

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An Apparatus for the Measurement of Small Tensions

The measurement of tensions ranging from 1 newton and upwards can be carried out in a variety of ways. (N = newton, is the force unit in the International System of Units and 1 N = 10^5 dyn = 0.102 kiloponds = 7.23 poundals). In order to measure smaller tensions when studying thermal and chemical contraction of collagen fibres, several methods are available. The classical kymograph system of levers and counterweights can be used, or one of the more modern electronic devices. Strain gauges have been used cemented on blade springs[1], commercially available tension pick-ups such as those manufactured by Statham[2] and also pick-ups as parts of larger materials testing machines e.g. Instron[3] and others.

All these systems have draw-backs. Naked strain gauges mounted on blade springs are influenced by environmental conditions, such as uneven exposition to heat and humidity. Encapsulated pick-ups with good resolution in the 100–1000 dyn range are extremely sensitive to mechanical disturbances such as vibration. Therefore most of these pick-ups are parts of big and inflexible systems.

In order to be able to measure tensions from 100 dyn and upwards the apparatus here described was assembled. It has been mainly used to measure isometric tension in the tendon fibres of rats' tails when subjected to thermal (62 °C) and chemical contraction-relaxation tests.

The construction. The electronic part of the apparatus consists of a displacement transducer, Bofors RLL-1, ± 3 mm. This is of the inductive type, a differential transformer. The transformer is wound on a bobbin and cast into a block of insulating material and is thus protected against disturbances including moisture. The transducer has a core of μ-metal mounted on a magnetically non-conducting bar. The electronic components are built into the transducer and it is fed by direct current from a 6 V battery. The output signal is about 70 mV for a displacement of 0.5 mm of the core.

The mounting device for the transducer is shown schematically in Figures 1 and 2. The arabic figures in the following description refer to Figure 1 and the capital letters to Figure 2.

The transducer (4) is mounted on a shaft (9) via a horizontal supporting arm (10), which is movable vertically. The core mounted on the rod (1) is suspended from a stainless steel blade spring (2 and B) placed on 2 wedges

[1] F. VERZÁR, *Experimentelle Gerontologie* (Enke, Stuttgart 1965).
[2] D. M. RASMUSSEN, K. G. WAKIM and R. K. WINKELMANN, J. invest. Derm. *43*, 333 (1964).
[3] H. R. ELDEN, Biochim. biophys. Acta *75*, 37 (1963).

(C). The rod (A) is put through a hole in the spring and locked with a pin. In order to adjust the position of the iron core inside the transducer [the thick portion of (1) inside (4)] and thus adjust the output voltage as desired, the base plate (E) is mounted on an outer cylinder that is connected with an inner cylinder via screw threads (3). The inner cylinder is fixed to the transducer (4). In order to keep the base plate in angular position when rotating the outer cylinder there are lockers (D) between the base plate and a flange on the inner and non-rotatable cylinder. One end of the specimen (6) is fastened into a clamp on the lower end of the rod (5) and the other end into a clamp on a movable arm (7) so that the distance between the clamps can be adjusted. The movable arm (7) is connected to the horizontal apparatus supporting arm (10) via a gear-rack drive (8). When measuring tensions in the 100–500 dyn range in a moist atmosphere the core can adhere to the cylindrical hole inside the transducer and give false low tension readings. To eliminate this a small D.C. electric motor with an eccentric on its driving axis is mounted on the top of the apparatus shaft. This provides small vibrations that eliminate the frictional forces between the transducer and the core.

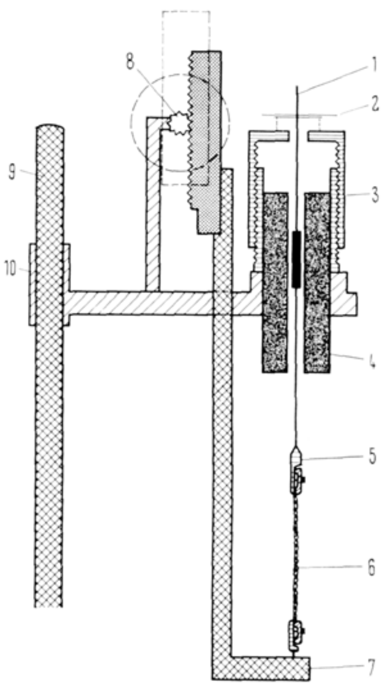

Fig. 1

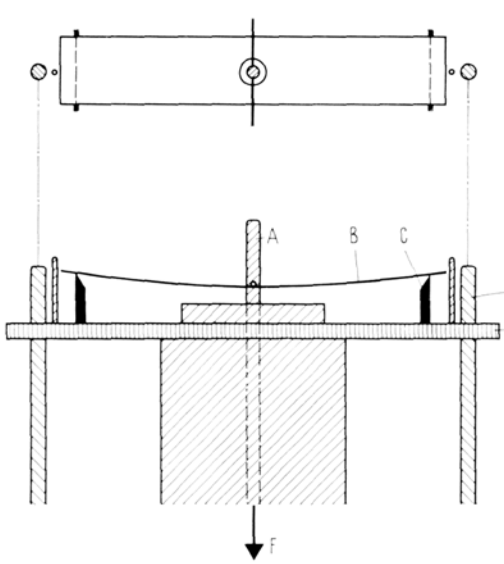

Fig. 2

Figs. 1–2. The construction of the apparatus. Figure 1 shows a vertical section through the device and Figure 2 shows a detail and the plane is cut at an angle of 90° to the plane in Figure 1. For explanation see text.

The properties of the apparatus. The calibrations were performed with weights suspended from the upper clamp [(5) in Figure 1] and the output voltage was read from a Hewlitt-Packard D.C. vacuum tube voltmeter (type 412 A). After that each weight was removed without disturbing the rod, it was checked that the voltage returned to the preloading value. This was always the case. A calibration series from 100–2000 dyn is shown in Figure 3 and such a series from 1,000–10,000 dyn was similar. The double series, as exampled, displays complete linear relationship between tension and output voltage.

In these calibration series a stainless steel blade spring (Sandviken) 70 × 12 mm and 0.10 mm thick was used. It gives the upper end of the system measured a displacement of 0.21 mm per 1000 dyn, which yields 29 mV output. This can be increased or diminished by selecting a thinner or thicker blade spring.

Conclusion. The apparatus described here was designed to overcome environmental disturbances such as vibrations, temperature and humidity fluctuations and at the same time preserve a flexible system. Constructed around a commercially available displacement transducer, it features easy adaptability to various measurement tasks provided a vertical system can be used, requires only a stable 6 V DC source and a recorder for the output voltage in the mV range. It gives a fully linear volt-tension relation and has proved to be dependable and easy to operate in laboratory practice.

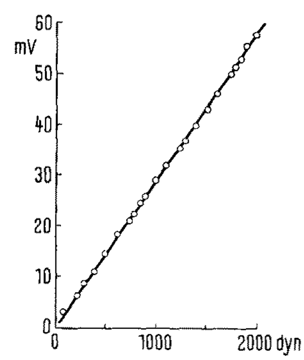

Fig. 3. A calibration series from 100–2000 dyn showing the relationship between the tension and the output voltage of the differential transformer.

Zusammenfassung. Ein Apparat zur Messung von kleinen Spannungen in biologischem Material wird beschrieben. Das System wurde konstruiert, um Störungen durch Milieufaktoren sowie durch Temperatur- und Feuchtigkeitsvariationen und Vibrationen zu eliminieren.

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