The observations made indicate that it is possible to keep moles in captivity with limited access to soil, and that this has a very beneficial effect on their condition and the state of their coat. An important factor in this case is suitable humidity in the place in which they are kept, to ensure that the soil in the boxes does not dry too quickly.

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A DEVICE FOR TESTING THE STRENGTH OF MOLES

PRZYRZĄD DO MIERZENIA SIŁY KRETA

A description is given of an apparatus for measuring the strength and work of the mole, consisting of a partitioning door inserted into an artificial tunnel and connected with a dynamometer and recording device. The apparatus makes it possible to record the frequency of digging movements made by the mole's fore legs and to estimate their force. It can also be used for studies on the activity of the mole, the degree of use of their right and left paws and as a means of providing captive animals with exercise.

Studies on the technique used by the mole (*Talpa europaea* Linnaeus, 1758) for digging tunnels showed that this activity requires strength out of proportion to these animals' body weight (Skoczeń, 1958). It was found that the weight of the column of soil pushed up by a mole from it tunnel is frequently 24 times greater that the animal's own body weight. It must be remembered in this connection that such labour, often prolonged (Godfrey, 1955), is carried out under specific habitat conditions such as oxygen deficiency, high CO_2 concentration and a high degree of humidity. It is therefore obvious that these animals must possess a particular capacity for physiological adaptation, as has been shown by the studies made by Quilliam *et al.* (1971).

When moles were kept in captivity they were seen eagerly to make use of any gaps available, which they endeavoured, with enormous effort and persistence, to enlarge in order to achieve a space sufficiently large to admit the body. It not infrequently happened that after prolonged efford the moles made their way through the wire netting of their artificial tunnels, in which the wire was 0.5 mm thick. These observations induced us to insert a movable partitioning door in the artificial tunnel made for the mole (*cf.* Skoczeń, 1961), and to connect this door with a dynamometer, which was in turn connected with a recording device. The whole appliance makes it possible to record the frequency of the digging movements made by the fore-paws and the value of the force

of individual movements in kG. The sum total, after suitable conversion, gives a picture of the work carried out by the fore legs (Table 1) during tunelling in relation to the body mass of the animals examined.

The partitioning door (Fig. 1.1), which was made of plywood, is inserted in a metal corridor or tunnel (2) 52 mm in diameter. The pipe forming the tunnel is mounted on special bases (3) which enable the tunnel containing the experimental mole to be moved as desired. The door moves on two rings (4) ensuring that friction is reduced to a minimum

Table 1

Section (10 minutes) of measurement of a mole's strenght and work (female weighing 57 g) in 50-second units of time.

Unit of time. 50 sec.	Number of movements	Force — avg. per movement, kg	Force in relation to body wt.	Maximum force per 1 movement, kg	Force in relation to body wt.	Sum total of force in kg	Number of intervals in (one unit)	Sum total of intervals in sec.	Time for work in sec.
1	33	0.555	9.74	1.280	22.45	18.14	11	35.5	14.5
2	23	0.518	9.09	1.350	23.68	11.96	16	43.0	7.0
3	39	0.543	9.53	1.300	22.80	20.10	20	35.5	14.5
4	33	0.535	9.52	1.240	21.75	17.43	21	42.2	7.3
5	40	0.486	8.53	1.110	19.47	20.26	24	38.6	11.4
6	29	0.522	9.16	1.220	21.40	15.32	18	40.0	10.0
7	39	0.567	9.95	1.330	23.33	22.24	25	35.6	14.4
8	33	0.518	9.09	1.120	19.65	17.05	18	35.6	14.4
9	37	0.420	7.37	1.040	18.24	15.51	23	38.5	11.5
10	48	0.483	8.47	1.060	18.60	23.34	34	32.3	17.7
11	21	0.564	9.89	1.060	18.60	11.85	19	46.8	3.2
12	16	0.667	11.70	1.400	24.56	10.68	14	47.4	2.6

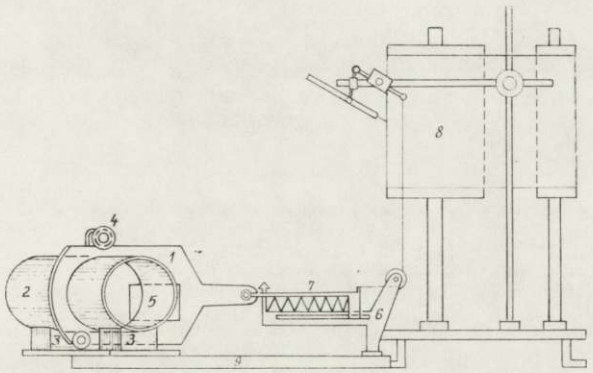

Fig. 1. A device for testing the strenght of moles. Explanations — see text.

and that the line of movement is constant. There is a hole (5) measuring 26×35 mm in the door, enabling the mole's paw to take hold and move

the door along in a line vertical to the axis of the tunnel. The size of the hole was established by experiment so that the mole could not squeeze through into the other side of the tunnel. The size of the hole can be changed according to differences in the mole's body measurements by moving the arm (6) on which the dynamometer is mounted. The door is connected with the dynamometer (7), the movable part of which is connected in turn with the recording device (8). In this way a record is obtained of the frequency of movements made by the mole's fore paws and the value of their strength in kG. Readings were made from the diagram by means of a calibrated geodetic device.

The whole of the appliance described above is secured to a firm base (9) to prevent it shifting during the experiment. It can also be included as part of a set of tunnels in the apparatus described earlier (Skoczeń, 1961) for keeping moles in captivity. The studies made so far show that this applicance is capable of wider application, primarily to describe the digging activities of the mole and its capacity for withstanding prolonged effort, for studies on the use it makes of the right and left paw, its daily activity and as a means of profiding exercise for captive moles, since, as is well known, their tendency to grow fat as the result of inactivity is one of the chief worries in keeping moles in captivity.

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