A NEW MODEL OF STEREOTAXIC APPARATUS FOR SMALL LABORATORY ANIMALS

Yu. N. Belenev

The Endocrinology Laboratory of the Soil Biology Faculty, M. V. Lomonosov
Moscow State University
(Presented by Active Member AMN SSSR A. L. Myasnikov)
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Stereotaxic apparatus has been widely used during the past 30 years. There are a great number of descriptions of such apparatus, differing in mechanism and adapted for different animals [1, 4], in foreign literature. Recently, a report appeared in our literature with descriptions of the original constructions. R. A. Durinyan and A. I. Bartyzel' [2] described a model of stereotaxic apparatus designed for operation on cats. An apparatus described by R. M. Meshcherskii [3] provides the possibility of working with animals of varying sizes. Its mechanism is rather complex and can be manufactured only under factory conditions.

In research using methods of electrolytic injury of various sections of the brain the need often arises to perform operations rapidly on a large number of animals. This necessitates a stereotaxic instrument. It must be simple and convenient to use, but at the same time must assure a rapid and reliable stereotype fixation of the animal's head and sufficient precision in the placement of the electrodes within the required boundaries. Moreover, in the construction of stereotaxic apparatus the preparation of the electrode placement mechanism, which assures the required precision of localization of injuries produced, often presents difficulties. We published an account of a simple model of stereotaxic apparatus designed to work on rats [1], in which the mechanism of electrode placement consisted of two specimen carriers* ST-12. A test of this model in our laboratory in 1958-59 showed that the use of such a device as the electrode placement mechanism, assuring the precision of their placement to 0.1 mm, is quite satisfactory for producing precise localized injuries (diameter to 0.3-0.5 mm) in the deep-lying sections of the brain. At the same time, the use of specimen carriers facilitates the preparation of a stereotaxic instrument and assures simplicity in working with it.

In the present article a description of a more improved and more convenient to operate model of stereotaxic apparatus is presented, in which the specimen carrier ST-12 is also used. A schematic picture of the apparatus is presented in Fig. 1.

The apparatus is mounted on a panel (1), manufactured from 10-millimeter textolite or ebonite (for rats, suitable panel dimensions are 200 × 300 mm). Fixation of the head is accomplished by ear and tooth holders. The two ear holders (2) are made of ebonite (in Fig. 1 the left ear holder is not pictured; only its support is shown). For rapid fixation of the operated animal's head the ear holders are freely shifted in the metallic supports (3); their movement is accomplished by paired springs (4), the tension of which can be regulated by the movement of the screw-threaded washer (5) at the metallic terminal of the ear holder (6). For a rigid fixation the ear holders, after their insertion into the acoustic ducts of the skull, are tightened by screws (7).

* The devices used are apparently modified from the driving mechanisms of calibrated microscope stages. – Publisher.

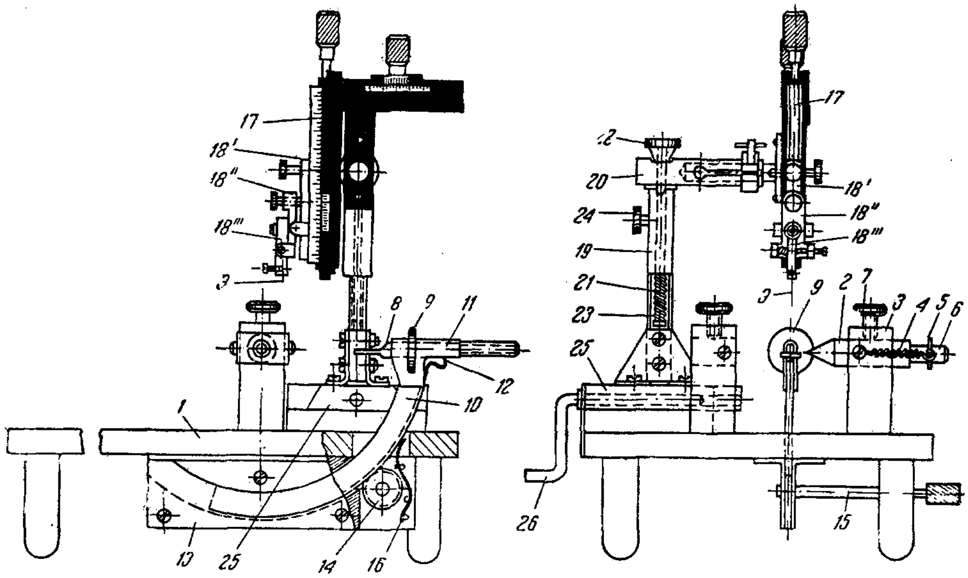

Fig. 1. Schematic picture of the apparatus. 1) Panel; 2) ear holder; 3) ear holder support; 4) ear holder spring; 5) washer; 6) terminal of the ear holder; 7) clamp screw of the ear holder; 8) teeth holder; 9) nut controlling the ear holder; 10) sector (rack); 11) brace; 12) tooth holder spring; 13) stock; 14) gear wheel (pinion); 15) gear wheel axis; 16) sector spring; 17) carrier ST-12; 18', 18", 18'''–3 articulation knobs; 19) holder support; 20) arm holder; 21) pivot; 22) pivot nut; 23) holder spring; 24) holder clamp screw; 25) transverse shifting mechanism; 26) screw for mechanism.

The tooth holder (8) is a metallic pivot with a screw thread, the end of which is compressed and has an opening into which the animal's incisors are inserted. The tooth holder is shifted in a forward-backward direction by means of turning a special nut (9).

In the present model there is provision for change in the angle of inclination of the head of the operated animal in a sagittal plane, which is required in the use of different topographical maps of the brain. This is accomplished by movement of the sector (10), which is graduated in angular degrees. The tooth holder is fastened to the sector by means of a brace (11). A spring (12) is used in order to allow clearance of the tooth holder. The sector is located in the stock (13), consisting of two plates adjacent to the sector at top and bottom, and two angular lateral walls by which the stock fastens to the panel. In the forward part of the stock a gear wheel (14) is mounted with an extended axis (15), the rotation of which is accomplished by movement of the sector. A spring (16) was used in order to allow for clearance of the sector in the stock.

The carrier ST-12 (17), fastened vertically, was used as the mechanism of electrode placement. The electrode (E), made of plexiglass and consisting of 3 components (18', 18", and 18'''), is inserted into the head. A knob permits orientation of the vertically set electrode, since it is possible to change the angle of orientation of the electrode in sagittal and frontal planes. With the aid of a specimen carrier a sagittal and vertical shift of the electrode is accomplished. It secures to a holder, enabling one to draw aside the carrier from its working position. A spring (23), attached to the pivot and placed in a cut in the support, provides fixation of the arm of the holder in a working position. A clamp screw (24) serves for rigid fixation in this position. The weight of the holder supporting the specimen carrier facilitates (with the aid of anglebars) the transverse shifting mechanism (25), which is made of ebonite in the shape of a swallowtail, the movement of which is achieved by a screw with a handle.

Working with the Apparatus. Before carrying out the operation, electrodes were inserted into the head, which then was oriented vertically in sagittal and frontal planes. Our experiment shows that vertical insertion of an electrode "by eye" was quite possible with the use of the usual metal anglebar as a standard. For convenience, the ear holder can be slid and fastened in position by corresponding screws. After setting the electrode, the screw securing the pivot holder is loosened and the arm of the holder is slightly raised by hand and is turned aside. Then, the head of the operated, previously narcotized animal is fixated by the ear holders in the auditory ducts (Fig. 2). For convenience, one holder is left fastened to the support; the clamp screw of the other is loosened.

With one hand the experimenter holds the head of the animal and with the other turns the movable ear holder. At first, the auditory duct is brought to the immovable ear holder; then, the movable one is softly inserted in

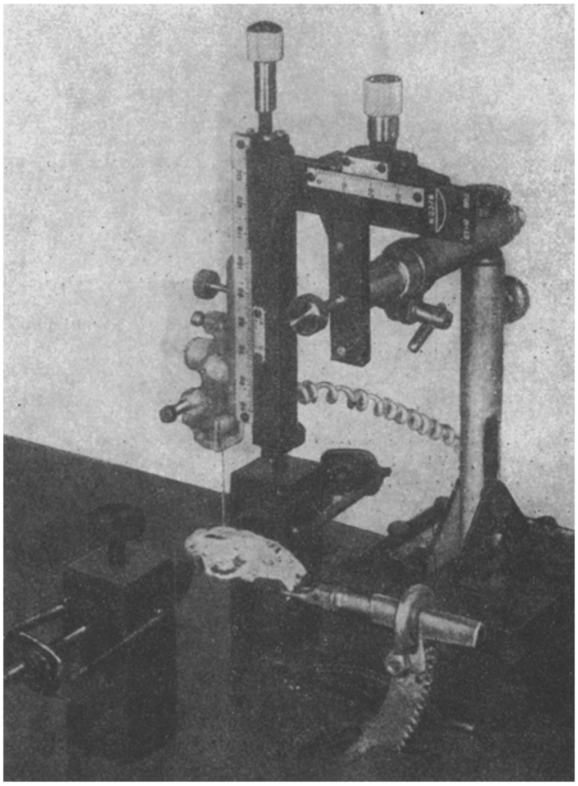

Fig. 2. General view of the apparatus.

the other auditory duct. The screw fastening the immovable ear holder is loosened, and under the effect of the spring the animal's head is suspended in the middle between the supports. Turning the head in a sagittal plane, the incisors are inserted in the corresponding opening of the tooth holder, which then, by the turning of its nut, is retracted for a tight fixation of the animal's head, making it possible to control any tremor. The ear holders are fastened by screws. Turning the sector sets a low angle of inclination of the head, after which one can proceed with the operation.

SUMMARY

A stereotaxic device simple in construction and operation is described. It allows achieving local electrolytic injuries of deeply located cerebral portions in small laboratory animals.

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