

A FELINE HEAD-HOLDER AND BODY-RESTRAINER
FOR USE IN CHRONIC VISUAL ELECTROPHYSIOLOGICAL RESEARCH

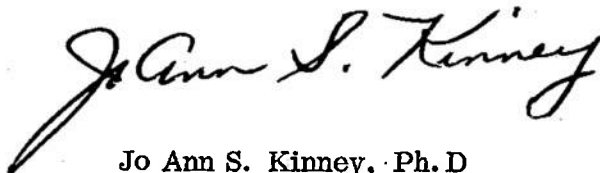
by

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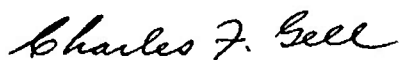
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SUMMARY PAGE

THE PROBLEM

To develop a means of restricting body movement and head orientation so that accurate and reliable visual evoked responses (VERs) can be obtained from implanted cats.

FINDINGS

The apparatus described provides an effective means of obtaining reliable VERs while at the same time it eliminates the major shortcomings of similar devices previously developed.

APPLICATION

This device can be used in research situations that require the acquisition of visually evoked responses from chronically implanted cats. Such an apparatus may prove particularly useful in studying the neurophysiological effects of hazardous environments, such as those which produce extreme nitrogen narcosis, hyperoxia, and carbon monoxide toxicity, where the use of human volunteers is undesirable.

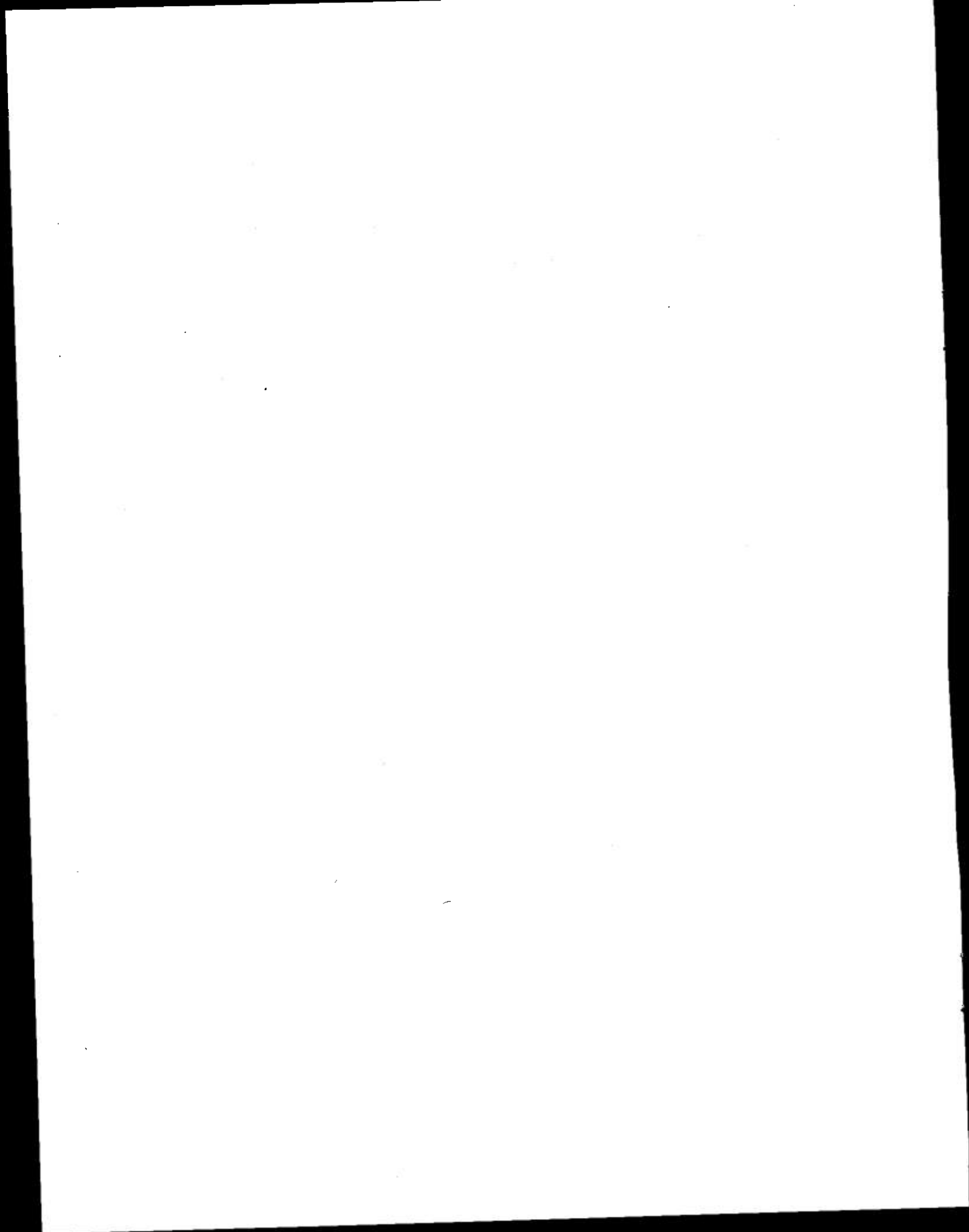
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ABSTRACT

This paper describes a device which was successfully developed to restrict the body movement and head orientation of cats so that visually evoked responses (VERs) could be recorded reliably in the awake, unsedated state. In addition to allowing VERs to be recorded from chronically implanted electrodes, this device has the additional assets of requiring very little adaptation on the part of the cat, being highly flexible with regard to the size of cats it can accommodate, and requiring only a single handler less than two minutes to adequately restrain each animal.



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INTRODUCTION

A problem often encountered when using awake, unsedated cats in neurophysiological research is the lack of an adequate way to restrain unwanted movement. This problem is particularly pronounced in situations where the experimenter wishes to study specific brain potentials evoked by visual stimulation without training the animal to orient toward the stimuli. Obviously, the less extraneous muscle activity and the greater consistency of head orientation that exists, the greater will be the accuracy and reliability of the visually evoked responses (VERs).

Although several cat restrainers have been developed for various research problems, all of these suffer from one or more of the following limitations when used in the present research. They either:

- (1) offer no restraint of head movement,
- (2) require long adaptation period before cat becomes accustomed to restrainer,
- (3) require a minimum of two handlers to restrain the cat,
- (4) severely limit the range of cat sizes that can be used.

The apparatus described below is the final product of an effort to develop a device which effectively eliminates

these shortcomings. Although simple in design, it has proven to be most suitable for our needs of controlling the cat's body movement and head orientation while recording VERs from chronically implanted electrodes.

DESCRIPTION

The apparatus, shown in Fig. 1, consists of two separate parts: a body restrainer and a head holder. The body restrainer has two pieces; a rectangular restraining box, open on top, into which the cat is placed, and a sliding top plate, with a large notch cut out, through which the cat's head protrudes. The restraining box measures 16" long X 5" wide X 5" high, and is equipped with longitudinal slots along the top edges to accommodate the sliding top plate. The top plate, measuring 16" long and 4-7/8" wide is held in the two slots, thus closing the box and enclosing the trunk of the cat. The notch cut out of the end of the top plate is 3" deep and approximately 1 1/2" wide at its narrowest point. After the cat is placed into the restraining box, the top plate is slid forward and adjusted so that it fits comfortably behind the cat's neck.

The head holder is constructed out of 1/4" clear plexiglas and consists of two separate pieces. One piece, the neck plate, measures 8" X 8", with a 3" deep x 3 1/2" wide notch cut out of the back. It is designed to attach to the restraining box from the front, at the

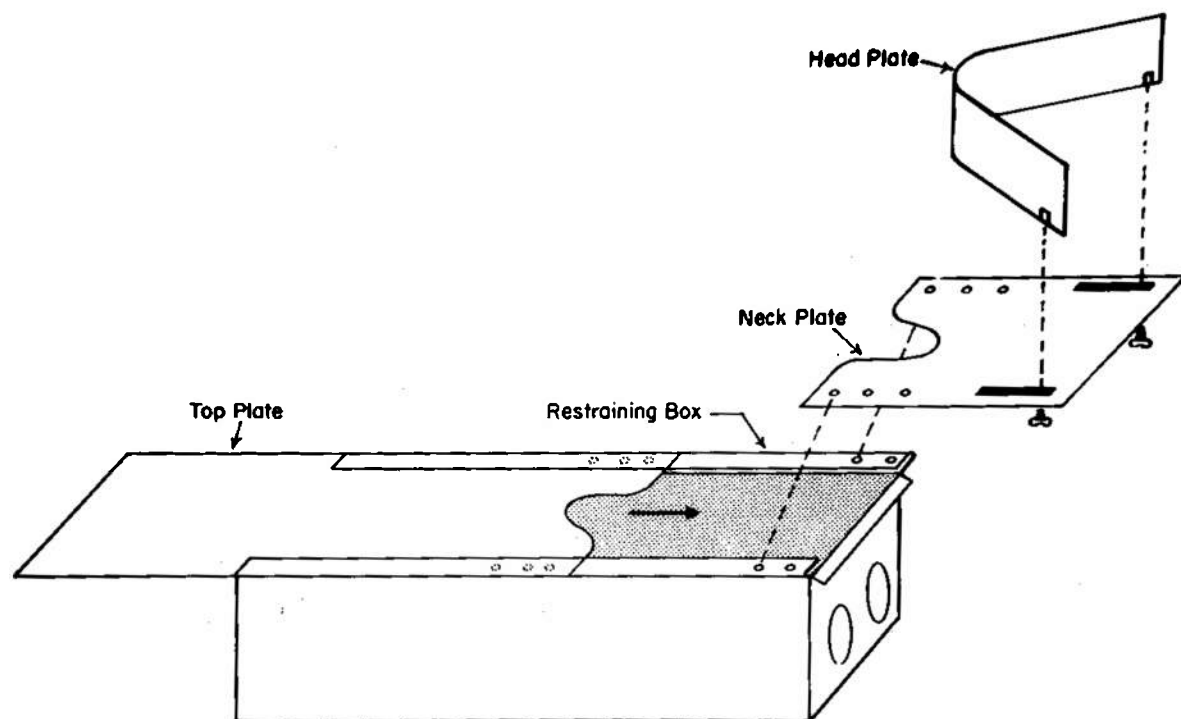


Fig. 1. A schematic diagram of the feline head-holder, body-restrainer.

same point at which the sliding top plate is locked from the back. It has a series of holes drilled along each side so that it can be adjusted and mounted according to the neck size of the cat. The two notches of the top plate and neck plate form an elliptical opening around the cat's neck thereby severely restricting his gross bodily movement. The other plexiglas piece, the head plate, is 15" long X 2 3/4" high, with a gradual 60° bend in the center. It attaches to two parallel slots cut out of the neck plate

via bolts that are threaded into the bottom edge of the head plate. It is designed to fit behind the cat's head, and by sliding it forward in the slots of the neck plate, varying degrees of head restraint can be accomplished (see Fig. 2). With the present specifications, lateral head movement can be limited to about 2" or less. If necessary, more head restraint can be achieved by decreasing the angle of bend in the headpiece.

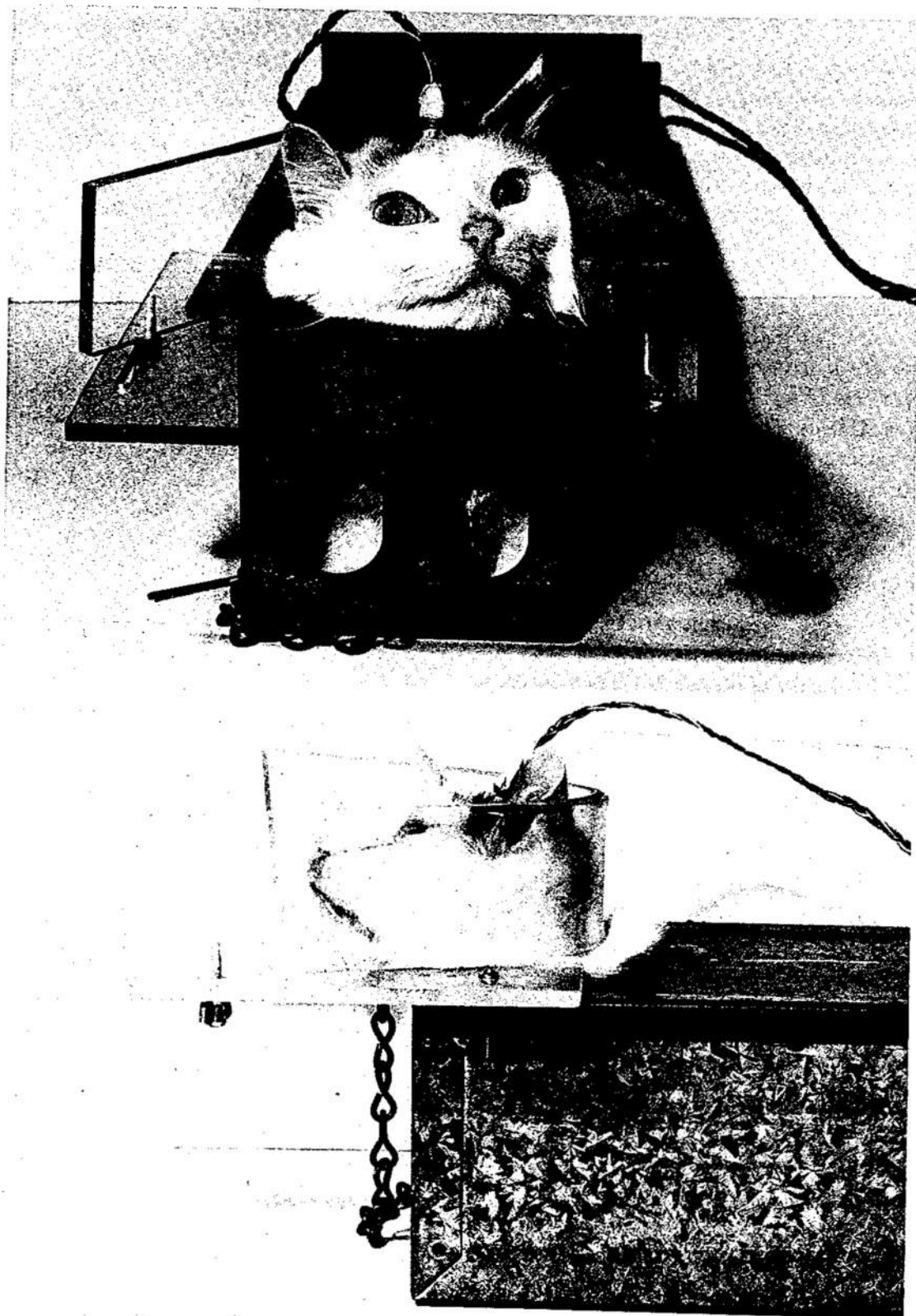


Fig. 2. Pictures showing position of cat when properly restrained in apparatus.

RESULTS AND DISCUSSION

VERs were obtained by placing the restrained cat directly in front of a white hemisphere and positioning a Grass photostimulator directly behind the cat. The visual stimuli were produced by projecting the flashes from the photostimulator onto the hemisphere at a rate of 0.5 Hz, and averaging the EEG time-locked to each of 50 flashes. It has been found that this apparatus effectively limits body movement and restricts head orientation so that highly reliable VERs are obtained from both cortical and subcortical brain structures, confirming the absence of significant artifact from muscle activity and variability of head orientation toward the visual stimuli.

It was also found that most cats require little or no time to adapt to the restraint of this apparatus. They have been used in procedures lasting up to an hour, and have remained reasonably calm throughout each session.*

*As an extra precaution against the possibility of self-inflicted injury, the cat's legs were taped to its body during deep compression studies. This was not done for any of the normal atmospheric, surface recordings.

Another feature of the apparatus is its flexibility with respect to cat size. In our current endeavors, the weight of the cats ranged from 4.5 lbs to 8.5 lbs and the range in head circumference was 26 cm to 32 cm (anterior-posterior) and 19 cm to 25 cm (dorsal-ventral). The apparatus was easily adjusted to restrain all cats equally well, and larger or smaller cats than these could also have been accommodated.

A final advantage of the restraining device is that a single handler can successfully restrain the cat. This is accomplished by opening the restraining box and placing all four feet of the cat (rear feet first) into the box. Then, gentle but firm pressure is applied with both hands on the cat's back, forcing him to lie down in the box. One hand then quickly slides the top plate forward until the cat is secured in the box. The neck plate is then placed on the box and adjusted with the top plate so that it fits loosely around the cat's neck. Finally, the head plate is attached to the neck plate and adjusted until the cat's head movement is appropriately restricted. After very limited practice, the entire procedure takes one person less than two minutes to complete.

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