

TACTILE RELIEF DISPLAY DEVICE AND METHOD FOR MANUFACTURE IT

FIELD OF THE INVENTION

The invention relates to an electromechanical relief display device provided with a frame and at least one tactical member which is movable between a first position and a second position. Touching the device, a person can determine in which position the tactile member is. The tactile member is coupled to an oblong piezoelectric flexion member which may be bent under the influence of voltages applied to it and which is supported in the frame by supporting means in two locations and in a third location is coupled to the tactile member.

BACKGROUND OF THE INVENTION

Such a relief display device is known from U.S. Pat. No. 4,044,350. With this known device a number of piezoelectric flexion members, also called piezoelectric reeds, are supported at their ends and in their central part coupled to a tactile member.

This construction allows a reasonable driving force to be obtained for the tactile member. However, the excursion of the tactile member is rather small with a predetermined flexion of a flexion member of predetermined length.

Devices of the considered type are used as a blind aid for instance in braille cells or rulers or in other devices for tactually displaying a number of points as shown from U.S. Pat. No. 3,229,387.

A difficulty with these devices is that the tactile members have to be located rather near to each other. Due to this and to the fact that the flexion members extend to both sides of the textile members, it becomes difficult to find sufficient space for the flexion members. For instance, in the braille cell shown in U.S. Pat. No. 4,044,350, the members have been mounted above each other in a number equalling the number of braille points in a character (six are shown, but there may be eight in a braille system with further signalling possibilities such as musical notation).

Another braille cell having flexion members has been shown in U.S. Pat. Nos. 2,283,178 and 4,473,356. In these publications the flexion members are mounted by clamping them near to one end in a fitting neck portion. According to U.S. Pat. No. 4,283,178, the flexion member is activated by a DC voltage and in U.S. Pat. No. 4,473,356 by an AC voltage. It should be noted that with the present invention both types of excitation are possible, because if a person can sense whether the tactile member is in the first or the second position he will also be able to sense its vibrational movement between the first and the second positions.

A difficult of these two publications is, however, that the flexion members or reeds are clamped at one of their ends. This feature at the one hand allows for a considerable excursion with a certain flexion member but leads to relatively small driving forces for the tactile members.

A further disadvantage of these known devices is, that with a predetermined force to be exerted on the tactile member, a rather strong flexing momentum works at the flexion member in the immediate proximity of its clamped part.

Still a further disadvantage is that it is very difficult to have the flexion member mounted in the correct posi-

tion. This is due to the fact that angular displacements of the flexion members at their clamping location are multiplied by almost the whole length of the flexion members, whereas it is not sure that all flexion members have exactly the same shape when no exciting voltage is applied to them. The above reasons necessitate an individual adjustment, for instance of the length of the tactile members, which means additional labour and a complication of the construction. Also, reed adjustment during use at times may be necessary. Individually adjusted tactile members have the further disadvantage that with cleaning, for instance in order to remove cutaneous fat, one has to see to it that the same tactile member again cooperates with the same flexion member after the tactile members have been temporarily demounted.

Finally, it is remarked that increase of the flexion excursion or the driving force for the tactile member by augmenting the applied voltage may be undesired or even forbidden in view of safety regulations.

SUMMARY OF THE INVENTION

The invention aims to overcome the above indicated disadvantages and more specifically to provide a relief display device of the indicated type enabling the combination of sufficient driving force and sufficient excursion as well as easy manufacture without adjustment.

The above aims are realized by providing that a third location is located outside the first and second locations.

With the present invention, the driving part of a flexion member is a free end. Thus, a greater excursion is obtained with a certain length and curvature of the member than in the case where the ends of the flexion members are fixed.

Furthermore, a more homogeneous distribution of forces is obtained than is possible with one-sided clamping. The well defined position between two spaced locations enables a manufacturing method without individual adjustment of the tactile members, as will be explained further on.

According to a further elaboration of the invention, it is provided that the support means of the flexion member at the said first location contains a protruding part of the said leaf. This part is attached to the frame. The support means in the second location consists of two clamping members between which the flexion member is clamped. Though generally the best results are obtained if the second location is in the middle of the flexion member, some variation is possible so that the term "middle region" encompasses a region going for instance from a quarter of the member's length from the first location to somewhat beyond the middle (because the excursion decreases quickly when the second location is located further away from the first location than from the middle).

Piezoelectric flexion members or reeds which preferably are used with the invention have a conducting central leaf, a piezoelectric layer on both sides of the central leaf, and a conducting coating on these layers. When using such a reed, it is according to a further elaboration of the invention provided that the attachment occurs at the first location by attaching the central leaf and at the second location by clamping the reed between the support members.

The attachment occurs preferably at a protruding part of the central leaf which is short in comparison to the reed's length. Such a mounting enables at the one