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A DISMOUNTABLE PLETHYSMORECEPTOR FOR DETERMINING THE VOLUME VELOCITY OF THE BLOOD FLOW IN THE LEG AND FOREARM BY THE VENOUS OCCLUSION PLETHYSMOGRAPHY METHOD

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The dismountable air plethysmoreceptor suggested by the author differs from the one-piece models in that it can be quickly and repeatedly applied to and removed from the human limb to be studied. Because of the flexibility of the inner wall of the dismountable plethysmoreceptor the blood flow can be recorded without preliminary injection of air into its inner cavity.

KEY WORDS: dismountable plethysmoreceptor; venous occlusion plethysmography.

Plethysmoreceptors used for direct volume plethysmography can be divided into the following three groups: 1) water, or hydroplethysmoreceptors, 2) water-air, and 3) air, or pneumoplethysmoreceptors [1]. The latter has become widely adopted in connection with the appearance of comparatively simple and convenient rubber plethysmographic cuffs, as suggested by Dohn [7] for the investigation of the circulation in the human limbs (in the forearm, leg, and hand).

Some workers have attempted to use ordinary cuffs for measurement of the blood pressure as pneumoplethysmoreceptors [4, 8]. However, in these cases in order to secure the cuff satisfactorily to the limb an unacceptably high positive pressure (10-50 mm Hg) had to be created in it. Even the improved flexible segmental oncometer introduced by Dohn [7] has its disadvantages, according to Skards and Vitols [2], for the cylindrical shape of the inner wall of the oncometer prevents it from fitting snugly against the limb segment to be studied, which is conventionally conical in shape. Skards and Vitols [2] have suggested a flexible segmental oncometer, in the form of a truncated cone for determining the volume blood flow in the forearm and leg by the venous occlusion plethysmography method.

Existing plethsmoreceptors, both water [5, 6] and air [3, 8], can be used to record the volume blood flow in the forearm more successfully than in the leg.

Considering the existing disadvantages of the use of all the above-mentioned plethysmoreceptors for measuring the volume velocity of the blood flow in the leg during dynamic physical exertion, the writer has attempted to develop and make dismountable plethysmoreceptors.

The suggested dismountable air plethysmoreceptor for the leg (Fig. 1) consists of a strip of viniplast 1, 40 mm wide and 2 mm thick, curved into a ring with its ends separate. Rubber edging 2, triangular in cross-section is glued to the inner edges of the body of the plethysmoreceptor, and the difference between the height of the edging on the two sides gives the inner surface of the plethysmoreceptor its conical shape. The inner

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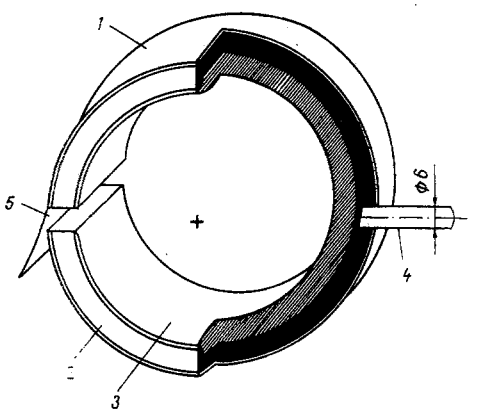

Fig. 1. Scheme of dismountable plethysmoreceptor.

surface of the body is covered with thin elastic rubber 3, made from the cuff of a surgical rubber glove, the edges of which are glued to the outer edges of the body. A rubber nipple 4, used for connecting to the system for mechanical-electrical transformation of the signal, is connected to the body. The separate ends of the plethysmoreceptor are joined together by means of adhesive tape 5. Because of the dismountable design the plethysmoreceptor can be applied and removed freely to the subject's leg. When applied to the leg the plethysmoreceptor fits snugly against the segment of the limb to be studied.

The flexibility of the inner wall of the plethysmoreceptor for the leg, resulting from the difference between the smaller diameter of the rubber sleeve and the larger internal diameter of the body of the plethysmoreceptor enables the volume velocity of the blood flow to be recorded without the preliminary injection of air into the cavity of the plethysmoreceptor; this is one of its advantages, for it greatly simplifies the occlusion-plethysmographic system and makes it more airtight, which is very important.

Considering differences in the diameter of the leg in different subjects, plethysmoreceptors with several different internal diameters were designed and made, and by their use it is possible to determine the intensity of the blood flow in the leg of virtually any adult.

Further investigations showed that the plethysmoreceptor as described above, designed for measuring the volume velocity of the blood flow in the leg, can also be successfully used to record this index in the forearm.

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