Determination of visual acuity is one of the more important functional examinations of the organ of sight.

In medical practice visual acuity (minimum separabile) is determined by special test-symbols and is characterized by the lowest angular value of a symbol that is still distinguishable to the eye. The test symbols may be presented singly, in groups, or in charts that give symbols for the entire range of visual acuity.

Visual acuity to a large extent depends on illumination of the background and contrast of the symbols. In order to obtain comparative results, it is therefore necessary to create equal examination conditions, i.e., to establish definite standards of illumination and contrast. The basic requirement of instruments and apparatuses for examining visual acuity is that they create such conditions and maintain their uniformity.

Another important requirement is that they afford the possibility of conducting examinations by means of a simultaneous binocular test with separation of the fields of vision. The essence of this method, which has of late gained wide acceptance abroad, consists of simultaneous presentation of separate, physiologically equivalent tests to the right and left eye. The right eye does not see the test presented to the left and vice-versa. In this way it is possible to conduct monocular examination of visual acuity with both eyes functioning, i.e., in the conditions most natural for work of the visual analyzer. Visual acuity in such cases is determined with consideration of the connection between accommodation of the two eyes as well as between accommodation and vergence. The nature of sensory-motor connections of the visual analyzer and the degree of participation of each eye in the act of binocular vision are clarified simultaneously.

It is possible on the basis of design characteristics to divide all instruments and apparatuses for examination of visual acuity into four basic groups.

1. Illuminators of Printed Charts. These are the simplest and, as a rule, cheapest apparatuses with the exception only of those in which a complicated and cumbersome mechanical system of control is used to make possible the presentation of separate symbols.

It is impossible to separate the field of vision reliably with them, which considerably reduces the functional possibilities and diagnostic value of the apparatuses in question.

2. Transparent Apparatuses consist of a housing, one or more of whose walls is a semitransparent lusterless plate with test charts inscribed on it, and an illuminator inside the housing that ensures even illumination of the charts.

Separation of the fields of vision (with the aid of polaroids or light filters of supplementary colors) considerably expands the area of application of these apparatuses.

Special tests make it possible to check for such visual disorders as strabismus, heterophoria, anisoconia, etc. (without structural complication of the apparatuses).

Transparent apparatuses have gained wide acceptance abroad on the strength of their obvious superiority over ordinary illuminators with printed tables.

3. Apparatuses for Projection of Visual Tests on reflecting screens are ordinary projectors designed to employ small diapositives on which various tests are inscribed. It is possible to separate fields of vision just as in transparent apparatuses.

The advantage of projection devices is that they can be used for a practically unlimited number of tests: replacement and storage involve no inconvenience or complications.

Their shortcomings are that they need a fairly powerful source of light to ensure adequate illumination of the screen, and the examination must be carried out in a dark room. These shortcomings are absent in projection apparatuses built in such a way that tests are projected on a semitransparent lusterless screen as in daytime motion pictures.

Like transparent apparatuses, projection devices can be used only in rooms of appropriate size, since the examination distance must be not less than 5 m. In some models (for example, in the test symbol projector produced by the state firm of K. Zeiss, Jena), the tests are designed so that the examination distance does not affect the angular value of the symbols observed. With reduction of this distance, however, the action of accommodation begins to be exerted.

Projection devices are nonetheless widely used in ophthalmological clinics in a number of foreign countries.

4. Collimator Devices are based on the use of an isolated optical system for examination of each eye. With the aid of such a system, an infinite number of test-object images can be presented. In connection with this, the size of the room in which examinations are conducted is of no significance. The examination can be either monocular, or binocular with separation of the fields of vision. As in projection devices, tests in apparatuses of this group are realized in the form of diapositives and can thus be used for several kinds of ophthalmological examinations.

Collimator devices are also convenient in that with the aid of a small additional attachment it is possible to examine visual acuity at close range.

Together with the fact that they can be used in any room, their small size and light weight make these apparatuses convenient for mass prophylactic examinations such as rapid determination of visual acuity in selection of professional personnel (the apparatus for rapid clarification of visual defects, K. Zeiss, Jena).

An illuminator of printed tables for examination of visual acuity is mass produced in the Soviet Union (the Rota apparatus).

The recently increased demand for such apparatuses, however, and newly developed methods of examination make it necessary to produce other designs of apparatuses for determining visual acuity.

A blueprint for apparatuses used in examination of visual acuity has been developed at the All-Union Scientific-Research Institute of Medical Instrument Engineering (VNIIMP) on the basis of analysis of recent models, their sphere of application, experience in using them, and data on the demand for them in public health institutions. The blueprint specifies manufacture of six kinds of apparatuses (see Table 1) that most fully meet contemporary medico-technical requirements and that wholly satisfy the need for such apparatuses in medical institutions.

According to the blueprint, the basic implements for strengthening the eye departments of polyclinics and hospitals are a stationary apparatus for examination of visual acuity, and a manual apparatus for examination of visual acuity at close range. Both are transparent apparatuses; separation of fields of vision can be accomplished with the aid of either polaroids or light filters. The stationary apparatus provides for presentation of separate signals or part of a chart by means of switching on different units of the apparatus. Remote control obviates the need for a nurse's assistance.

The apparatus for examination of visual acuity at close range can also be used for examination of visual acuity below 0.1 (special symbols of the Polyak variety of optotype will be provided for such cases).

It will be possible to conduct mass prophylactic examinations and fit eyeglasses directly in schools and factories with the aid of the portable apparatus, which should be lightweight and attach conveniently and quickly to a wall.