

Chapter VII

ASSISTIVE DEVICES FOR THE VISUALLY IMPAIRED

Assistive devices for the visually impaired can be divided into the following six categories:

1. Educational Devices
2. Mobility Devices
3. Vocational Devices
4. Daily Living Devices
5. Low Vision Devices
6. Psychological Tests for Vocational Assessment and Training

1. Educational Devices

The educational devices can be further classified into the following broad eight categories:

- 1.1 Braille Duplicators and Writers
- 1.2 Writing Devices
- 1.3 Braille Paper
- 1.4 Talking Books and Tape Recorders
- 1.5 Reading Machines
- 1.6 Braille Computers
- 1.7 Mathematical Devices
- 1.8 Geography Devices
- 1.9 Science Devices

1.1 Braille Duplicators and Writers

1.1.1 Thermoform Machine: 'Indutherm' is an indigenous

semi-automatic Braille duplicating machine. It is useful for taking out multiple copies of the Braille matter on the Indutherm (or Braillon) sheets from the master generally prepared on the Braille paper. This machine operates on the principle of vacuum and high temperature.

Manufacturers

- a. National Scientific Company,
1958, Pilanji Kotla,
Mubarakpur, New Delhi - 100 003
- b. Asian Power Cyclopes,
Rochipura, P.O. Majra, Dehradun 248 171
Phone : (0135) 620 488.
Fax: 620 961

Similarly, Vacuum Forming Machine is also available in standard sizes. It can also be used for taking out multiple copies of Braille matter using PVC, HIP, Acrylic & ABS sheets with 2 mm thickness.

Manufacturer: IDEM Thermoformers, Wonderpack Industries, 72 I Floor, Shivilal Mansion, Lamington Road, Near Mumbai Central, Mumbai - 400 008

1.1.2 Braille Writers: It is an upward writing machine for writing on one side of the paper, enabling the Braille to be read as it is written. This machine can be compared to a normal type writer with a major difference that it has only nine keys, three for paper setting and six for embossing, the braille embosser combinations of six dots in a Braille cell.

The Braille machine is made of metal with an enamel finish, with plastic key-tops and adjustable margin stops. The paper is roller-fed and line spacing is achieved by pressing a special key. The most popular Braille writers are:

- Stensby Braille Writers
- Perkins Braillers

- Taj Braillers
- Worth Perkins Brailer
- Minal Brailer

Manufacturers

- a. Moksha Enterprises,
F-6, Nacharam Industrial Estate,
Road No. 18, Nacharam,
Hyderabad - 500 076 Andhra Pradesh.
Phone : (040) 7151849
Fax: 7813618
- b. Worth Trust, 48,
New Thiruvallam Road,
Katpadi - 632 007, Tamil Nadu
Phone : (0416) 242739
Fax: 243939
Gram : WORTH, Vellore
Email : worth@md3.vsnl.net.in
- c. Minal Engineering Limited,
214/A, Paradise Complex,
Sayajigunj, Vadodara -390 005, Gujarat
Phone : (0265) 323 493, 332 962
Fax: 641216

1.2 Writing Devices

i. *Interline Braille Frame:* is used for writing standard character interline Braille. The frame comprises a wooden board, a metal guide, a reversible paper clamp and a stylus. The clamp fits at the top of the board and has a small swivel stud for locking and holding Braille paper. When one side of the paper has been Brailled, the clamp with the paper still held, is turned over as

a unit. The binding margin is made automatically.

ii. *Taylor Postcard Frame*: It is used for writing small character Braille on one side of the paper. The corner pins are arranged in such a way that the Braille can be read without removing the paper from the frame; when the top section is lifted, the paper remains attached to it.

iii. *Pocket Braille Frame*: The four-line pocket Braille frame produces small character Braille on one side of the Braille paper. This is specially used for making small and occasional notes.

iv. *Stylis*: These are produced with handles of various shapes to suit individual needs. The points of all stylis are made of stainless steel and the handles are of polished hardwood or synthetic material.

v. *Braille Kit*: is a rexine coated or a decorative wood box 36 Cms. by 28.5 Cms. with a weight of 3085 Gms. and contains the following items:

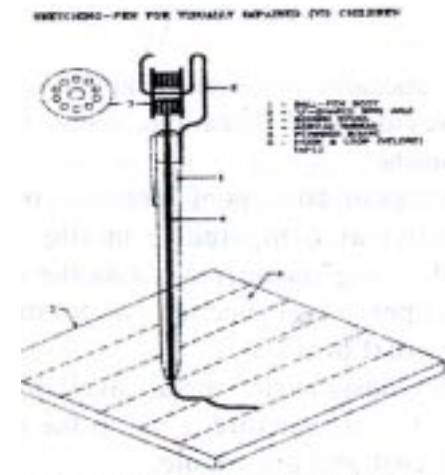
- Braille Writing Frame
- Braille Writing Pocket Frame
- Rubber Sheet
- Foot Ruler
- Compass Set
- Two Stylis
- Folding Stick or Abacus and
- Signature Guide.

vi. *Pragnya Sketching Device*

Mrs. Pragnya Bhatt and Mr. Dilip Bhatt, father of a low vision child, Nikunj and volunteers of Blind People's Association have developed an innovative sketching

device. It enables a visually impaired child as well as a low vision child to create simple sketches and diagrams out of a thread. It is based on principle of using acrylic thread as “writing ink” and nylon fabric fastener strips as a “writing slate”.

Product Design: Acrylic thread of a contrast colour that works as refill is passed through the empty body of an open ended ball pen, keeping the other end attached to bobbin spool. The thread is wound on the spool



that rotates about a wire axle, attached to the upper part of the ball pen. The nylon fastener stripes are stitched together width wise and pasted on the wooden board to make 1'x1' area.

Operation: The child holds the pen as any other normal pen for a sighted person and makes contact of the thread over the slate surface. Keeping continuous touch with the surface, the child glides the pen in different directions and the thread delivery is maintained smoothly through the rotating spool.

A line can be terminated by snapping off the thread by using a sharp stationary blade. A continuous running thread can also make different shapes like circles, rectangles, curved lines, letters, graphic symbols, maps etc. The drawn picture can be easily “erased” by simply pulling away the thread from the slate surface and rewinding it again over the spool. The child can immediately feel the shape by moving fingers over the thread surface and add, correct or erase the line quickly. It enables interaction of the child with the writing media and encourages drawing of various objects. A low vision child may see the shapes by holding the board close to eyes.

Advantages

- Self operated excellent user friendly device
- Serves as useful educational media for the teaching personnel
- Operates on concept of “draw as you think” which is better as compared to tactile devices where “embossing” is carried out on the reverse side of the paper, metal sheet etc. to get mirror image of the actual profile.
- Simple design using readily available components.
- Easy to manufacture, even in the rural areas.
- Low cost and affordable.
- No training manual required as it is easy to operate.

Awards

- i. **National Award:** Mr. Dilip Bhatt and Mrs. Pragnya Bhatt have been conferred the National Award for outstanding technological invention in the field of welfare for the Persons with Disabilities by the President of India on 3rd December 1997.
- ii. National Research and development Corporation (NRDC) **Science & Technology Award:** The inventors

were also conferred Science & Technology Award on 26th January 1998 on the occasion of Republic Day.

- iii. World Intellectual Properties Organization (WIPO) **Gold Medal** for the best product patented from the developing countries.

- iv. Displayed in the exhibition titled “**Heralding the New Millennium**” on the occasion of 87th session of the Indian Science Congress during 3-7 January, 2000 at Pune as “Innovative India”.

- v. Patent has already been filed for this device under Patent Cooperative Treaty (PCT) by the National Research and Development Corporation, New Delhi.

Manufacturers

- a. National Rehabilitation Engineering Institute, Blind People’s Association, Vastrapur, Ahmedabad-380 015
Phone : 6305082, 6304070
Gram : “BLINAB”
Fax: 6300106
E-mail : bpa@vsnl.com
Web: http://education.vsnl.com./bpa_ahmedabad
- b. National Institute for the Visually Handicapped, 116, Rajpur Road, Dehradun - 248 001 Uttar Pradesh.
Phone : 744491, 744578
Fax: 748147
Gram : “NIVH”
Email : nivhddn@nde.vsnl.net.in
- c. Moksha Enterprises

1.3 BraillePaper : The standard size of Braille paper is 22"X28" and weight 8.6 kg. per gross.

Manufacturers

- a. Titaghar Paper Mills Ltd.
- b. Andhra Pradesh Paper Mills Ltd.
- c. West Coast Paper Mills Ltd.
- d. Rohtas Paper Mills Ltd.
- e. Orient Paper Mills Ltd.

1.4 Talking Books and Tape Recorders

1.4.1 *Talking Books:* The material recorded on cassettes has emerged to be the most popular mode of imparting education to visually impaired persons. As Braille books are very heavy and many newly blind persons are not able to learn Braille easily, talking books are emerging to be the most viable alternative.

For listening to the talking books, the conventional cassette players with the compact cassettes with a playing time of either 60 or 90 minutes is generally used.

The Major Talking Book Libraries in the country are:

- a. Talking Book Library,
NIVH, Dehradun
- b. M. P. Shah Talking Book Library,
National Association for the Blind,
11, Khan Abdul Gaffar Khan Road,
Worli Seaface, Mumbai 400025
Phone : (022) 4935370, 4936930
Fax : 91-22-4932539
Email : nab@giabm01.vsnl.net.in
- d. A N Kinariwala Talking Book Library,
BPA, Ahmedabad

- e. Blind Relief Association,
Lal Bahadur Shastri Marg,
New Delhi - 110 003
Phone : 436 1376
Gram : "BLINCENTRE".
- f. Poona Blind Men's Association,
82, Rasta Peth, Pune
Phone : (0212) 626433 627 036
Fax: 628741.

Many regional and district level development agencies for the visually impaired have their own small talking book libraries.

1.4.2 *Digital Tapeless Recorder:* Kun Yoong Trading Co. RM.1302, Hwanghwa Bldg., #832-7, Yeoksam-Dong, Kangnam-Ku, Seoul, Korea has developed Digital Tapeless Recorder (Check-back) for the Blind. The blind people can use it alone without someone's help. It has a special voice prompt for the blind which includes a voice guide, easy research mode, volume adjustment and option for use of earphone.

1.5 Reading Machines

- i. Kurzweil Reading Machine: A portable optical scanner that reads type-set or type-written text and turns it into speech. Its features include:
 - a large memory to provide improved processing of incoming text;
 - an automatic contrast control;
 - tools for format analysis;
 - multi-lingual capability for text in any of these verbal languages;
 - communication interface which allows it to serve as an input or output device with other data or text processing equipment.

Manufacturer:

Kurzweil Educational Systems,
Inc. 411 Waverley Oaks Road,
Waltham, Massachusetts 02154, USA.
Tel.: +1617 893 8200
Fax: +1617 893 4157
Email : info@kurzweiledu.com
Web : http://www.kurzweiledu.com

Supplier in India:

Empire Industries Ltd.,
Empire House, 414,
Senapati Bapat Marg, Mumbai - 400 013

ii. *Optacon*: is a book-sized electronic device with a movable camera, the size of a pocket knife and a tactile screen the size of a fingertip which presents a tactile image on an array of vibratory pins. The reader passes the camera over printed material with his right hand and his left index finger feels in vibratory relief the image the camera sees. The manufacturer claims that an experienced Optacon user reads up to 90 words per minute, about half his Braille reading speed.

Manufacturer:

Telesensory Systems Inc.,
P.O. Box 7455, Mountain View,
California 94039-7455, U.S.A.
Tele : +1415335 1800
Fax: 1414 335-1816,
Email : tele@netcom.com,
Web : http://www.telesensory.com/index.html

1.6 Braille Computers

i. *Braille Window*: is the Braille-display for connection to all sort of IBM compatible personal computers.

ii. *Keystone*: is a portable information handling, word-processor and computer access device that talks to its user.

iii. *EHG-BW/ 2-PIEZO* is a monitor and key board which provides output in raised dots and can be conveniently used by the visually impaired persons.

iv. *Galaxy Piezo*: is a special computer for the visually impaired and it gives output in embossed dots.

v. *Galaxy speech*: is a special computer for the visually impaired with speech output

vi. *Braille'n Speak*: is pocket size note taker. It can be used for word processing, as a calculator, as a clock and a calendar. It can store 200 pages of Braille text.

vii. *Versa-Braille II+*: is recognized as a convenient Braille operating system. It can be used for editing, programming and word processing. The input is from six keys and output is in the form of raised dots. It is a product of Telesensory Systems Inc.

viii. *Index Braille*: Index Braille is a Sweden based privately owned business with a mission devoted to development and production of Braille Embosser.

The company has introduced Double-sided Braille Embosser, popularly known as "Index Everest". It has a high speed Interpoint Braille Embosser which uses normal cut sheet. Over the years, the Everest has proved to be one of the most reliable Embossers on the market.

Manufacturer

Index Braille
Hantverkavagen 20, Box 155,
S-95423 Gammelstad, Sweden
Phone : +46-920 203080
Fax : +46-920 203085
E-mail : info@idexbraille.com
Web : www.indexbraille.com

Distributor for India

Sparsh Products
151-5, Raipur, Road,
Dehradun - 248001 Uttar Pradesh
Phone : +91-135 735011
Fax : +91-135 651108, 650944
E-mail : reetarao@del3.vsnl.net.in

ix. *Speech Synthesizers*: A speech access system converts text from a computer into spoken words. It is the hardware device that does the speaking in a speech access system.

a. *External device*: It connects to a computer externally and comes with a speaker and a socket for headphones and can be moved around to different machines.

b. *Internal device*: It comes as a chip or a circuit board that must be inserted inside the computer with sockets for speakers and headphones. It can be moved around to different machines, it works faster than an external device.

c. *Soft-ware based device*: It is loaded as software on a compatible computer and it gives speech out through the sound system of the computer itself. The

Microsoft Voice is useful for reading the documents and for operating window commands with the help of multimedia kit.

Important features of synthesizers include

- voice quality
- speed at which text is converted to speech
- memory requirements, and
- compatibility of the synthesizer to the computer (Mac or PC) and the number of languages available.

d. *Language software*: The Indian Institute of Technology (IIT) Chennai has developed Braille Software as well as Language Software which enables a visually impaired person to access computers for Braille as well as language outputs in all the Indian languages. The Vidya Vriksha Training Centre for the Disabled, a Chennai based NGO is imparting training to visually impaired persons in the use of software. It is also providing the software completely free of cost to the users and the institutions. It has also developed a system of keyboard mapping and operations in Indian languages and instruction manual for use of the special version of the ITI Multilingual Software.

1.7 Mathematical Devices

i. *Taylor Arithmetic Frame*: The surface of this aluminum frame is divided into star shaped holes with eight angles, thus allowing the double-ended metal types to be placed in different positions according to a set system. This frame is suitable for teaching arithmetic to visually impaired persons.

ii. *Arithmetic and Braille Writing Slate*: This has a Arithmetic frame on one side and a Writing slate on the other. It also has reversible type clamp and two guide lines supplied with a wooden stylus.

iii. *Abacus*: A simple instrument for performing rapid arithmetical calculations. It consists of a frame holding thirteen vertically arranged rods on which beads slide up and down. The beam supporting the beads is marked with a raised dot at each rod position and a raised bar between every third rod. The bars serve to indicate the decimal point and other units of decimal measure.

iv. *Talking Calculator*: Audible calculator in synthesized speech. Useful for calculation, clock, alarm and calendar. Manufactured by Casio and Sharp companies of Japan.

v. *Primary Mathematics Kit*: specially designed for the visually handicapped children to comprehend mathematical concepts. It contains:

- a plastic box
- slide strips
- number boards
- fractional strips
- Braille clock
- geometrical shapes - geometrical figure tray
- magnetic board, and
- geometrical devices.

Manufacturer : NIVH, Dehradun

vi. *Spur Wheel*: A serrated wheel revolving in a plated metal handle. It is used for making continuous embossed lines on the reverse side of the paper.

vii. *Compass Set*: It includes a foot ruler, a protractor and a set square in nylon and a spur wheel. It enables visually impaired students to use the same techniques as his sighted counterpart. The foot ruler and set square have embossed markings for their convenience. The compass has a removable component fitted with a toothed wheel for drawing embossed dotted lines on the reverse of the Braille paper.

viii. *Geometry Mat*: A sheet of rubber for use as a base in conjunction with the spur wheel and Braille paper for making geometrical drawings.

ix. *Opisometer*: A bell rings each time the disc moves a distance of one meter. Useful for mapping and understanding mathematical problems in length and perimeter.

x. *Other mathematical devices are*:

- Three-in-one: Arithmetic Frame, Writing Frame and Abacus
- Composite Braille Slate: Abacus, Arithmetic Frame, Rubber Mat and Wooden Frame
- Graded Abacus
- Fraction Boards
- Counting Device
- Hundred, Tens Units Board
- Arithmetic as well as Algebraic Types
- Geometric Shapes and Solids

Suppliers of educational devices are:

- a. NREI, BPA, Ahmedabad
- b. NIVH, Dehradun
- c. Asian Power Cyclopes

- d. Moksha Enterprises
- e. Voltas Ltd., Kaybee Cell,
Volkart Building, 19 J N Heredia Marg
Ballard Estate, Mumbai - 400 038
- f. Advance Engineering Works,
22 Lytton Road, Dehradun - 248 001
Uttar Pradesh,
Telefax : (0135) 654530
- g. Artificial Limbs Manufacturing Corporation,
G T Road, Kanpur - 208 016 Uttar Pradesh
Phone : (0512) 250173
Fax : 252617
Gram : “Artlimbs”
- h. Pneumatic Controls,
35-B, Rama Road,
New Delhi 110 015
- i. NAB Louis Braille Memorial Research Centre,
Rustom Alpaiwala Complex,
124, Cotton Depot, Cotton Green,
Mumbai - 400 033
Phone : (022) 3756802

1.8 Geography Devices

1.8.1 *Sensory Quill*: It is an equipment for obtaining a raised line format of any writing or drawing. The height and texture of the line can be altered. Useful in learning handwriting skills, mathematics, science, drawing and spellings.

Manufacturer:

V. R. Vardhman International,
Vardhman House, 1, Raj Block,
Naveen Shahadara, New Delhi 110 032

1.8.2 *Maps and Globes* :

i. *Raised Relief Plastic Maps*: Vacuum formed plastic maps printed in strong colours with names in letterpress for the benefit of person with low vision. The main towns are shown by large dots and principal rivers by depressions. Braille symbols denote the names of seas, main rivers and towns, a key to which is given in the guide. The boundaries on political maps are indicated by raised lines.

In India, political and physical maps are available for Asia and India. The vacuum printed diagrams are also available for various body systems, anatomy, physiology etc. at the following address:

- a. Bharat Educational Stores, Chippi Tank, Meerut
Uttar Pradesh
- b. Krishna Models Manufacturing Co. Ltd., Nai Sarak,
Near Chandni Chowk, New Delhi- 110 015

ii. *Relief Globes*: A plastic globe in textured relief. The land masses are shown in different colours. The principal towns are indicated by raised dots; rivers and lakes by depressions. Dotted lines indicate the tropics, arctic, and antarctic circles, the international date-line and meridians. The names of oceans and the main land are shown in Braille.

Nystrom’s Bathymetric World Model is raised relief map of the world with oceans drained. All under water features are exposed. A cassette recording explaining the features is supplied with the product.

iii. *Braille Diagram Board*: Metal sheet fixed on a board with closely formed holes in which round headed

pins are stuck to form maps and diagrams.

Manufacturer: NIVH, Dehradun

1.9 Science Devices

1.9.1 *Conductivity Apparatus:* Demonstrates the difference in the heat conductivity of copper and iron. It consists of a wooden stand with horizontal heating rods.

1.9.2 *Three Dimensional Raised Relief Plastic Charts:* Rigid PVC sheet, printed and formed in multi-colours. The following charts are available:

- i. *Botany General:* includes typical plant cell, plant meiosis, plant mitosis, Ribo-Nucleic Acid, Bacterial forms, Spirogyra and Funaria - common Moss in Botany
- ii. *Botany Advance:* depicts fertilization, T. S. dicot leaf, dicot stem, types of placentation
- iii. *Zoology:* Vertebrate and Invertebrate
- iv. *Human Physiology and Human Body Systems* including human skeleton, circulation system, heart, nervous system, a section of the brain, muscles, digestive system, the ear, the nose, and the eye.
- v. *Human Reproduction* includes male and female reproduction organs, fertilization and foetus

Manufacturer :

Bharat Graphics,
194, Industrial Area Phase II,
Chandigarh - 160 002

2. Mobility Devices

2.1 **Canes:** The following types of canes are available:

i. *Symbol Canes:* Made of sections of light metal tubing, generally aluminum or its alloys, joined through the center by means of an elastic cord. The canes fold up conveniently for carrying in the pocket or handbag. When required for use, the top section is held and others automatically fall into position.

Devised for portability and not intended to be used other than as a guide aid and an indication that the user is a visually impaired person. This cane is popularly known as a Braille folding stick.

ii. *Guide Canes:* A stronger version of the symbol cane and intended to be more of a mobility aid but not a means of support. The four sections, covered with ribbed plastic sleeving, are joined through the center by means of an elastic cord enclosed in nylon sleeving. It is fitted with an elastic loop handle and a standard nylon tip.

iii. *Long Canes:* A wooden or aluminum stick of 85 to 90 centimeters. Three models are available:

- rigid
- two piece, and
- four piece.

The aluminum cane is generally sleeved with PVC material, having a rubber grip and a nylon tip with or without a crook.

iv. *Electronic Travel Devices:* An ETA is described as a device that sends out signals to sense the environment

within a certain range or distance, processes the information received and furnishes the person with relevant information about the environment. Most of these devices are based on integrated circuits and emit sound or tactile signals.

As ETAs are not available and prevalent in India, it is not very necessary to give description of these devices. However, for the sake of information, these devices are listed below:

- Lind Say Russel E-model Path Sounder
- C 5 Laser Cane
- Ultrasonic Torch
- Sonic Guide
- Light Probes
- Mowat Sonar Sensor
- Nottingham Obstacle Sensor
- Electro-cortical Prosthesis
- Electro Roftalm
- AFB's Computerized Travel Aid
- Polaroid Ultrasonic Travel Aid

For details about ETAs, refer to NIVH publication "*Selected Abstracts & Annotated Bibliography on Orientation and Mobility*"

2.2 Mobility Show Card: A plastic show card to help visually impaired persons to cross busy roads and to hail a taxi.

2.3 Mini Beeper: A battery operated, hand-held electronic gadget having application in mobility, recreation, sports and obstacle location.

3. Vocational Devices

The vocational devices should ensure the following:

- A visually impaired person's ability to perform a definite technological operation.
- Employment of various means of mechanization with the aim of lightening jobs for such person.
- Complete safety of a person's labour.
- Preservation of residual touch, sight and hearing.
- High quality of manufactured products.
- Increase in labour productivity.
- Self reliability as regard the operations he is required to perform.

3.1 Goniometer : It is an instrument to measure body angles and it is useful to physiotherapists.

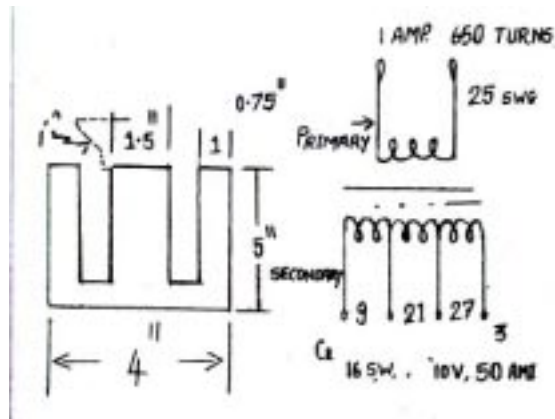
3.2 Attachment to Lathe : It enables the visually impaired to operate the Capstan as well as a Central lathe. It is a attachment which can be mounted on the movement bar and can be fixed to enable the person to operate the machine to a desired length.

A new device has also been developed which emits a sound signal when the tool carriage reaches a desired point. A movable switch is fitted on the movement bar and can be fixed as desired. Whenever the tool carriage touches the switch, the sound signal is emitted.

3.3 Spot Welding : It has been developed by using:

- 5 Kg E-type lamination cord,
- One bobbin,
- 25 and 16 S.W.G. copper wires,
- One carbon rod,
- One combination pleyer,
- Metal box, and
- One line cord wire.

As it has low voltage with high amperage current, it is safe for visually impaired persons to carry out the soldering of joints.



Advantages

- No risk of any electric shock to the operator
- Low cost
- Portable
- No need for dry solder.

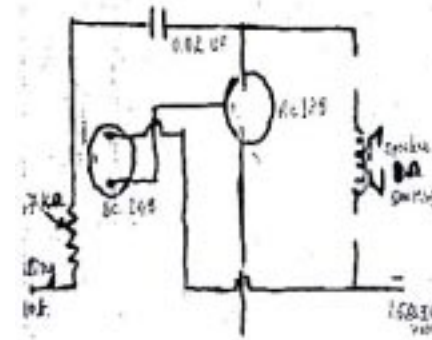
Limitation: It can, however, be used only for copper wire soldering.

3.4 Continuity Tester : It is a low voltage electric circuit for testing continuity of winding wires in case of motor winding or other such operations. The light signal is replaced by the sound signal for enabling the operators to establish continuity of the wires.

Material: It has been developed by using:

- Two transistors (BC 148 and AC 128)
- One resistance (47 Kilo-ohms)
- One capacitor (0.02UF)
- One speaker (8 Ohms, 500 MW)
- Two testing probes

- One PCB, and
- One assembly case.



Advantages :

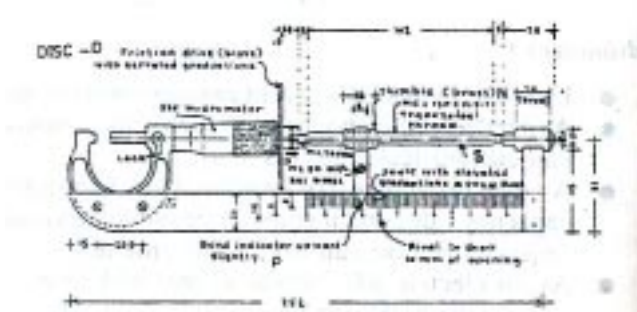
- Use of 1.5 volts DC current ensures safety of user.
- As it reflects difference between high to low resistance and current leakage, it is sensitive.
- As tone resistance can be altered by changing the capacitor value and it emits audio output, a visually impaired person can use it conveniently.
- As no electric AC current is required, it can be used in the field conditions.
- It is compact, easy to carry and low cost.

3.5 Braille Micrometer : The Centre for Biomedical Engineering, Indian Institute of Technology, New Delhi has developed a new attachment of the precision micrometer for the visually impaired. With the use of the attachment, conventional micrometer readily available in the market is adapted for the use of visually impaired persons.

Design of Attachment: The thimble scale is amplified by attaching a circular toothed brass disc of 55 mm diameter. Each degree of rotation is represented by a tooth of the brass disc, such that one fiftieth of the pitch is represented by 3.45 mm which can be easily perceived by touch. To improve the efficiency in the measurement, the disc is marked with one and two projecting

rivets after each 5 and 10 degrees of rotation respectively. In order to differentiate these from the zero marking, an additional rivet is provided at the initial point. The reading is obtained by counting the teeth clockwise from the zero marking to the tooth which matches with the edge of the linear scale.

To amplify the pitch of the linear spindle scale, a nut on an additional screw moves linearly by the amount equal to the pitch of the attached screw. This gives an additional linear displacement corresponding to each revolution. Choosing a suitable pitch of 1.55 mm, a movement of 2 mm was obtained for one rotation, thus increasing the resolution four times.



For a 25 mm, the total length of 100 mm is traversed by the pointer which can be easily managed by one hand.

Reading on the Micrometer

- Check for zero error by closing the gap between the anvil and the spindle.
- Count from initial point the tooth which matches with the edge of the fixed scale. The error noted is as (+-e) number of teeth.
- Place the object to be measured between the jaws and the thimble is rotated to grip the job.
- Take the pointer reading (p) on the fixed scale and then read the dial counting the number of teeth clockwise from the zero point (t).

- Interpret the measured value as $0.5p+t+-e$

Advantages:

- Simple and can be made locally at nominal cost
- As the least count 0.01 mm same as that of the original model
- Same attachment can be fitted on to the micrometer of various ranges
- Can be attached to conventional existing micrometer easily

Manufacturer: NREI, BPA, Ahmedabad 380 015

Sales price : Attachment - Rs. 250
 Micrometer - Rs. 800

3.6 Other Vocational Devices: The American Foundation for the Blind, 15 West 16th Street, New York, NY 10011 is supplying a variety of tools and instruments for the visually impaired as listed below. These tools are yet not available in the country.

- Rotomatic Rule
- Folding Boxwood Rule
- Stanley Saw Guide
- Stanley Drill Guide
- Light Probe
- Metal and Voltage Detector
- Stanley Combination Square
- Stanley Caliper Rule
- Starrett Micrometer
- Ohaus Port-O-Gram Talking Scale
- Audible Carpenters Level

4. Daily Living Devices

These devices can be further classified into the following five categories:

- 4.1 Clocks and Watches
- 4.2 Games and Puzzles
- 4.3 Sports
- 4.4 Kitchen Equipment
- 4.5 Personal Devices

4.1 Clocks and Watches :

i. *Alarm Clock:* A standard alarm clock adapted for the use of the visually impaired. It has strengthened hands and an open plastic dial having the hour positions indicated by two raised dots at the 3, 6, 9, 12 positions and single dots at the remaining hours.

Manufacturer: HES Limited, Patel Estate,
Jogeshwari (West), Mumbai - 400 102

ii. *Travel Alarm Clock:* This adapted clock as mentioned above is fitted into a case. The whole clock is packed into the case when folded. When opened, the case also serves as a stand for the clock.

ALIMCO Alarm Clock has time setting knobs. The dial is encased in a transparent plastic cover which can be easily removed from the top for obtaining access to the clock dial. The raised dots are provided for indicating hours with two dots for 3, 6 and 9 position, 3 dots for 12 hour position and single dots at the remaining hour positions.

Manufacturer: ALIMCO, Kanpur

iii. *Pocket Watch:* A hunter watch, the hinged cover of which opens when the winding knob is depressed.

Fitted with strengthened movements and dots as mentioned earlier.

iv. *Ringer Timer:* A one-hour ringer, in streamlined plastic case for timing any operation where an audible reminder is required. Each five minute period is indicated on the embossed setting dial by two dots and the first quarter hour is additionally marked to show the individual minutes.

v. *Wrist Watch:* has the appearance of an ordinary watch, with the front cover being fitted with a transparent centre. The front can be lifted with a lever mechanism when the winding knob is depressed. The general arrangement for dial marking is two dots on the 3, 6, 9, 12 positions, and a single dot at the intervening hours, but for the 12 o'clock position two or three dots according to the particular watch.

Manufacturer: Hindustan Machine Tools Ltd.,
Watch Marketing, Division,
26/1, Levelle Road, Bangalore - 560 001.

vi. *Talking Time:* This is an electronic watch as well as alarm clock fitted with an electronic device which announces the time whenever the knob is pressed. It is possible to set time, date, day and alarm etc. All the settings are audible in signals, it is thus possible for a visually impaired person to do the setting himself.

The most popular brands are Sony and Sharp. In India, Sikkim Time Corporation Limited (SITCO), Sikkim has introduced Talking Wrist Watch. The SITCO has established Marketing Divisions in all the major towns in India.

4.2 Games and Puzzles :

i. *Playing Cards*: Superior quality standard playing cards with the reverse embossing in standard Braille on the top left corner.

ii. *Chess*: A wooden board with the black squares raised and all the squares drilled in the centre for the reception of the pegged chessmen. Holes are provided at each end for pieces not in play. The pieces are of uniform height, the white having a point at the top to distinguish them from the black.

iii. *Dominoes*: Made of plastic and having raised black dots on a white background with black inset pieces on the reverse. These dominoes are ideal for players with low vision also.

iv. *Brahma Puzzle*: The puzzle consists of three pegs on a wooden base and eight discs of different diameter each with a hole in the center. The purpose is to transfer all the discs from the peg to another without allowing any disc to be placed over a smaller one.

v. *Audible Ball*: Made of strong good quality rubber in which holes have been punched. Small metal balls are inserted for creating sound enabling the ball to be located when in play.

An ordinary good quality ball of plastic of 5 Cms. radius can be converted into an audible ball by drilling a hole, putting small size pebbles and then sealing the hole using the soldering rod. This ball can be used for playing cricket. Such a ball has been developed by the National Institute for the Visually Handicapped, Dehradun is the most appropriate.

vi. *Draught Board*: A wooden board with sunken playing squares. The colours of the men are distinguished by size. Pieces of double thickness are used as kings.

A variety of other games as listed below have also been adapted for the visually impaired:

- Bezique Maker
- Bridge Scorer
- Lexicon
- Happy Family
- Whot
- Patience Board
- Chess Clock
- Jigsaw Puzzle
- Electronic Ball
- Beetle Game
- Centre-peg
- Dice and Dice Cup
- Nine Men's Morris
- Scrabble
- Unilock Word Building Device
- Tic-Tac-Toe
- Checkers Set
- Rattle Bells

Only Chess, Playing Cards, Nine Men's Morris, Draught Board and Checker Set and various puzzles are available in India. Other games are available from the Royal National Institute for the Blind, London.

Manufacturers :

- a. NREI
- b. Asian Power Cyclopes
- c. Advance Engineering Works

- d. Pneumatic Controls, New Delhi
- e. Pinball Manufacturing Co.,
147, GIDC Makarpura Industrial Estate, Vadodara
- f. Latha Industries,
89/1 Triplicane High Road,
Triplicane, Chennai - 600 005

4.3 Sports :

- i. *Football, Basket Ball and Soccer Ball*: These are equipped with a small electronic beeper which is battery powered and emits a compact sound. The beeper is held within a moulded cavity designed for easy access to 'on & off' switch. These devices can be imported through V. R. Vardhans International, Vardhans House, 1/Raj Block, Naveen Shahadara, Delhi - 32
- ii. *Cricket*: is becoming very popular in India. The standard rules have been drawn. It can be played using the audible plastic ball as mentioned earlier.
- iii. *Stick Walking*: The ordinary strong bamboo sticks with foot rest at a height of 30 Cms from the ground can be used for training the visually impaired in stick walking.
- iv. *Swimming*: is also emerging to be a popular sport among visually impaired persons. The normal swimming pool with sound indicators on the sides can be used for training them in swimming.
- v. *Athletics*: The normal track with some precautions and safety measures can be used for training the visually impaired in race, shot put, javelin throw, bag-walk, musical chair, hit the target etc.
- vi. *Table Tennis*: has become a popular in-door game

for the visually impaired in many South-East countries. The normal table tennis table with some modifications in the net and the sides can be used for the purpose.

4.4 Kitchen Equipment

4.4.1 *Equipment Adapted for the Visually Impaired :*

- i. *Egg Poaching Ring*: An adaptation of standard egg ring to enable visually impaired persons to fry or poach eggs, and to serve them easily. It has a handle vertically attached to the egg ring.
- ii. *Measuring Jug*: A heat proof clear glass jug of standard capacity with raised markings inside to indicate the specific volume. With the use of fingers, a visually impaired person can measure the volume.
- iii. *Bread Cutting Box*: An adjustable slide is fitted to gauge thickness of the slice. It enables visually impaired persons to cut the loaf of bread into even slices using a standard bread knife.
- iv. *Liquid Level Indicator*: A simple electronic device, powered by a battery, enables a visually impaired person to ascertain the level of liquid being poured into a cup. It emits a sound signal when a particular level is reached.
- v. *Self Adhesive Labels*: These plastic labels can be embossed with Braille and used for labelling a wide variety of articles.

Note: These equipments are still not available in India. These have to be imported from the Royal National Institute for the Blind, London.

4.4.2 *Open Market Products with Special Relevance for Use by the Visually Impaired*

- a. Tomato Slicer
- b. Chilly Cutter
- c. Kitchen Helper
- d. Vegetable and Fruit Scrapper
- e. Multi-purpose Scrapper
- f. Egg Beater-cum-Juicer
- g. Gas Lighter
- h. Milk Cooker
- i. Pressure Cooker
- j. Jar & bottle opener
- k. Pan holder

4.5 Personal Devices

i. *Sound Beacon*: This pocket size electronic device emits a sound which can be varied from a loud continuous whistle down to low intermittent beeps at various rates. It is generally used as a homing device.

ii. *Notex*: It consists of a rectangular base and flaps made of high-density polythene hinged together. It differentiates Indian currency notes of different denominations. It considers length and breadth of a currency note for its differentiation.

Available From: NAB Louis Braille Memorial Research Centre

iii. *Magnets*: Round, square and U-shaped magnets for picking up pins, small nails and other iron or steel objects.

iv. *Signature Guide*: A template to guide the visually impaired persons in placing signature in proper position on letters, cheques etc.

v. *Address Templates*: Made of cardboard with four

raised lines to guide a visually impaired person to write his address on Inland letters and envelopes.

vi. *Light Probe*: Full function light detector may be adjusted for desired sensitivity to light.

vii. *Location Finder*: Find your house, apartment, or office easily with portable, light weight location finder. A siren, attached outside location, will sound on pressing transmitter attached to a key chain.

viii. *Other Personal Devices*: The American Foundation for the Blind and Maxi Devices are supplying a variety of personal devices for the visually impaired persons as listed below. These are so far not available in India.

- Thermo Voice: announces temperature
- Talking Blood Pressure & Pulse Monitoring Kit
- Becton Dickinson Magni Guide: for accepting barrel of insulin syringe
- Insulin Needle Guide
- Talking Blood Glucose Monitoring Kit
- Big Print Address Book
- Talking Wallet
- Locklid Saucepan
- Weight Talker
- Keyfinder
- Clothing Identifiers
- Tactile Braille Signs
- Eye-Ease Eyedrop Guide
- Medicine Spoon

5. Low Vision Devices :

There are two main types of low vision devices:

- optical devices which use lenses to magnify objects
- non-optical devices and techniques which make objects easier to use

5.1 VTS Link: is a portable large print computer and work station, specially designed to meet diverse needs of the visually impaired. It provides people with low vision with the most comprehensive solutions to computer access available today. It features a custom-made high contrast flat display screen which presents a sharp clear image of character up to 75 mm.

5.2 Visualtek: Closed circuit TV magnifying system magnifies up to 60 times the normal size with wide variation of light intensity and both positive and negative images.

5.3 Schmidt Reader: is also a closed circuit TV and functions on the same principle as the Visualtek.

5.4 Magnifying Lenses: have many applications other than reading: they make everything bigger and brighter. Following models of magnifier lenses are available:

- Mounted Magnifying Lens:* It has an extra large sized Fresnel lens as magnifier. It provides large visual field and leaves both hands free for manipulation of reading material or hand work. It is useful for quick scanning of large surfaces and objects.
- Flexible Arm Illuminated Magnifier:* It has a large sized precision glass lens and a circular tube light mounted around the lens. The lens-light assembly is mounted on a spring balanced stand with feather touch movements and a reach of 900 mm, allowing the lens to be placed in any position and freeing both hands of the observer for work. It is an ideal aid for inspection,

quality work in electronics, instrumentation and precision engineering industries, gems and jewellery, geology and hospitals. (Lense Product Catalogue)

iii. *Magnifying Binoculars:* handy in close work, both hands free.

iv. *Book Magnifier:* Having a large field it enables reading of printed material such as newspapers, paper back books, fine legal print etc. It magnifies one page at a time.

v. *Illuminated Magnifier:* Provides magnification along with illumination of the object. A range of models, including battery operated ones. Ideal for viewing maps, directories, botanical and geographical specimens when ambient light is not adequate. Useful for close work.

vi. *Paperweight Magnifier:* is a moulded plastic lens. Clear plastic allows light through to copy.

vii. *Super Loupe:* handy 2X magnifying lens hangs from neck cord and rests against chest, leaving hands free to do hand work.

viii. *Eye Loupe:* A favourite with watch makers and jewellers. Using precision acrylic lens the unit is very light and can be held comfortably in eye sockets. It is also available with adapter for use with spectacles. It can be put on and taken off easily.

ix. *Head Loupe:* Mounted on a comfortable handband it can be flipped up when not in use. As both eyes are used this magnifier provides 3D vision enabling fine manual coordination. The lenses have built-in prisms that eliminate squinting and eyestrain. It can

be worn over spectacles also. It is best suited for any kind of detail work where both hands are required to be free to attend to his work.

x. *Flashlight Magnifier*: ivory light hood rests on printed material keeping focal distance steady.

xi. *Fresnel Wallet Magnifier*: Slim extremely light weight and visiting card size, it fits easily into pocket or purse. A ready at hand magnifier for reading fine print in dictionaries, menu cards, instructions or medicine bottles, etc.

xii. *Pocket Magnifier*: A general purpose magnifier commonly used as an inspection tool and a reading aid. It is easy to hold and can be used to read a sign or a bus number.

xiii. *Rayner Recumbent Spectacles*: has a single prism mounted on a sturdy black plastic frame which requires little adjustment.

xiv. *Superscan Reading Glasses*: can be worn over ordinary spectacles

xv. *Windsor Spherical Magnifiers*: a range of hand-held magnifiers available in 50, 76 and 102 mm lens diameter giving 3.0, 2.0 and 1.8 magnification.

xvi. *Stand Magnifier*: Handy table top magnifier, ideal for magnifying printed matter, films, artworks, maps etc. Rests on work surface and leaves both hands free. The stand has side openings allowing illumination and easy accessibility of tools to the object being viewed (Lensel Product Catalogue)

xv. *Hand Held Magnifiers*: Commonly used general purpose magnifiers. These have precision lenses made

of optic grade acrylic. The lenses are break resistance and much lighter than equivalent glass lenses, hence more convenient to use.

Manufacturer : Lensel Optics Pvt. Ltd.,
66/2, D2, MIDC, Chinchwad,
Pune - 411019
Phone : (020) 774581, 774340,
779460, Fax: 770212
E-mail : lensel@pn2.vsnl.net.in

5.5 Overhead Projector: is supplied with screen, stand, lamp and transparency sheets with magnification facilities.

6. Psychological and Learning Aptitude Tests

6.1 Psychological Tests : The psychological assessment and training programme is an integrated process designed to develop each individual person's skill potentials as much as possible. The administration of these tests is yet not very common in India. The assessment for employment potential is generally based on his level of performance in each skill, his rate of skill acquisition and his performance reliability.

Note: These tests were standardized in the U.S.A., new reliability and validity norms must be established locally.

The complete training exercise battery comprises of five psychomotor tests. These have been selected for inclusion on the basis that each will assess and train a different aspect of five manipulation and hand-finger dexterity:

a. Minnesota Rate of Manipulation Test

Skill Objective: arm-hand dexterity

b. Pennsylvania Bi-manual Work Sample

Skill Objective: Finger dexterity, gross movement ability and bimanual co-ordination

c. Purdue Pegboard

Skill Objective: manipulative dexterity as required in performance of assembling, packing, simple machine operations and routine manual jobs.

d. Crawford Small Parts Dexterity Test

Skill Objective: dexterity in handling and assembling small parts.

e. Stanford-Kolhs Block Design Test for the Blind

Skill Objective: fine tactile discrimination.

Note: For administration and scoring of these tests, kindly refer to Manual for A Motor-skills training programme for industrial placement of visually impaired workers.

f. The Blind Learning Aptitude Test (by: Ernest Newland)

This individual test has items in bas-relief form, consisting of dots and lines. The test taps the psychological operations by means of which learning takes place by sampling six different kinds of behaviours.

The Test is being used in more than a dozen countries other than United States of America. Shukla (1987) established that as learning aptitude affects scholastic achievements, the Blind Learning Aptitude Test can be used as a tool for predicting performance in schools in India. He also established that the rural students have better learning aptitude than their urban counterparts. Similarly, urban students exhibit more behavioral disorders in class-rooms situations than rural students.

The Science & Technology Mission for the Persons with Disabilities has funded the following projects in the area of visual impairment:

1. Universal graphical and Braille classroom communication system
2. Development of Braille micrometer
3. Development of text reading system with voice output for Indian languages
4. Development of electronics guide stick for the visually impaired
5. Evaluation of mobility devices for the visually impaired
6. Improving the productivity and safety in manufacturing situation
7. Development of interpoint Braille writing frame
8. Development of standard white cane for the rural blind
9. Fabrication of magnifiers for persons with low vision
10. Development of computer operated speech synthesizer
11. Viewing aids for children with low vision

For details, please contact :

Science & Technology Mission for the Persons with Disabilities

4, Vishnu Digamber Marg,
New Delhi - 110 002.

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