

SLIDE PROJECTOR FOR SCHOOL

VIJAY BAPAT

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INDIAN INSTITUTE OF TECHNOLOGY, BOMBAY

1975

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Design of slide projector for

✓ 52
Design of Slide Projector

Diploma Project

Submitted in partial fulfilment of the
requirements for the postgraduate diploma
in Industrial Design

by

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Approval Sheet

Diploma project entitled "Design of Slide Projector" by Vijay Bapat is approved for the postgraduate diploma in Industrial Design

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and Poona

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and all my friends

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PROBLEM STATEMENT

To design a slide projector to be used
by Educational Institutes

INTRODUCTION.

We learn mostly through our eyes. Every properly functioning human being, transforms the visual signals that he receives from outside, into meaningful entities. Without the perceptual ordering of his sense responses into the image of things in space, man can not orient himself, and without shaping his physical environment in accordance with these images he can not survive.

Approximate contribution of our sensory organs in learning are given below :

1% through taste

2% through touch

4% through smell

10% through hearing

83% through sight

This reveals that learning through sight overshadows learning through any and all other senses that, no adjustment for error or incidents and exception, could lessen the impact of sight on the process and learning.

We do not think in words or numbers but our mind thinks in pictures or natural forms and shapes, present in the surrounding environment. To communicate facts, figures and ideas visual presentation is the most effective medium.

GENERAL BACKGROUND

Audiovisual aids have very great influence in education. The students' grasping power of the subject and its retention is increased tremendously with audiovisual aids.

The extensive development since 1900 of the visual-aids movement has been due to :

- . social and economic changes which have made new demands on education;
- . changes in educational thinking;
- . population increase leading to relative teacher shortage and need for greater efficiency;
- . a need to make the best use of the information explosion;
- . the possibilities presented by technological development.

Different media like overhead projection, episcopic projection, slide projection, films and television etc. are developed for giving visual aid in educational fields.

All these media are quite popular in western countries. Indian schools also have realised the importance of audiovisual aids and they are now using them more and more in their educational programmes. Indian Government is also now a days

using television medium for educational purpose.

These media are not designed to suit the Indian social and economical set up of education and newly designed visual aid to be operated in Indian conditions will be welcomed by schools in future.

INFORMATION

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INFORMATION FROM SCHOOLS

. Majority of the schools do not have auditoriums or special rooms for visual display. Many schools used to convert a class room into a projection room for temporary arrangement.

. All the teachers interviewed like to have number of visual aids to make teaching efficient and easy.

. Most of these teachers complain that they cannot use visual aid equipment too often, as whole class is to be shifted to projection room which creates lot of disturbance and consumes time as well.

. Controlling the students in dark is not efficient and particularly for new young teacher it gives lot of trouble.

. Most of the schools do have an epidiascope or a slide projector and these schools are using them mainly for functions.

. Subjects like sciences, history, geography, need maximum number of visual aids.

. Maximum time of visual aid use is about 60% out of 35 minutes period; for subjects like sciences and geography.

. In most of the schools these instruments are operated by the science teachers and this creates lot of problem in manipulating the timetable of whole school.

. . All these instruments employ the bulbs which are imported. Many times in small towns these bulbs are not available and bulbs have to be stored in large number.

. Most of the schools can afford to pay Rs. 1000/- for such instruments.

INFORMATION FROM STUDENTS

. Many students, complained that few teachers are not good at drawing and these teachers ask the students who are good at drawing to draw figures on black-board.

. Some of the science teachers ask the students to refer the text books for figures while teaching zoology and botany, as all schools cannot afford to keep all specimen slides and expensive microscopes to study details.

. Text books give figures and illustrations mostly in black and white and printing is also not good.

. Students understand better if they see clear photographs or figures about the concepts.

. Students always like to see coloured photographs or figures.

. Students complain about different maps shown in geography classes are quite difficult to understand. Students from the last benches cannot see much of these maps.

INFORMATION FROM DEALER

. Very few Indian made slide projectors are available in market.

. Not a single Indian slide projector is having automatic or 'semi-automatic slide feeding arrangement.

. Bulbs are imported and cheapest of these, 'Salvania' costs Rs. 75/- which has life of only 25 hours.

. The spare parts for slide projector are not available in market.

. Projection lenses are imported for all these projectors except Central Camera's 'Solar' projector.

. No daylight projector is available in market. Only recently 'Photophone' have announced rear screen 8 mm film projector.

. Special educational slide kits are not available.

Information about the existing visual aids -

1] OVERHEAD PROJECTOR

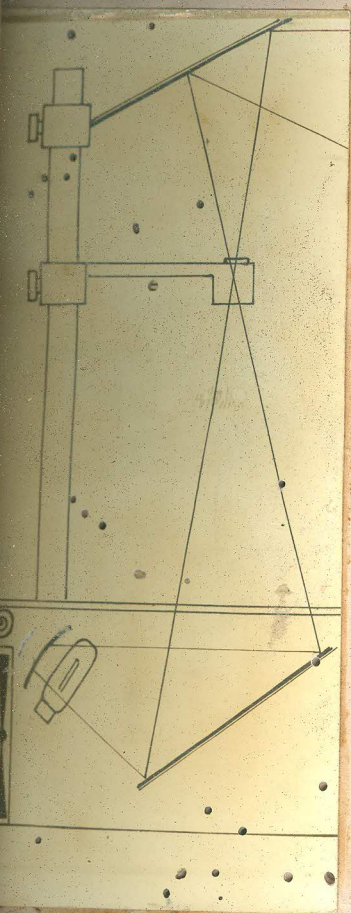
This is very popular visual aid in western countries, but not much in Indian schools due to nonavailability and cost. The ~~selling~~ cost of a Phillips (Holland) overhead projector is Rs. 1500/-.

The overhead projector is designed for use in daylight conditions. The projected image size on the screen varies from 6 to 10 sq. ft. Some overhead projectors can be adopted to show 35 mm films and 2 in x 2 in slides like Ofrex-fordigraph.

Technamation adds the possibility of linear and rotary movements at various speeds to a diagram using the application of polarized light with polaroid segments in the transparency and a rotating polaroid disc before the projection lens.

Principle -

The principle of working is as shown in photograph. This consists of a box which accommodates projection lamp, reflector, plane reflecting mirror and a translucent acetate film roll on which operator writes. Above the box a vertical pillar is fitted, on which a



lens unit and a reversing mirror slides. The lens has got a focusing arrangement.

Light rays from projection lamp travel towards plane mirror, are reflected and passed through the acetate film with written material, and are focused using the lens system. Lateral inversion is done by the top reversing mirror and ^{rays} are directed towards the screen. Lens system is of short focal length since this projector is to be placed near the screen.

Merits -

- . A dark auditorium is not required.
- . The presenter can face the audience while operating this projector.
- . As operator writes on the acetate film it is projected.
- . Slides and photographs need not be collected.

Demerits -

- . Although the overhead projector is intended for use in daylight conditions the image is not always very good. Lines can easily disappear unless these are fairly heavy at least 1/16 in thick and whenever possible support is to be given with tonal or colour area.
- . Tones should have a strong contrast.

.. Colours like yellows and browns are difficult to reproduce well. Red, blues and green give good result.

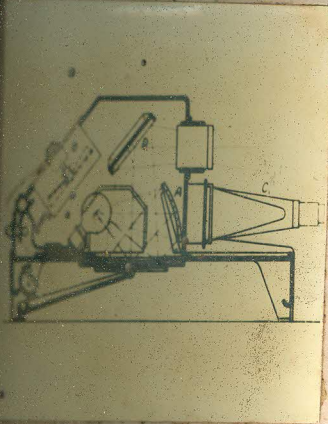
. Full colour transparencies are difficult and expensive to produce for this projector.

. Large model projector is bulky to transport and awkward to set up.

2] THE EPIDIASCOPE

This instrument can be used for projecting photographs, printed material as well as slides. This is available in market and many schools are using this in their educational programme.

Principle -



Photograph shows the diagrammatic view of the epidiascope. For episcopic projection lamp is placed at an angle of 45° so that part of its light falls on the object and remaining on the mirror A which reflects it back to the object to give uniform illumination. Light travels from mirror D to the lens C_2 and thence to the screen. Light is provided by a 500 Watts lamp. Fan B is used for cooling purpose.

For diascopic projection the lamp is turned vertical and pushed forward near the condenser associated along with the lens C_1 and it works like a slide projector.

Merits -

- . Photographs or printed material up to size of 18 x 18 cm can be projected.
- . No special slide making is required.
- . It can be used as slide projector also.

Demerits -

- . Instrument is bulky.
- . Photographs and printed material get wrinkeling due to very high heat produced by the 500 W lamp.
- . It requires dark auditorium.
- . Teacher can not face the students while operating this instrument.

3] FILMS

This visual aid is not much famous in Indian schools due to non availability of educational films and few schools use this medium occasionally. Projected image size varies too much depending on whether lecture hall or class room is used. In cineloop maximum size is 18 x 12 inches.

Long films can give a rich and varied introduction to new subject, while short films are more suitable for the follow-up of the specific points. 8 mm loop films are in average

of 4 minutes in length. These usually deal with single concept, demonstration or topic. Any frame can be held by remote control.

Principle -

A is the lamp mirror or reflector for the film projection lamp B. C is the condenser and D the shutter which rotates in front of the film aperture E. F is the projection lens.

Merits -

- . Film is highly motivational and it can provide nearest substitute for life experience, having the possibility of realistic image, colour, movement, time and sound.

- . The range of visual techniques is great allowing many ways of communicating for different objectives different learning steps and different viewers.

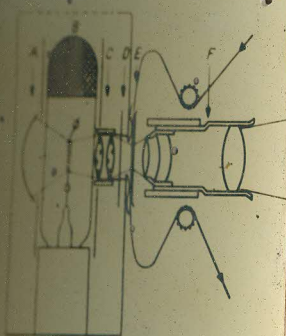
- . It has a life quality in contrast with stills from films.

- . Any frame from 8 mm loop film can be held by remote control for detailed discussion.

Demerits -

- . Film making is too costly in India and educational films are not available.

- . Instrument itself is costly as compared



to other instruments.

. It requires skilled operator and dark projection room.

4] TELEVISION

Television contacts mass audience and gives the possibility of mass teaching which is important in economic terms, of poorer countries. However the preparation of programmes for mass audience has disadvantages :

- . The time of broadcast may be inconvenient.
- . There is no possibility of adjusting the content in presenting it to particular audience group.
- . There is no feed back i.e. communication is one way only. There is no possibility for pupil interaction with programme.

E.V.R. (Electronic Video Recording) is the most flexible, adaptable form of television. Being in a cassette it can be used at just the moment required and only that section, which teacher wants the students to see, need be shown.

Compared with films superimposition, fadeouts and dissolves are all easier to do by television. Further live demonstration on T.V. is always more convincing than in a film.

Uptil now E.V.R. is too costly for Indian schools which cost Rs. 30,000/- . There are very few transmitting centres in India and though they all used to transmit educational programmes daily twice, this medium is not much useful in Indian education.

5] SLIDES AND FILM STRIP PROJECTOR

This is very popular visual aid throughout the world. Slides can be in colour or in black and white. Colour slides are growing rapidly in popularity and usage as they are cheaper in comparison with movie films. Slide projector can be used in presentation to both large and small audience group.

Slide projector is a compact unit and can be stored easily. Automatic as well as semi-automatic slide projectors are available which are very useful for programmed lectures.

Merits -

- . This can be used for any kind of audience.
- . Slide projection is more appealing than the epidiascopic or overhead projection.
- . Storage of slides is easy and compact.
- . Slide projector is portable.
- . Life of slides is longer as compared with photographs used in episodic projection.

Demerits -

- . Slide making is expensive.
- . It requires dark projection room.

Different systems used in existing slide projector are :

1] ILLUMINATION SYSTEM

The flat type of filament is essential in projection lamps. These lamps are designed for both horizontal and vertical burning. Some of the models have a silvered bowl and this internal reflector is advantageous as this reflector has longer life and it is placed at best suitable position in the lamp.

Halogen lamps are also used which operate cool without altering the colour temperature and light out put.

A spherical mirror is placed behind the bulb to collect some of the light radiated in that direction. It also ensures uniform brightness of the filament; by forming image of lamp filament on it in slightly displaced position.



The photographs show, one, the filament without mirror and other with mirror. A table given on the next page shows characteristics of principle projection lamps.

THE PRINCIPLE PROJECTION LAMPS

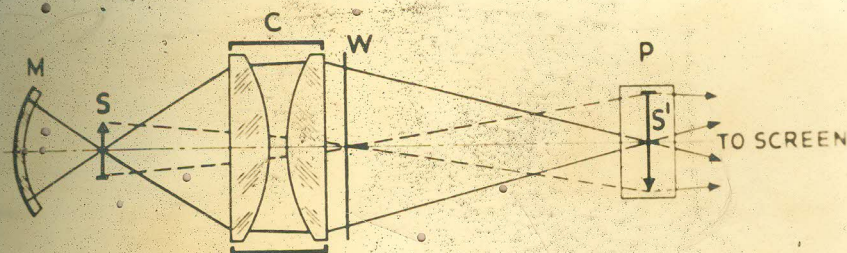
Type	Volts	Watts	Intern. Lumen	Filament		Life	Lamp base
				Height x Width in mm	Filament		
6156N	100-130	50	800	5 x 3	central	50	BA 15 s
6157N	100-130	75	1300	5 x 4.5	central	50	BA 15 s
6159N	33	100	2400	4.8 x 4.5	excentr.	25	BA 15 s
6130C	80	100	1900	4 x 3.5	excentr.	50	special
6158N	100-130	100	1900	5.5 x 5	central	50	BA 15 s
6067C	100-130	100	1900	6.5 x 5	central	50	P 28
7224C	50	200	4700	7 x 6	excentr.	50	P 28
6166N	100-130	200	4700	5.5 x 6	central	25	BA 15 s
6070C	100-130	250	5700	7 x 6.5	central	50	P 28
6131C	100-130	300	7400	7 x 6.5	central	25	P 28
6116C	75	375	9400	9 x 9	central	50	P 28
6117C	100-130	400	9500	7.8 x 6.8	central	25	P 28
6152C	100-130	500	12500	7.8 x 7.6	central	25	P 28
6153C	100-130	750	19800	9.5 x 9	central	25	P 28
6170C	100-130	750	17800	9.5 x 10	excentr.	50	special
7205C	100-130	750	19800	11 x 9.5	excentr.	25	P 28
6186C	100-130	1000	27500	11 x 11.5	central	25	P 28
7242C	100-130	1000	27500	11 x 11.5	central	25	P 28
6186H	100-130	1000	27500	11 x 11.5	central	25	B and H46
7209H	100-130	1200	35500	12 x 12	central	10	B and H46
7201C	15	13 Amp.	4600	5 x 5.5	excentr.	100	special
7204C	31	13 Amp.	11700	6 x 9	excentr.	50	special

2] COOLING SYSTEM

As projection lamps create lot of heat which if not carried away will distort the slide so cooling system is provided; consisting of electric motor driven fan. Different types like blower placed at the bottom, axial exhaust fan, or centrifugal type of fan are of common use. Most of these fans are of A.C. type and for compactness, these fans normally have displaced stator winding.

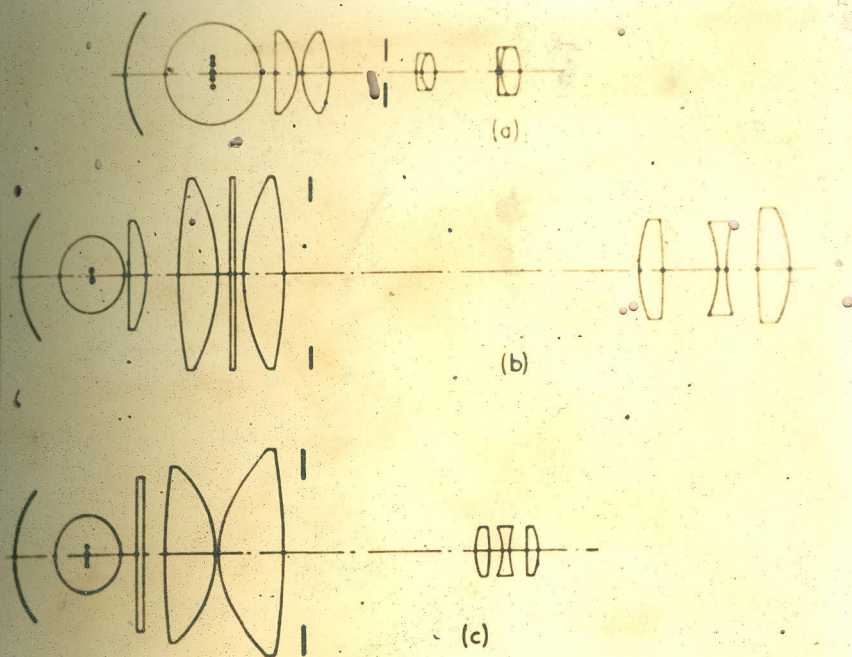
3] CONDENSING SYSTEM

Function of this optical system is to provide uniform ^{light} over the transparency.



Common arrangement of the condenser is shown in photograph. An image of the source S is formed by the condenser system C at S' in the projection lens P.

The focal length of the condenser is chosen in conjunction with that of the projection lens, with which it is to be used so that it works at such a magnification that the image S' just fills the aperture of lens P. The transparent object is placed at W, close to the condenser.



-Some typical projection condensers

(a) An 8mm Cine Projector. (b) A 2 x 2 Projector. (c) A 2 x 2 Table Viewer.

Common condenser consists of two planoconvex lenses. If more condensation is required complicated condensers, as shown in photographs are to be used.

Non spherical shapes like paraboloidal and hyperboloidal can also be used, but these are costly to manufacture.

4] SLIDE FEEDING SYSTEM

There are three types of slide feeding systems in common use.

. Simple feeding system -

Deep U shape metallic channel guides the slide and sliding part. Operator has to put one slide in proper position at one end to give forward motion to the sliding part. While placing the next slide in proper position, the sliding part will remove the earlier slide from the view; the other end.

This is the simplest type of system provided with cheaper slide projectors. It has main disadvantage that operator has to see the slide

before putting it for projection and this positioning many times creates inverted or reversed image. Also reshowing of some slide is difficult, as operator has to search for that slide.

. Semi-automatic slide feeding system -

In this system a tray with pockets is provided in which operator can arrange number of slides before hand. By some mechanism, one slide goes into the projector, after projection comes back in the same pocket of the tray. For new slide, tray rotates or slides to next stop and same sequence repeats. This mechanism involves gears, rack and cam arrangement which is operated by hand. Any slide can be shown at any time.

. Automatic slide feeding -

In this system same tray as mentioned above is employed and instead using hand operating, motor driven mechanism is employed. This can be operated by remote control or push button or even touch sensing control.

This is the best system demanding minimum human effort for operating it. But due to complicated electronic circuits and fractional H.P. motors it is costly at present.

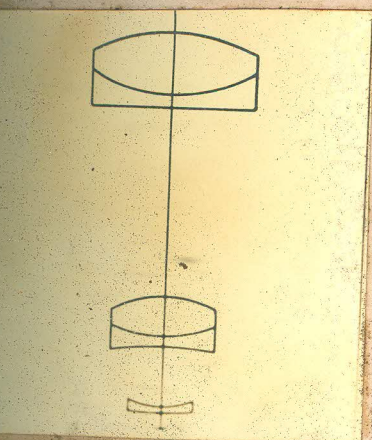
5] THE PROJECTION LENS

The main requirements of lens used for projection of transparencies are :

- . It must pick up a large cone of light from the object, the whole of the illuminating cone, that it should be of large aperture.

- . To give good satisfactory definition, correction of spherical aberration should be good.

- . Colour correction must be good and the oblique aberrations like coma, astigmatism etc. must be well corrected.



The majority of the lenses used for cinema and slide projection have been developed from the Petzval Portrait lens. Photograph shows a modern cine-projection lens with field flattener. Normally cemented surfaces are avoided as much as possible due to risk of overheating of cementing material.

6] PROJECTION SCREEN

The most commonly used reflecting screen is a simple white painted cloth, sheet or wall and it will give even brightness, when viewed from any angle, but this demands maximum possible light from projector. If there is insufficient light available to produce satisfactory image, then partially specular screens such as sand blasted aluminium, one coated with metallic paints,

beaded screen covered with tiny glass spheres on a metallized backing, or one of the new lenticular screen having vertically ribbed highly specular plastic coating can be used.

HYPOTHESIS

1] STRUCTURAL AND FUNCTIONAL

- 1.1 It should be designed for locally available bulbs.
- 1.2 It should be sturdy and stout to withstand probable rough handling in schools.
- 1.3 It should be daylight projection type to enable its use in any class room without much modification.
- 1.4 It should work even on batteries to enable its use in villages where electricity is not available.
- 1.5 It should have atleast semi-automatic slide feeding to enable teacher to prearrange the sequence of slides and also to enable reshowing of some slides.
- 1.6 It should be designed to project slides as well as film strips.
- 1.7 Maintenance should be minimum and easy.
- 1.8 The design has to be done for batch production.
- 1.9 Attempts should be made to make it indigenious.

2 ☐ ERGONOMICAL

- 2.1 Unit should be compact and light in weight for easy shifting from one classroom to other.
- 2.2 Cleaning of the lenses and mirror should be easy and proper access should be given to bulb for replacements.
- 2.3 It should allow the teacher to stand in front of pupil while operating the instrument.
- 2.4 Feeding system should be easy to operate.
- 2.5 Exposed electric supply wires should be avoided.

3 ☐ FORMAL

- 3.1 Form should be integrated and it should go well with the educational field.
- 3.2 Colour system should be proper to avoid undue contrast with environment of the surrounding class room.
- 3.3 Better communication particularly about placing the slide should be provided.

4 ☐ COST

- 4.1 Selling cost should be below Rs. 800/- .
- 4.2 Running cost of the instrument should be minimum.

SYNTHESIS

This design was attempted giving maximum importance to consumers' need and manufacturers' information and their requirements. The survey on consumers' need was done in few educational institutes from Bombay and Poona. But because of lack of technical information from factories the design was limited, taking some of the standard available parts, like lenses & condenser etc.

Main aim of designing the system was to make it portable compact unit, which can be operated in any class room in daylight conditions; so rear projection system using translucent screen is chosen.

The main advantages of translucent screen are :

- . A lower light out put is required from the illumination system.

- . Since screen is viewed from the opposite side of the projection lens, obstruction of the imaging light by the observer does not occur; also operator can face the audience.

- . Compact system is possible.

Demerits :

- . Diffusion by the translucent screen of the incident light is inadequate for true binocular vision of the screen image, for shorter viewing distances.

. Prolonged use of this screen can cause discomfort to audience.

. A further source of discomfort is the existence of scintillation effect, the screen being studded with bright pin points of light - coloured or white.

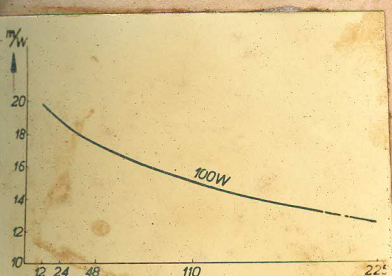
In schools particularly these problems of discomforts are not severe as, its use is for short time, maximum being 20 minutes and this system will be useful for daylight projection.

Best diffusing material is etched or ground glass. But as it is breakable, comparing the results of different available diffusing materials like natural polystyrene, tracing cloth, tracing paper, natural polystyrene is chosen. It is ^{relatively} unbreakable and it can be kept flat easily without much problem of sagging.

Image size of 38 x 26 cm (15 x 10.5 in) was fixed so that a class of 50 students can see the picture clearly. As slides are horizontal as well as vertical, screen size was fixed 38 x 38 cm to accommodate both. A projection lens of 50 mm focal length was used which requires a distance of 65.6 cm between the screen and the slide.

The following are the main features of this design :

1] Maximum efforts are given to find out locally available bulbs, which will satisfy the conditions required for illumination. A low voltage high wattage bulb gives larger illumination than normal 220 Volts bulb as indicated in the graph. This higher efficiency is due to thicker filament drawing higher current, can be heated to higher temperatures. A 6 Volts double filament and 36 Watts each, bulb is chosen. These bulbs are locally available as these are used in head lights of cars trucks and buses.



The relationship between efficiency (lm/W) and nominal voltage for a 100 W lamp rate at a life of 7000 hours on that voltage.

This bulb needs a transformer which costs about Rs. 100/-. But as this is an initial investment and bulb replacement cost will be only Rs. 5/- so in long run this system will be cheaper than the existing systems, which employ imported bulbs with a life of 25 or 50 hours; ('Salvania' the cheapest of all costing Rs. 75/-.)

As this system has to illuminate 35 mm slides only, a parabolic reflector along with a condensing system is used, as it gives a compact beam of light and reduces wastage of light.

A d.c. motor of 12 Volts, 1 Watt is used as this motor is compact in shape, cheaper in

comparison with a.c. motors of same ratings. As r.p.m. is 5000, the double blade fan of exhaust type is used, so as to remove hot air surrounding the bulb immediately through shortest travel. This d.c. motor will also enable the slide projector's use with car battery in remote villages where electricity is not available.

2] Reflecting mirror system -

The outer size of the bag is 45 x 45 x 13 cm and as the distance of 65.5 cm is required between slide and screen reflecting mirror is used to reflect the light beam. Different mirror and screen combinations are tried with 45° angle, which is the best reflecting angle.

Distance between lens and 1st mirror = A

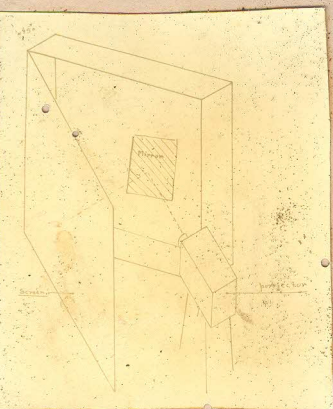
Distance between 1st mirror and 2nd mirror = B

Distance between mirror and screen = C

Solution 1

$$A = 45 \text{ cm}; \quad C = 22 \text{ cm}$$

Mirror size becomes too big and some mechanism is involved to keep the slide projector at required position.



Solution 2

$$A = 22.5 \text{ cm}; B = 22.5 \text{ cm}; C = 22.0 \text{ cm}$$

Two mirrors inclined at 45° in two different planes are used. Size of second mirror becomes big and though projector is at bottom level, it should be slided out to get the required distances.

Solution 3

$$A = 22.0 \text{ cm}; C = 45.0 \text{ cm}$$

To reduce the size of mirror, first mirror is placed inside the projector itself after condenser and second mirror with folding arrangement is placed very near to the lens. Whole projector is placed opposite the screen at the extreme end.

The last solution is chosen as mirror size is only $16 \times 16 \text{ cm}$. Slide projector is fixed to the bag and it is convenient to operate while standing at back side without stretching hands.

Front coated mirrors are used, to avoid problems of double reflection, present in back coated mirrors. Mirror is prepared by vacuum coating of aluminium on glass. Aluminium is chosen, as it gives reflectivity of the order of 90% and after few years, it does not drop below 82%. Aluminium is cheaper than silver of reflectivity 97%. Glass gives the best results but as it is breakable same process of aluminium coating on 'Milor' film is chosen.

3] Slide feeding system is improved. A strip of P.V.C. which can accommodate 25 slides is used and for storage this can be folded in zigzag manner. This P.V.C. strip will cost only Rs. 1/- and school can afford to buy number of such strips for different subjects.

Feeding mechanism is only dented wheel to be rotated by a knob. This arrangement will enable the teacher to prearrange 25 slides in required sequence and reshewing of any slide can be done, by just rotating the knob in reverse direction. Spring locking is provided which will indicate the completion of feed of one slide.



4] The product is designed for batch production. Most of the joints are done with rivets and few with standard screws and bolts. Main outer casing is Fiber Glass reinforced plastic moulding, by hand laying method. F.R.P. is chosen, as it is lightweight, strong material, which can be moulded in any shape. Colouring is done, by adding pigments while moulding only and very few after moulding processes are required to get finished product.

All other parts are fabricated with aluminium sheets of gauge 16 and 18. Lens fitting is done with standard P.V.C. tube.

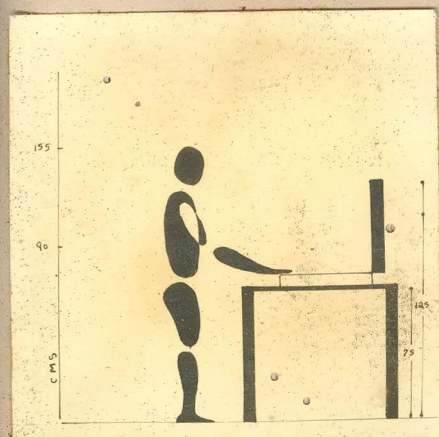
Doors are provided to protect the screen from dust and damage. Arrangement of doors is done, in such a fashion that while operating this projector in classroom, doors will shield the screen against the light falling on it, to give maximum dark background to the projected image. Material for doors is polystyrene 3 mm sheet with embossed structure for additional strength.

5] Slide feeding mechanism is improved for convenience of operation. The access to the optical parts is much improved. Top portion of the projection lamp unit will not be heated much because of ample air circulation by exhaust fan.

Switches are provided at convenient place and operator does not have to stretch his hands for putting them on and off.

Total weight of this projector is only 6.5 kg and one can easily carry this unit from one class room to other.

When placed on the standard table (75 cm high), it is convenient for teacher to operate this unit, till he can see his pupil though he will be standing at the back side of screen.



6] This unit can be operated on car battery, where electricity is not available. A separate lens of 35 mm focal length and film strip holder is provided which will enable its use for projection of stills of the films.

7] Overall costs estimation of different parts is given below :

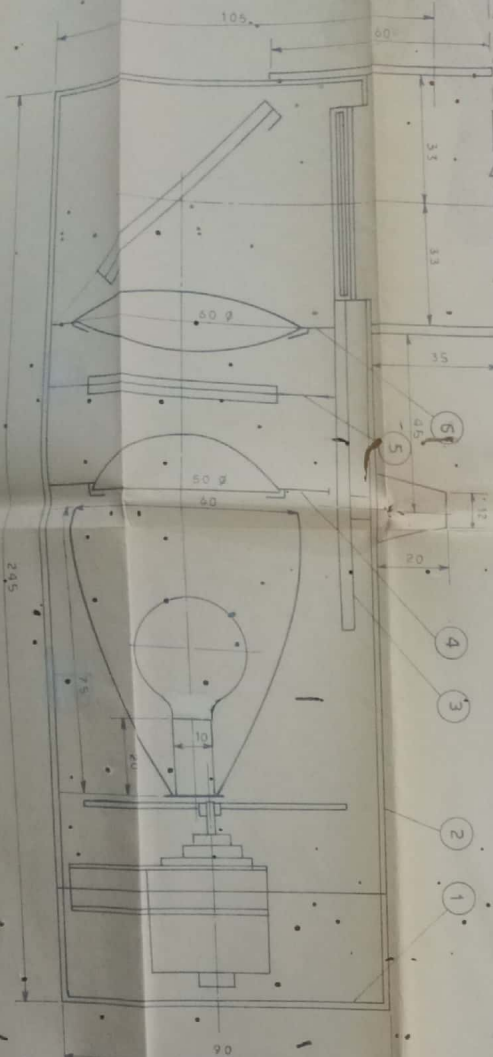
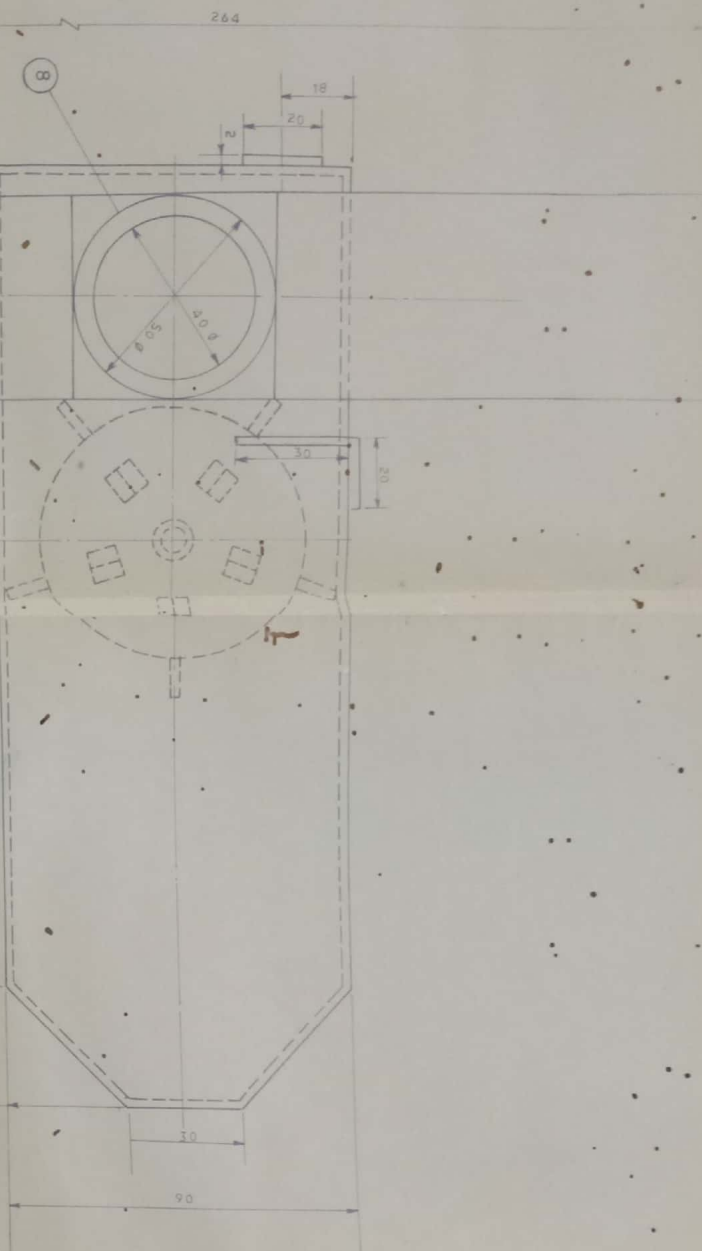
	in Rs.
. Bag	90.00
. Doors	20.00
. Handle	1.00
. Locks	5.00
. Hinges	2.00
. Transformer	100.00
. Projection lens	150.00
. Mirrors	20.00
. Condenser	50.00
. Fan and motor	30.00
. Bulb, reflector and holder	10.00
. Projection box and mirror supports	50.00
. Polystyrene pockets	25.00

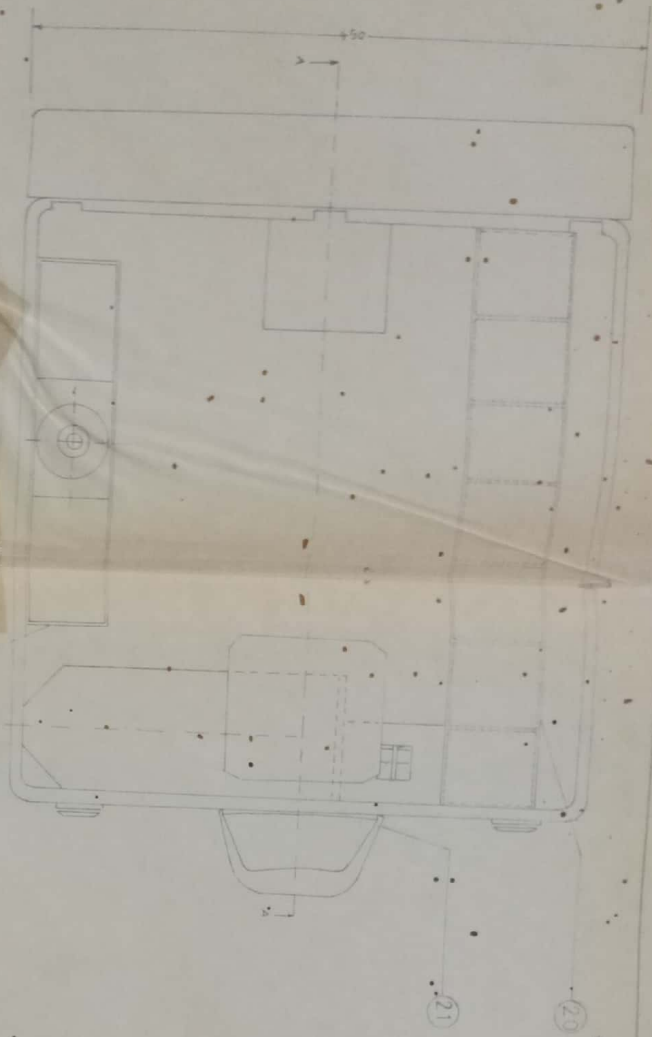
Total 553.00

FRONT VIEW

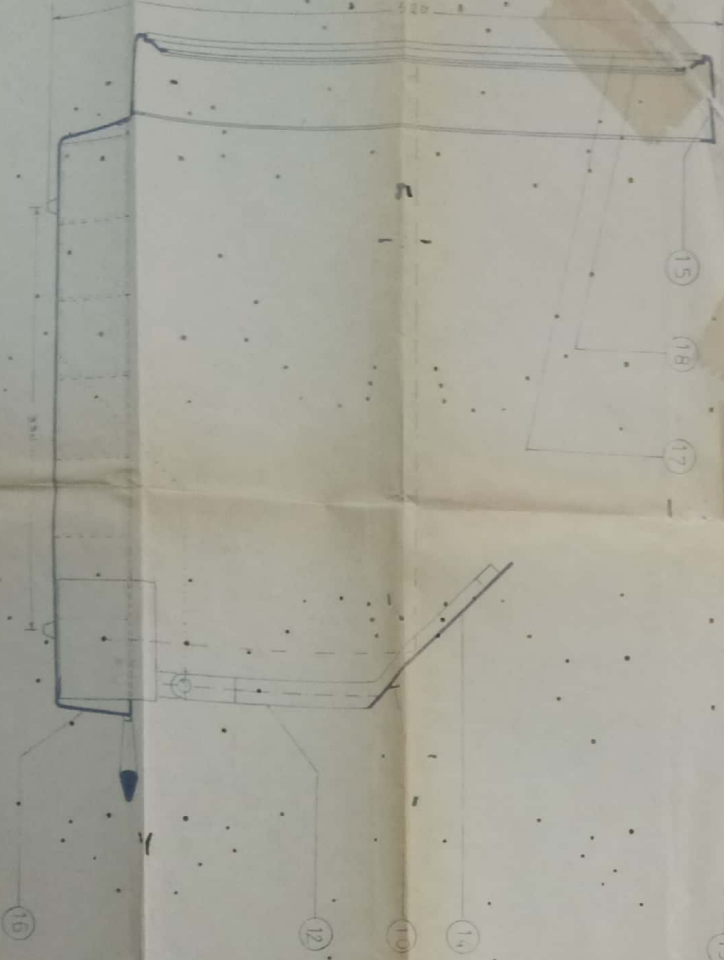
TOP VIEW

DIPLOMA PROJECT			
SLIDE PROJECTOR FOR SCHOOL		VIJAY BAPAT ROLL NO 732703 73-75 BATCH	
SCALE 1:1		PROJECTOR	ASSEMBLY
DIMENSION IN MM			
NO	DESIGNATION	NO. OF	MATERIAL
1	MAIN CASING	1	ALUMINIUM 20 SWG
2	COVER	1	ALUMINIUM 20 SWG
3	SLIDE FEEDING WHEEL	1	ALUMINIUM 20 SWG
4	PLANO-CONVEX LENS SUPPORT	1	ALUMINIUM 20 SWG
5	GLASS SUPPORT	1	ALUMINIUM 20 SWG
6	CONVEX LENS SUPPORT	1	ALUMINIUM 20 SWG
7	SLIDE CHANNEL	1	ALUMINIUM 20 SWG
8	LENS TUBE	1	P.V.C TUBE





SECTION AT A-A



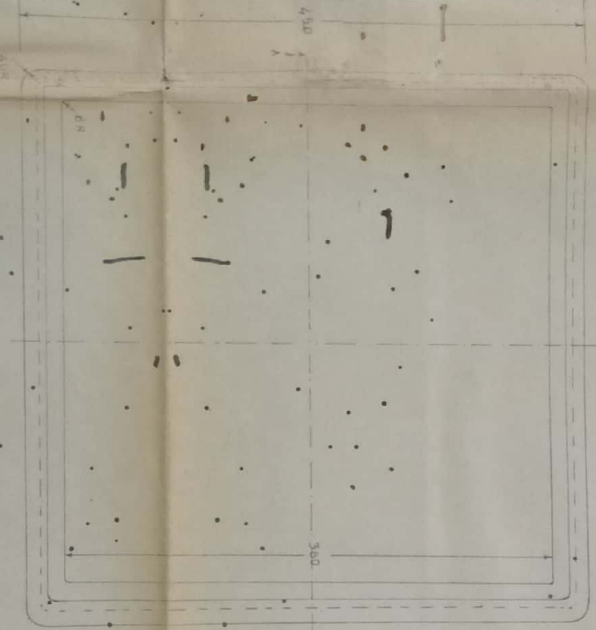
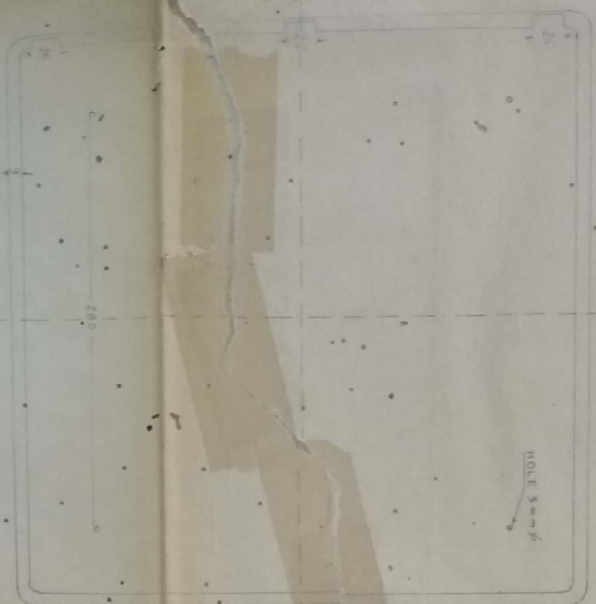
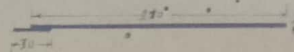
21	HANDLE	1	H.D.P.
20	POCKET FOR SLIDES	1	PMSTYRENE
19	POCKET FOR LENS	1	POLYSTYRENE
18	SCREEN	1	PMSTYRENE
17	DOOR	2	POLYSTYRENE
16	BOTTOM PORTION	1	F.R.P.
15	TOP PORTION OF BAG	1	F.R.P.
14	MIRROR	1	AL COATED GLASS
12	MIRROR SUPPORTING LINKS	2	AL 20 SW.G.
10	HANDLE FOR MIRROR	1	AL 20 SW.G.
NO.	DESIGNATION	NO OF MATERIAL	

DIPLOMA PROJECT			
SLIDE PROJECTOR FOR SCHOOL		VIJAY BAPAT	
SCALE 1/3 FULL SIZE	FULL ASSEMBLY OF EXHIBIT		
DIMENSIONS IN MM			
INDUSTRIAL DESIGN CENTRE, I.I.T. BOMBAY			

DOOR

(17)

SECT AA

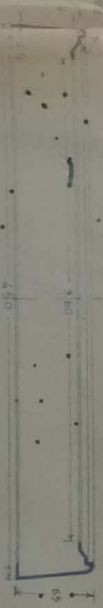
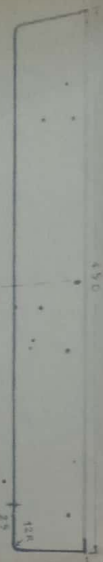


SCREEN

(15)

BOTTOM PORTION SECT AA

TOP PORTION SECT AA



DIPLOMA PROJECT

SLIDE PROJECTOR
FOR SCHOOL

SCALE 1:1 FULL SIZE
DRAWN IN M.M.

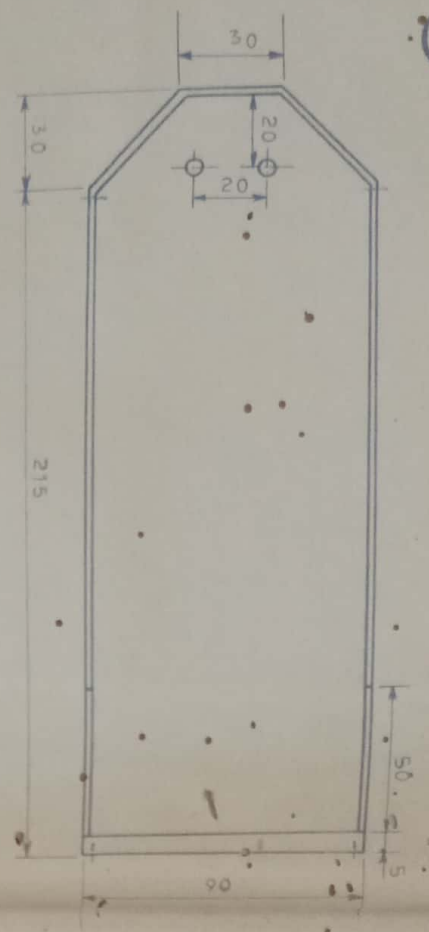
INDUSTRIAL DESIGN CENTRE

V. K. BAPAT
NO. 732703

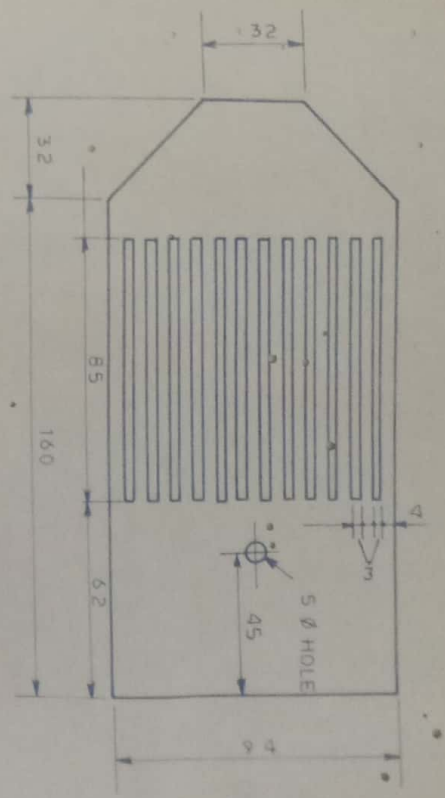
DETAILS OF BAG

U.T. BOMBAY

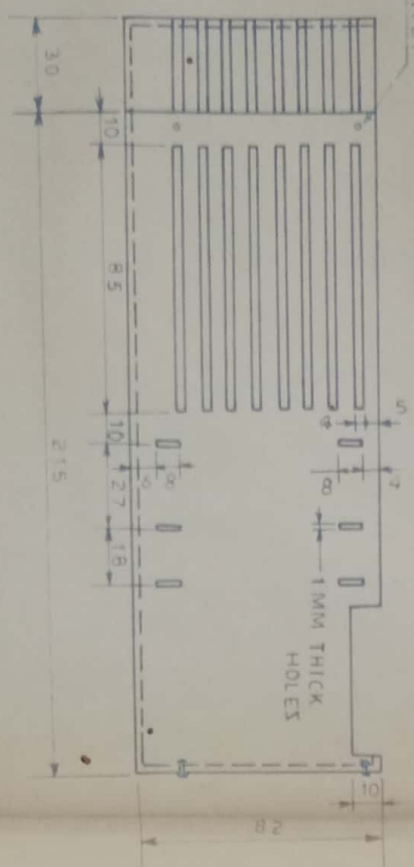
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2

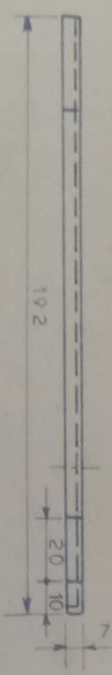


15 Ø RIVET

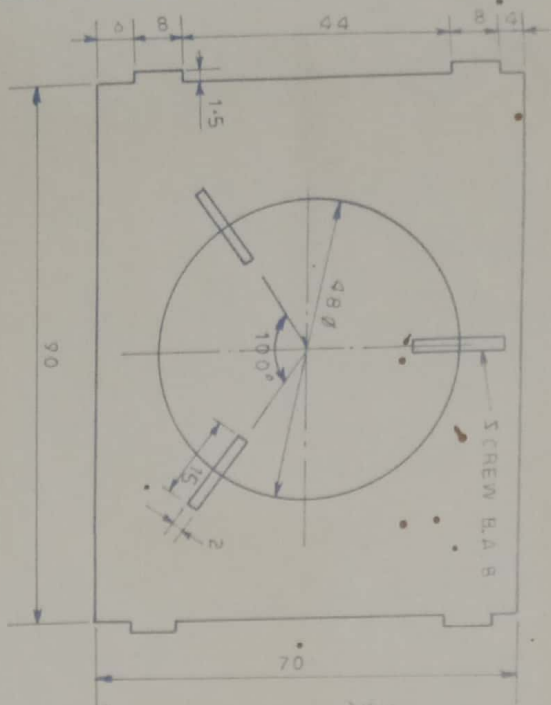


MAIN CASING

TOP COVER FOR BOX

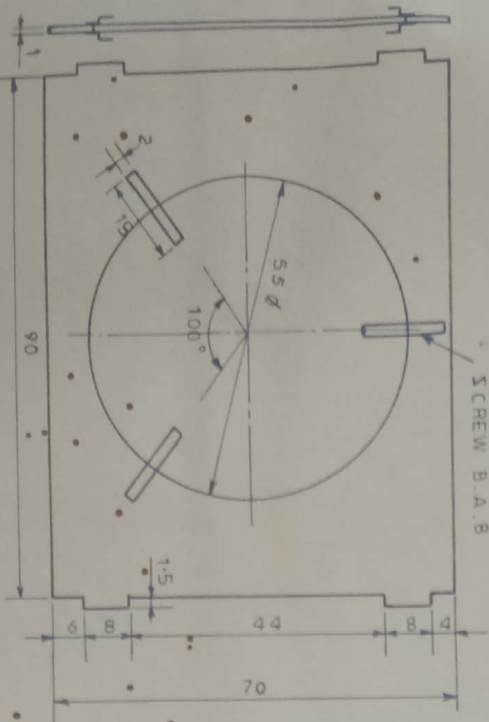


DIPLOMA PROJECT			
SLIDE PROJECTOR FOR SCHOOL		VIJAY BAPAT	
SCALE 1:2		ROLL NO. 732703	73-75 BATCH
BIMENSION IN MM		DETAILS OF PROJECTOR CASING	
INDUSTRIAL DESIGN CENTRE, I.I.T. BOMBAY-76			

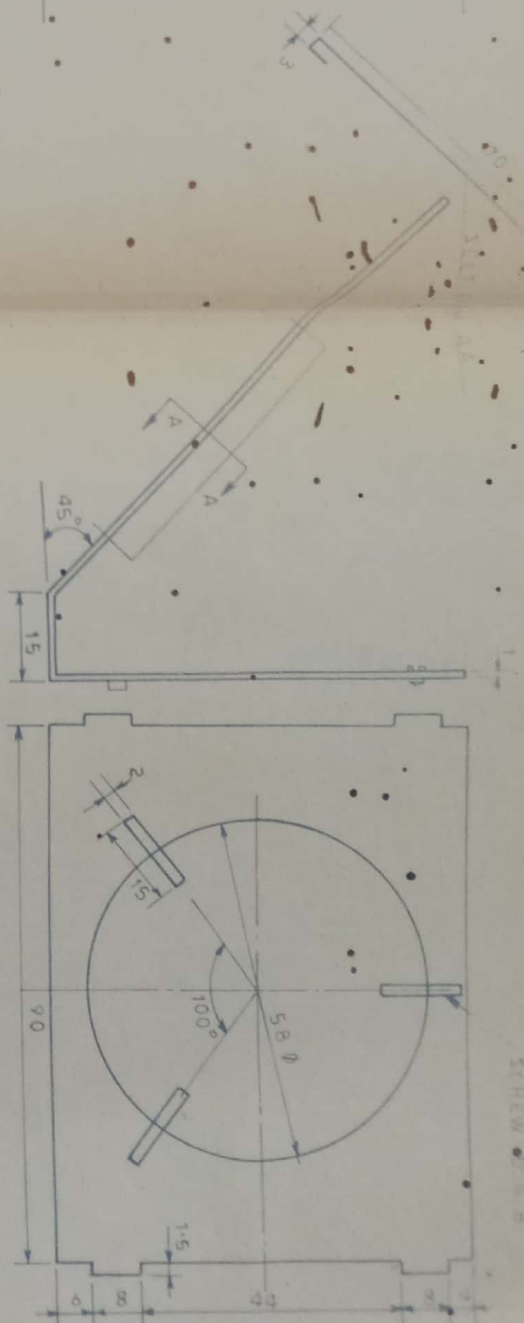


PLANO-CONVEX LENS SUPPORT

5



HEAT INSULATING GLASS SUPPORT



CONVEX LENS AND MIRROR SUPPORT

DIPLOMA PROJECT

SLIDE PROJECTOR
FOR SCHOOL

VIJAY BAPAT

ROLL NO 7322703 73-75 BATCH

SCALE 1:1

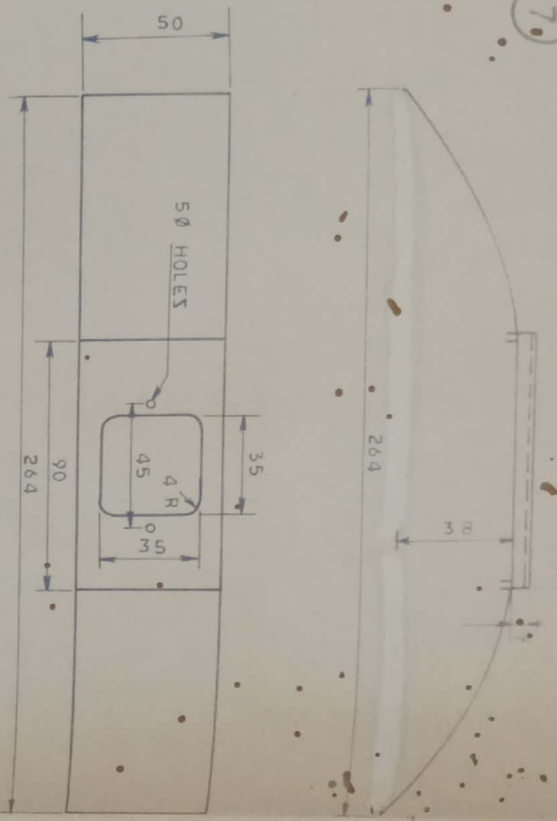
DIMENSION IN MM.



DETAILS OF CONDENSER

INDUSTRIAL DESIGN CENTRE, IIT BOMBAY-76

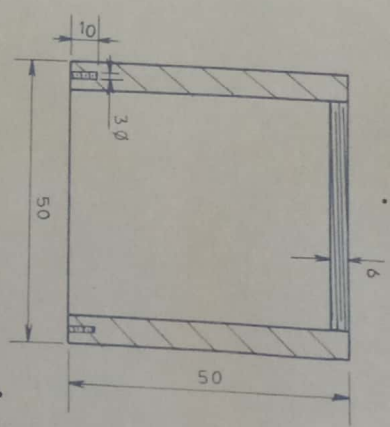
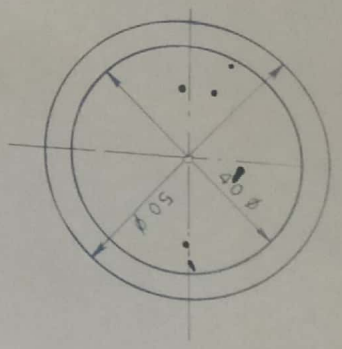
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CHANNEL FOR SLIDES

SCALE 1:2

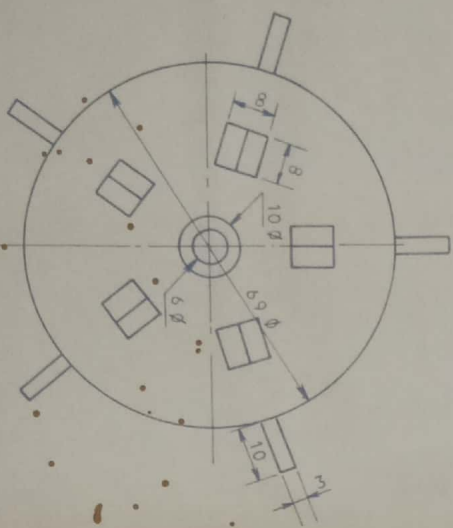
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LENS TUBE

SCALE 1:1

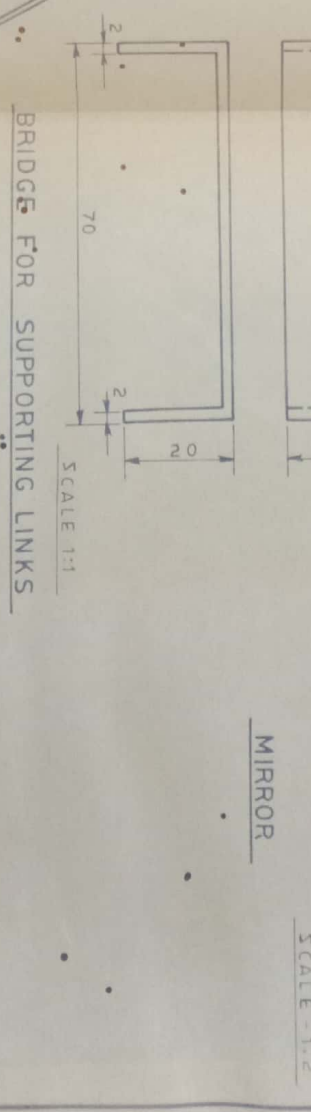
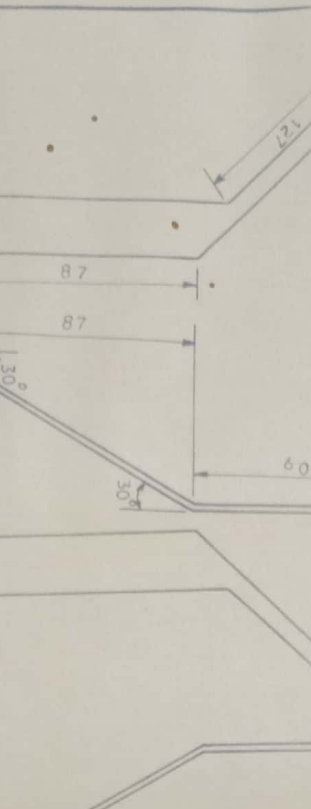
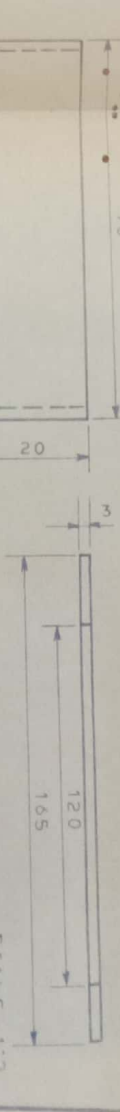
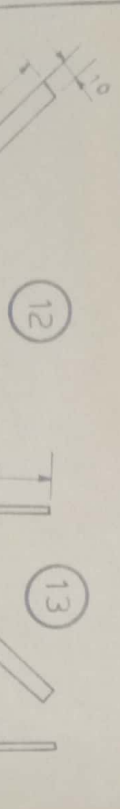
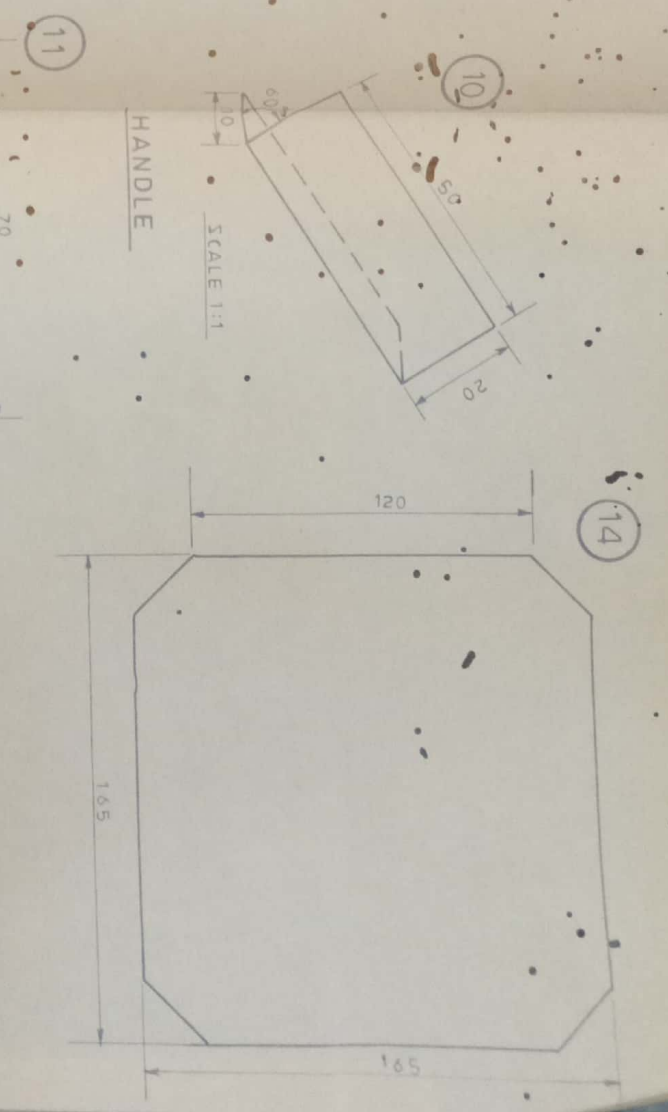
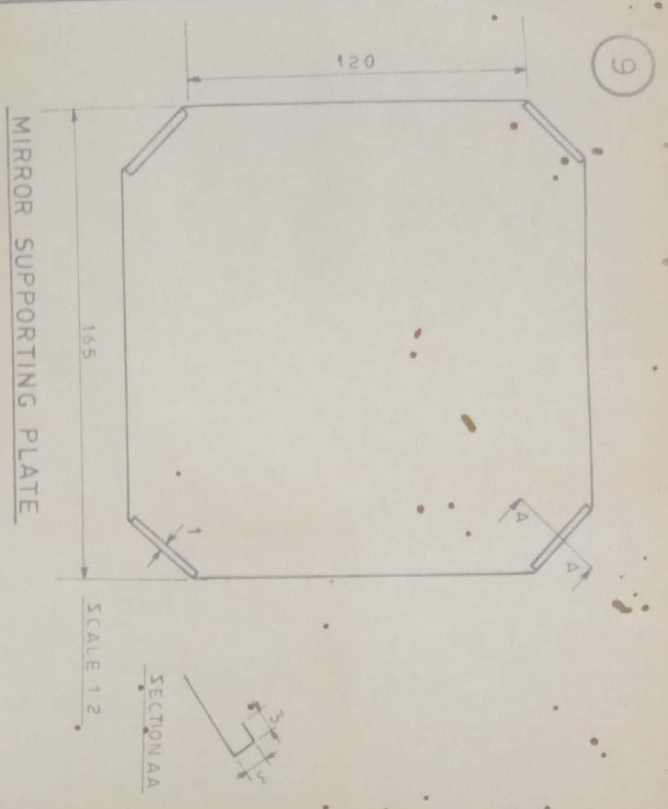
3



SLIDE FEEDING WHEEL

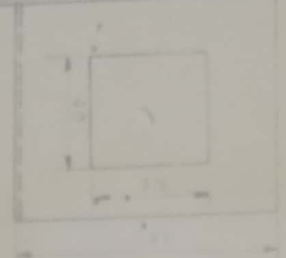
SCALE 1:1

DIPLOMA PROJECT			
SLIDE PROJECTOR FOR SCHOOL		VIJAY BAPAT	
SCALE - DIMENSION IN MM.	 	ROLLNO.732703 73-75 BATCH	
		DETAILS OF SLIDE FEEDING AND LENS ARRANGEMENT	
INDUSTRIAL DESIGN CENTRE, I.I.T. BOMBAY-76			



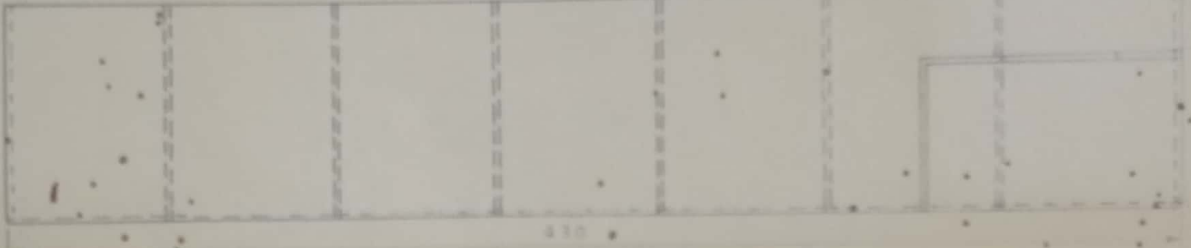
SUPPORTING LINKS

DIPLOMA PROJECT	
SLIDE PROJECTOR FOR SCHOOL	
SCALE	VIJAY BAPAT
DIMENSION IN MM	ROLL NO. 732703 / 73-75 BATCH
	DETAILS OF MIRROR ARRANGEMENT
INDUSTRIAL DESIGN CENTRE, I.I.T. BOMBAY - 76	

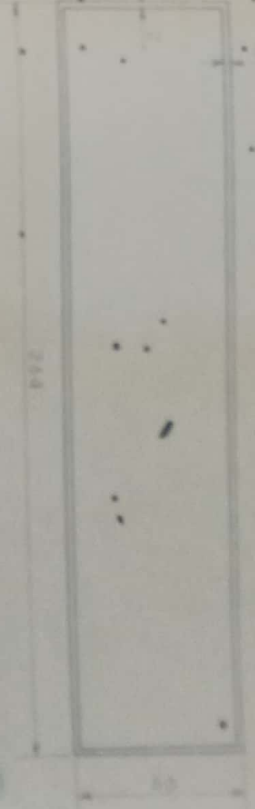


TOP VIEW

20



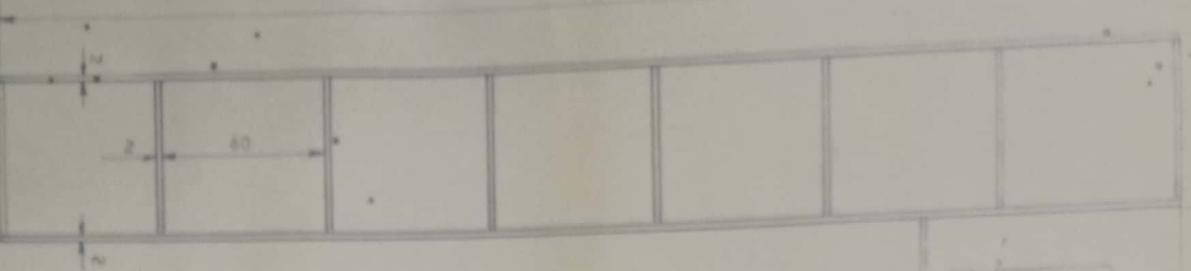
FRONT VIEW



POCKET FOR LENS ASSEMBLY

19

POCKET FOR SLIDES



DIPLOMA PROJECT

SLIDE PROJECTOR
FOR SCHOOL

VIJAY BAPAT
ROLL NO. 732703 73-75 BATCH

SCALE 1:2

DIMENSION IN MM

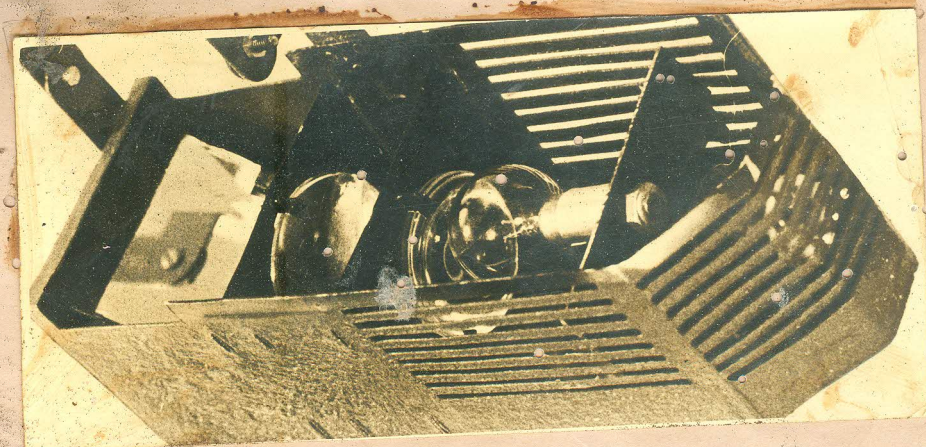
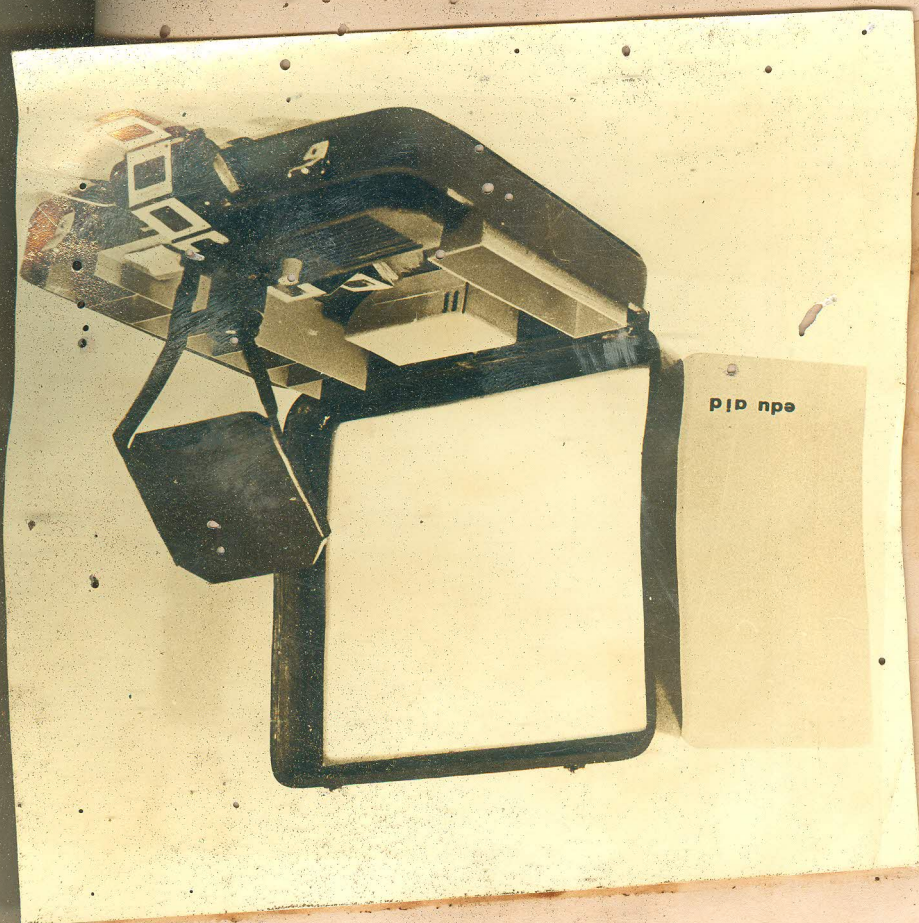


DETAILS OF POCKET

INDUSTRIAL DESIGN CENTRE, IIT BOMBAY-26

PHOTOGRAPHS





BIBLIOGRAPHY

1. Lenses in Photography by Rudolf Kingslake.
2. Engineering optics by Habbell and Cox.
3. Artificial light and photography
by Rieck and Vorbeek
4. Physics - Jenkin and White.
5. The audio visual encyclopedia -
Howard M. Tremaine.
6. Instrumental Optics.
7. Designing for visual aids -
Andrew Wright.
8. Industrial Design Magazines. .