school bag

diploma project

bakhale v l

industrial design centre

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Design of School Bag

diploma project

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

by

V.L. Bakhale

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Industrial Design Centre
Indian Institute of Technology
Bomaby
1971

Approval Sheet

Diploma Project entitled

"Design of School Bag"

by V.L. Bakhale is approved for the Postgraduate Diploma in Industrial Design

Guide:

Chairman:

Examiners:

Acknowledgment

I wish to take this opportunity of thanking our Adviser, Prof. V. N. Adarkar for his valuable advice and encouragement during the various phases of this course.

I wish to thank Prof. S.Nadkarni for his valuable advice and suggestions regarding this project.

I owe a debt of gratitude to my guide Shri A. Gopinatha Rao who has been always very co-operative with me in my project work.

My thanks are also due to Shri I.C. Joseph, Chief Designer, Larsen & Toubro Ltd., Bombay, for his valuable advice on material selection.

I should like to thank my colleagues and our staff members for their helpful suggestions and criticisms.

Finally I thank our typist Shri P. Prabhakaran who has been always very fast in his work.

V.L. Bakhale

Contents

1. Introduction

Now a days we see so many new designs of school bags coming to market and old designs going out of market. This clearly shows that a new design is really necessary for school bags, which will satisfy users and producers needs perfectly well.

The problem of school bag arose not before 50 years. In the past the education system was different and students were not required to carry large number of books and in some cases lunch box and water bottle too. Hence in the past an ordinary bag was used as a school bag but in big cities like Bombay the problem of school bag becomes acute. In big cities students come to school from distant places through local trains and buses. These local trains and buses are always crowded and in such crowded places school bag obstructs free body movement. It become very troublesome to travel through these vehicles.

Every student has to carry large number of text books and exercise books. The number of books can not be reduced because these are the minimum necessary books. The weight can be reduced by school co-operation only i.e. by providing special lockers to students so that they can keep some of their things there. But all schools can not do this and so we have to think of a new system which will make students carry the books easily. We can not reduce the weight but can provide means to carry it easily. From this point of view various school bags are introduced into the market.

But most of the bags are not convenient. Some are heavy some are light. The light bags are flexible and spoil the books. Some bags are not water proof and so can not be used in the rainy season. Most of the bags are costly. Cheap bags last for six months while costlier bags last for 2-3 years but their size is not suitable. Thus not even a single bag in market satisfies customers needs and hence re-

design of school bag is very essential.

2. Problem Statement

Redesign a school bag which will satisfy all the needs of the customer and producer, constrains are:

1) It should be functionally good .
2) It should be ergonomically well designed
3) It should have good appearance
4) It should be designed for income group above Rs.400/- and below Rs.1000/- per month. Cost should not exceed Rs.10/- per piece.
5) Suitable for mass production.

3. Information

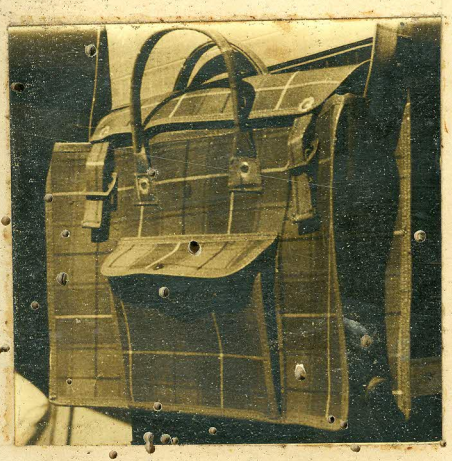
Data regarding school bag was collected from various sources such as,

1) From shop keepers
2) From books
3) General observation of students
4) From parents
5) From teachers
6) From students.

3.1 Shop keepers:

A questionnaire was made and various shops in Thana, Mulund, Vikhroli, Dadar and Craford Market were visited. Various types of bags are available in shops are shown below:

Aluminium bags.
Available in various sizes
Cost Rs.14 - 20.



Canvas bags.
Available in various sizes.
Cost Rs.3 - 8.

Hand bags and air bags
Available in various shapes and sizes.
Cost Rs.7/- and above.

Thick cloth bags.
Available in various sizes.
Cost Rs. 3 - 5.50.

In addition to this there are also plastic and leather bags available in market. Leather bags are mostly like canvas bags and plastic bags like aluminium bags. No difference at all except the material used.

The prices of all these bags vary between Rs. 3 to Rs.20. Canvas and aluminium bags are mostly sold in market because of their large demand. As far as life is considered aluminium bag last longer than any other bags. But initial investment is more in aluminium bag. Though the life is more the size is such that bag cannot be used after two years.

The initial investment is less in canvas bags but the life and durability of the bag is very less. So economically speaking both the bags are more or less same.

Most of the complaints made to the shop keepers are about belt, hinges handles, etc. and about the life of the bag. Generally father decides the type of bag to be purchased and not the child. The manufacturers of these bags are local and not very famous.

3.2 Data collected from books:
Very little information is available in books about school bag. Most of the information available is about various ways of carrying school bag and its ergonomical aspects. There are four ways of carrying school bag.

3.2.1 Ruck sack:
This is the best way of carrying the load. This way of carrying load is generally adopted by soldiers and rock climbers because while climbing they have to lean forward and carry a load which

nearly equals their body weight. They do not have any other way but this. The energy expenditure is minimum in this case and also it allows free body movement.

3.2.2 Low back:

This is also the way of taking load on back but the position of the load is at the lower portion of the back. This is next to ruck sack type as far as energy expenditure is considered. But this gives pain in shoulders. This type also allows free body movement.

3.2.3 Across the shoulders:

This is third in order of preference and the position of load in this case is under one of the arms. This type restricts free body movement to some extent and produces bend in posture.

3.2.4 Hand carriage:

This is the worst way of carrying load and does not allow free body movement. If the load is too heavy, it may even produce permanent body deformity in case of children. Energy expenditure

is maximum in this case and it is not at all advisable for school bag.

3.3 Data collected from general observations

Various places were visited to see general behaviour of the students with the bags. How they use it and how they carry it in local trains and buses.

3.3.1 The various ways of carrying the bag. Most of the boys prefer to carry on shoulder rather than carrying in hand. Elder boys prefer to carry books in hand. That is a fashion.

3.3.2 Some times the size of the drawing book is odd and it can not be accommodated in bag. That has to be carried in hand.

3.3.3 Some students use bag carefully but not all.

3.3.4 Some students sit on bag in local trains. Bag is handled roughly.

3.3.5 The students mostly sit or stand near the doors of the local train. If their hands are not free some accident may take place.

3.3.6 It is easier to board the train when the hands are free. The boys get in while the train is in motion.

3.3.7 The closing and locking arrangements of school bag are not reliable. Small kids can not even close these bags.

3.3.8 In most of the cases the bag is too heavy for children. They can not walk fast with the bag and the length of the belt is always more for them.

3.3.9 A simple way of reducing the belt length. It makes easier to carry the bag.

3.4 Data collected from parents

A questionnaire was made and copies were distributed to various people through schools. The question asked were:

1) What is the age of your school going son/daughter?

2) What is the type of bag he/she uses for carrying books?

3) How much it costs?

4) What is the nature of frequent troubles about the bag?

5) How long one bag lasts?

6) What are the reasons for discarding this bag afterwards?

7) What type of complaints are made by your son about the school bag?

8) Do you think that school bag full of necessary things becomes too heavy for your son/daughter?

9) Does your son carry books more than necessary in his/her bag?

10) Do you think that the present bags are inconvenient? If so, in what manner?

11) What are the other things your son/daughter carries in bag?

12) How much would you like to pay for a school bag which is most convenient?

13) What is your profession?

The general information gathered from this questionnaire is given below:

1) The age of the students is between the age group of 8-12 years.

2) Most of the students use aluminium or canvas bag.

3) The canvas bag costs Rs.5-8 and aluminium bag costs Rs.14-20.

4) The bag (canvas) tears in short period. The corners wear out during washing. The joint between the belt and the bag is not sufficiently

strong. The hinges and the handle of the aluminium bag gives trouble after six months.

5) The canvas and thick cloth bags last for 6-8 months. The aluminium bag lasts more than two years.

6) The bags are discarded because of no possibility of repairing them any more. It looks shabby after some use.

7) Most of the complaints are about the weight of the bag. The handle of the aluminium bag hurts the fingers. The canvas bags are not water proof. The canvas bags are too flexible and the corners of the books are spoiled.

8) Most of the students carry books according to requirement.

9) The present bags are inconvenient.

10) Hardly 25-30% of the students carry lunch box daily.

11) The price of the bag should not exceed Rs.10/-.

12) Most of the parents belong to middle class group.

13) It is better to have students name on the bag.

3.5 Data collection from teachers

A questionnaire was made and copies

were distributed in various schools. The questions asked were:

1) Have you got any school bag storage system in your school?

2) How many text books and exercise books students usually carry in their bags?

3) Do you think that some of the students carry books more than necessary in their bags?

4) Do you ask your students to bring books according to time table daily? Do you take any extra period daily?

5) Just like students uniform, is there any regulation or specification about their bags?

6) Do you think it possible to insists on a particular type of bag?

7) Do you think that the present bags are convenient? If not, can you tell some of the faults in bags?

8) Are there any complaints made by students (about the school bag) to you? What is the nature of these complaints?

9) Can you tell me anything about the income group of students in your class?

10) Do you think it necessary to have school's name on the bag?

11) Do you have any idea about the number of students who bring water bottle daily?

12) Is it true that all students bring lunch box daily?

13) Do you think that the bag is too heavy for the students below age 12? If so have you made any attempt to reduce this weight?

Following information was collected from teachers:

1) School bag storage systems are not provided in school.

2) Number of text books and note books that a student has to carry depends on the class in which he is studying.

3) Some of the students carry extra books.

4) Extra periods are rarely taken.

5) No regulation about the school bags is made.

6) It is possible to insist on a particular type of bag.

7) Present bags are not convenient.

8) Most of the complaints are about the size and weight of the bag.

9) Most of the students are from middle class families.

10) It is better to have school's name on the bag.

11) 50% of the students carry lunch box and water bottle daily.

12) Attempts are not made by school to reduce the weight of the bag.

3.5 Data collection from students

It is very difficult to collect data from students because their answers are not to the point. But this is a fact that every year they want new bag. Present bags are too heavy for them. They want bag whose capacity can be changed.

4. Ergonomical Factors

The weight of the school bag full of necessary things is about 5-6 lbs. This is too much for children. But we can not reduce it unless school provides some storage system to children.

The other alternative is to make school bag such that it can be carried easily by children. As already mentioned there are four ways of carrying the school bag:

1) Ruck sack type
2) Low back
3) Across the shoulders
4) In hand.

From the experiments it has been found out that ruck sack is the best way of carrying bag. Energy consumption is minimum in this case and maximum when carried in hand.

The two important factors governing the design are:

1) There should be free body movement while carrying the bag.
2) Body deformity should not be produced in long run.

Carrying the bag in hand or across the shoulder produces bend in posture and are therefore not advisable. Out of the other two alternatives ruck sack and low back type students prefer low back type. The energy consumption in low back type is more than in ruck sack type. But energy consumption is not as important as the two above mentioned factors. Thus we can provide a belt system such that the bag can be carried both way the ruck sack and the low back.

The other important factor is the belt length. Since the body dimensions such as height, differ from one student to other, a particular length can not be suggested. It is better to provide an arrangement to change the belt length. The opening and closing arrangement should be very simple.

5. Analysis of the school bag

5.1 Aluminium bag

The various parts of the bag are

Box:-

Material - aluminium

function - to contain text books note books, lunch box, pencils, etc.

Process - press work.

Handle: Fixed to the front of the bag

Material - aluminium

Function - for holding the bag

Process - bending and fixing with rivets.

Hinges:-

Material - aluminium

Function - to join cover and box

Process - rivetting.

These bags are available in various sizes:

14" x 10" x 4.5"

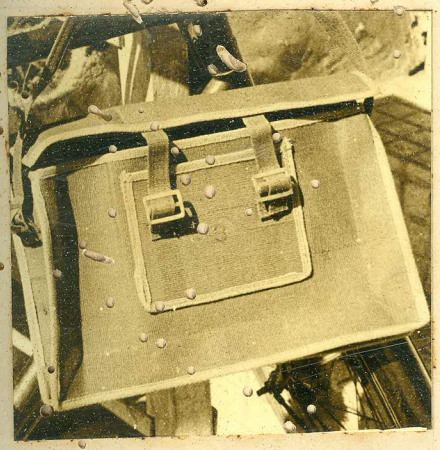
12" x 9" x 4.5"

11" x 9" x 4"

10" x 8" x 4"

9" x 7.5" x 3.5"

Prices vary from Rs.7 to 20.



5.2 Canvas bag

The various parts of the bag are analysed as follows:

Bag:-

Material - canvas

Function - to carry books

Process - stitching to suitable size.

Belt:-

Material - thick canvas

Function - to carry bag

Process - stitching.

Buckles:- Total No.5

Material - brass or mild steel

Function - for changing the length of the belt. To maintain flexible joint between the bag and belt. Also used for closing the bag.

Process - punching.

5.3 Flexible PVC bag

The various parts are analysed below:

Bag:-

Material - PVC or fabric coated with plastic.

Function - used to carry various things.

Process - stitching.

Belt:-

Material - flexible PVC

Function - for carrying bag

Process - stitching.

Chain:-

Material - brass

Function - for closing the bag

Process - special type of press work.

Bottom supports:-

Material - chromium plated mild steel

Function - to support the bag in vertical position and avoid wear and tear from bottom.

Process - press work.

Buckles:-

Material - stainless steel or chromium coated mild steel

Function - to join bag and the belt together. For changing the length of the belt.

Process - stamping.

5.4 Polythene bag

These bags are exactly similar to aluminium bag and are made by injection moulding.

5.5 Leather bag

These bags are like canvas bags. Special types of bags can be made according to the wishes of the customer.

6. Hypothesis

6.1 Aluminium bag

1) Aluminium bags are very costly for middle class people.

2) The quality of these bags is not good. Students use bag roughly and often hinges or handle comes out.

3) These bags can not be painted. Painted bags are available in market but that colour goes away after some use.

4) Corners of these bags may hurxt people. The costlier bags have rounded corners while cheap bags have sharp corners.

5) Handle hurts fingers.

6) Closing arrangement is not proper and additional lock is to be used.

7) Bag is quite heavy.

8) It is to be carried in hand and so it obstructs free body movement and produces bend in posture.

9) It is not perfectly water proof.

10) Sizes are not suitable.

6.2 Canvas bags

1) These bags are quite cheap as compared with aluminium bag. But life is hardly 6-8 months. Initial investment is less but running cost is too much because of restitching and repairing.

2) Strap length is not adjustable.

3) These bags are too flexible and spoil the corners of the books.

4) These bags can not be used in rainy season.

5) Bags can not be washed.

6) Opening and closing arrangement is not reliable.

7) As the bags are not perfectly water proof, water goes inside the bag in the rainy season. The books are spoiled and the bag stinks for two three days.

8) Corners wear out very fast.

6.3 Flexible PVC bags

1) These bags are costly. Price Rs.8-12.

2) Last only for 4-5 months if used daily.

3) Most of the bags are provided with chain for closing. The chain is not at all reliable.

4) Are not meant for rough use.

5) Strap is very weak.

6.4 Plastic bags

1) Available only in small sizes.

2) Are made from polythene and so affected by weather.

3) Loses colour slowly.

4) Scratches are visible and looks shabby after some use.

5) Shape is not retained for longer time.

6) It is to be carried in hand and so it does not allow free body movement.

7) Opening and closing arrangement are not reliable.

6.5. Leather bags

1) Bags are very costly.

2) Can not be used in rainly season.

3) Are made mostly like canvas bags and so have same defects.

7. Synthesis

From the data collection and hypothesis following constraints have been fixed:

1) The bag must not cost more than Rs.10/- per piece.

2) It should last for two years.

3) It must be water proof.

4) It should be washable.

5) It should be light in weight.

6) It should have some flexibility.

7) Strap length should be adjustable.

8) Proper closing arrangement must be provided.

9) It should be carried easily without hurting any part of your or other's body.

10) Space for writing childrens and schools name should be provided.

11) Special compartments should be provided for compos box, pencils, rubber, etc.

12) It should be aesthetically good.

13) It should be ergonomically well designed.

14) Should be easy for storage in shops and also easy for transportation.

15) Mass production should be possible.

8. Material Selection

8.1 Material selection is the most important and final factor of product design because on it only depends the reliability of the product. The main reason for chosing suitable material are:

1) To reduce production cost.

2) To reduce basic material cost.

3) To make functional change.

4) To improve service performance including longer life and higher reliability.

5) To use a lower cost materials part.

6) To take advantage of new materials.

8.2 The various materials which can be used for school bag are:

1) Thick cloth or canvas.

2) Aluminium

3) Leather

4) Cardboard covered with rexin.

5) Plastic.

8.3 From this the final material is chosen on the basis of:

1) Value Analysis

2) Failure Analysis

3) Cost Vs. performance

4) Weight to property basis.

Let us analyse the various materials on the basis of above mentioned points.

8.4 Thick cloth or canvas

1) These materials are not water proof.

2) These materials are not washable.

3) Not suitable for mass production process.

4) Wear resistance is very low.

5) Godd finish is not possible.

6) Dimensional accuracy is very less.

7) Life is less.

These materials have got some advantages, such as,

1) Flexible

2) Low cost

3) Available in large scale.

4) Light in weight.

5) Available in some colours.

8.5 Aluminium

1) Aluminium is water proof.

2) Can be washed.

3) Mass production process can be used.

4) Wear resistance is ~~xow~~ high.

5) Good finish is possible.

6) Dimensional accuracy is high.

7) Life is more.

8) No effect of weather.

9) Available on large scale.

But aluminium has got some disadvantages such as,

1) High cost

2) It is very rigid

3) It is not available in different colours and cannot be painted.

4) Its density as compared to other materials is high.

8.6 Leather

Though leather is used sometimes for school bags it is not advisable because of following disadvantages:

1) It is very costly.

2) Cannot be used in rainy season.

3) It is not available in various colours.

4) It is affected by weather.

5) It is not available on large scale.

8.7 Card board covered with rexin

This material is also used for school bags but it has got following disadvantages:

1) It is not perfectly water proof.

2) Cost of the bag will be more.

3) High rate of production cannot be achieved.

4) Wear resistance is less.

5) Life is less.

8.8 Plastics

Plastics have got following advantages:

1) It is water proof.

2) Can be flexible.

3) Cost is low.

4) It is washable.

5) Mass production process, can be applied.

6) Available in various colours.

7) Wear resistance is high.

8) Density is low.

9) Good finish is possible.

10) Dimensional accuracy is high.

11) Sufficiently durable.

From the comparison of these various materials we find that plastic is the most suitable material for school bag.

8.9 The various plastics which can be used for school bag are:

1) Polythene

2) Polypropylene

3) P.V.C. (rigid or flexible)

Out of these materials polypropylene is not available in India.

Polythene is affected by weater. It warps to some degree. It is not scratch proof. Sometimes it develops cracks. PVC satisfied all the needs of the school bag. Thus PVC is the most suitable material for school bag.

8.10 Material for belt

Same material i.e. flexible PVC is chosen for belt. As same material is used for belt and bag inventory control becomes easy.

9. Design and Development

9.1 Body of the bag:

1) Suitable size of the bag is chosen so that all the books can be accommodated easily.

2) Particular shape is given to the body from the top. It makes easy to take out the books from the bag.

3) The width of the bag is reduced at the bottom. This gives rigidity to the bag and also the shape retaining property.

4) The complete body is made in one piece and so it is sufficiently strong.

9.2 Cover:

1) Suitable cover is designed for the bag which will flash with the body.

2) A space is provided on the cover to write the name and address.

3) The width of the cover is reduced at the top so that it becomes easy to handle.

4) It is a single piece plastic cover and is very strong.

9.3 Belt:

1) Belt is made in two exactly similar parts . These parts will be arranged in such a way that the

bag can be carried in ruck sack or low back ways.

2) If one part of the belt fails other can be used for the time being.

3) Belt length is adjustable.

9.4 Closing arrangement:

1) The closing arrangement works on gravitational force and locking is perfect.

2) All the hinges, rivets, latch, etc. are avoided.

10. Design Decision

1) Body and cover:

Material - P.V.C.

Process - Injection moulding

2) Belt:

Material - P.V.C.

Process - Injection moulding

3) Buckles:

Material - Chromium plated mild steel

Process - Punching

4) Compass box:

Material - P.V.C.

Process - Injection moulding

5) Cover on name plate:

Material - Perspext

Process - Moulding

11. Salient Features of the bag

1) The bag is to be made of P.V.C. by injection moulding. The mass production reduces the cost.

2) The bag is perfectly water proof. Can be washed and made available in various colours.

3) All the hinges, rivetting work, latch etc. are avoided.

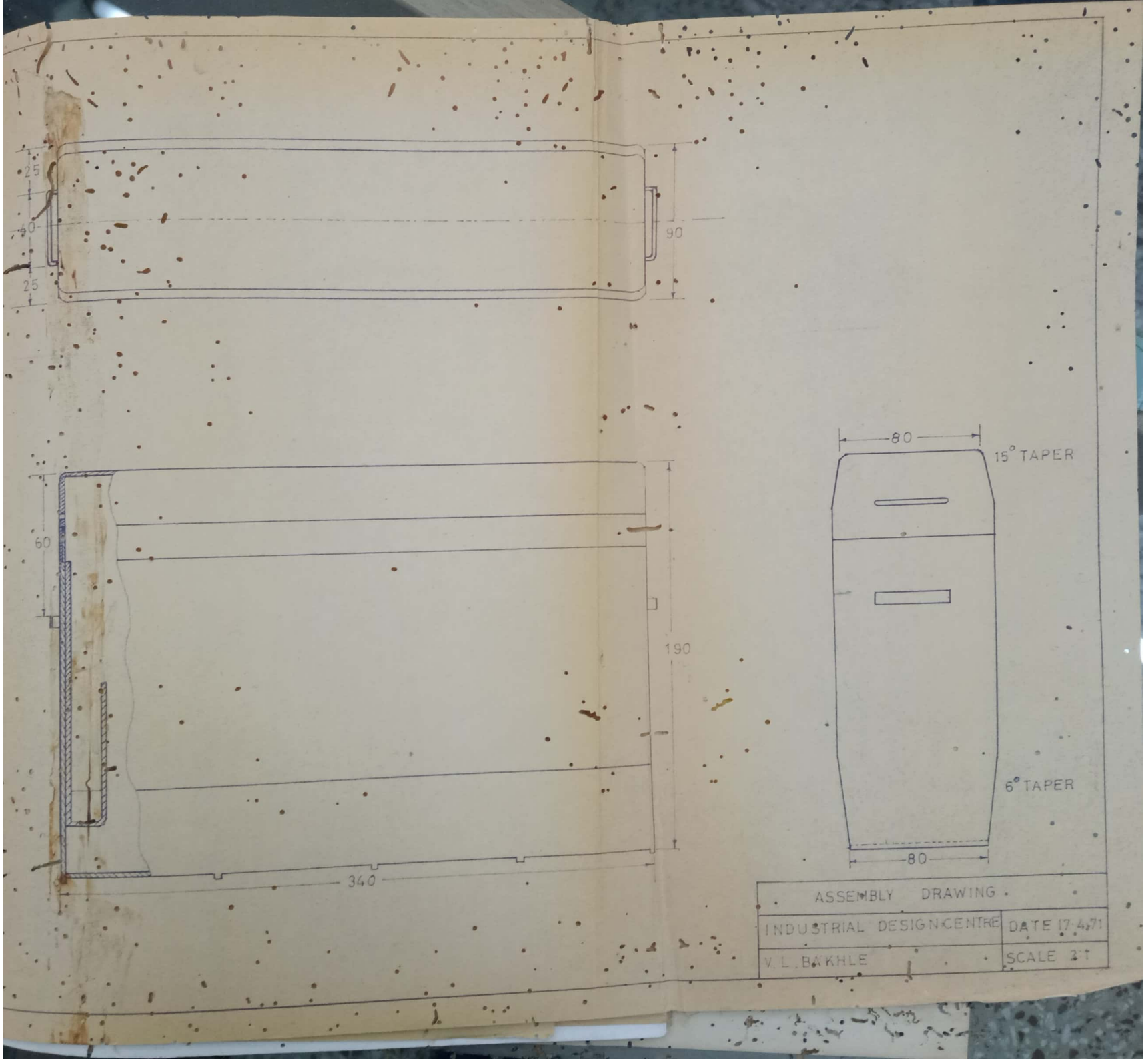
4) The bag closing arrangement works on gravitational force. The closing is perfect.

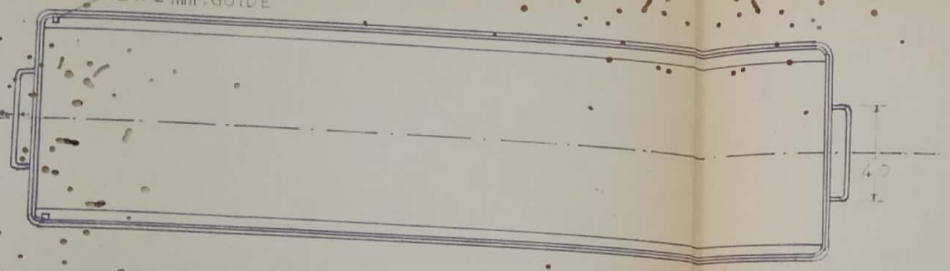
5) Special belt system is provided which makes it possible to carry bag in ruck sack as well as low back way.

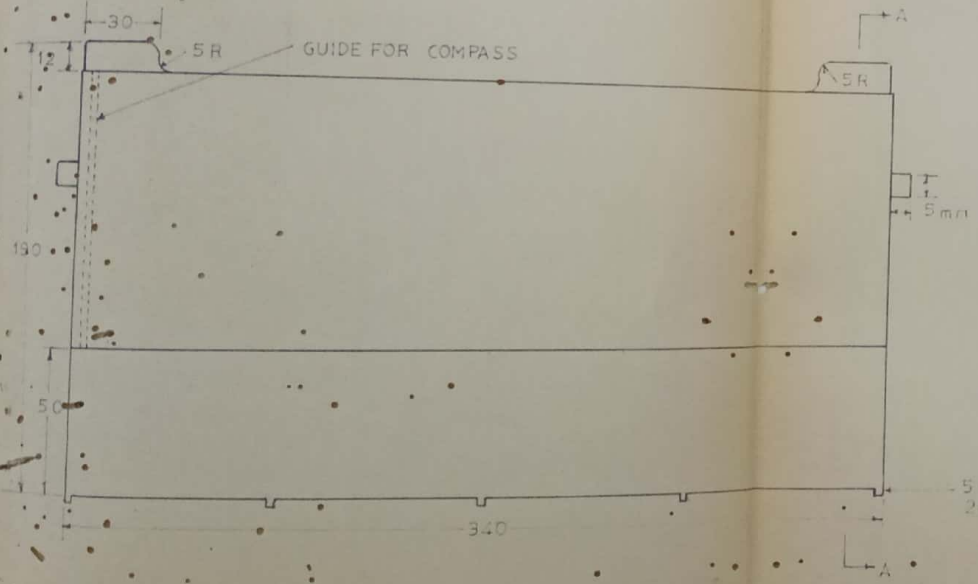
6) The belt is made in two halves which are exactly similar. When both are used belt length can be changed. When one belt fails, the other can be used to carry the bag for the time being.

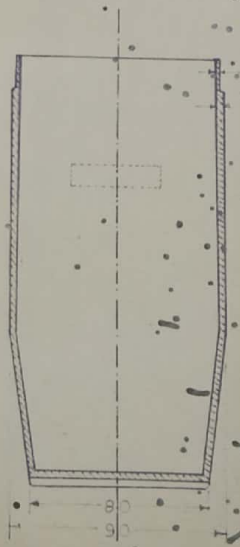
7) Special compartment is provided to keep compass, pencils, etc.

8) Arrangement for writing name is provided.









SECTION AA

1	BODY	P.V.C.	1
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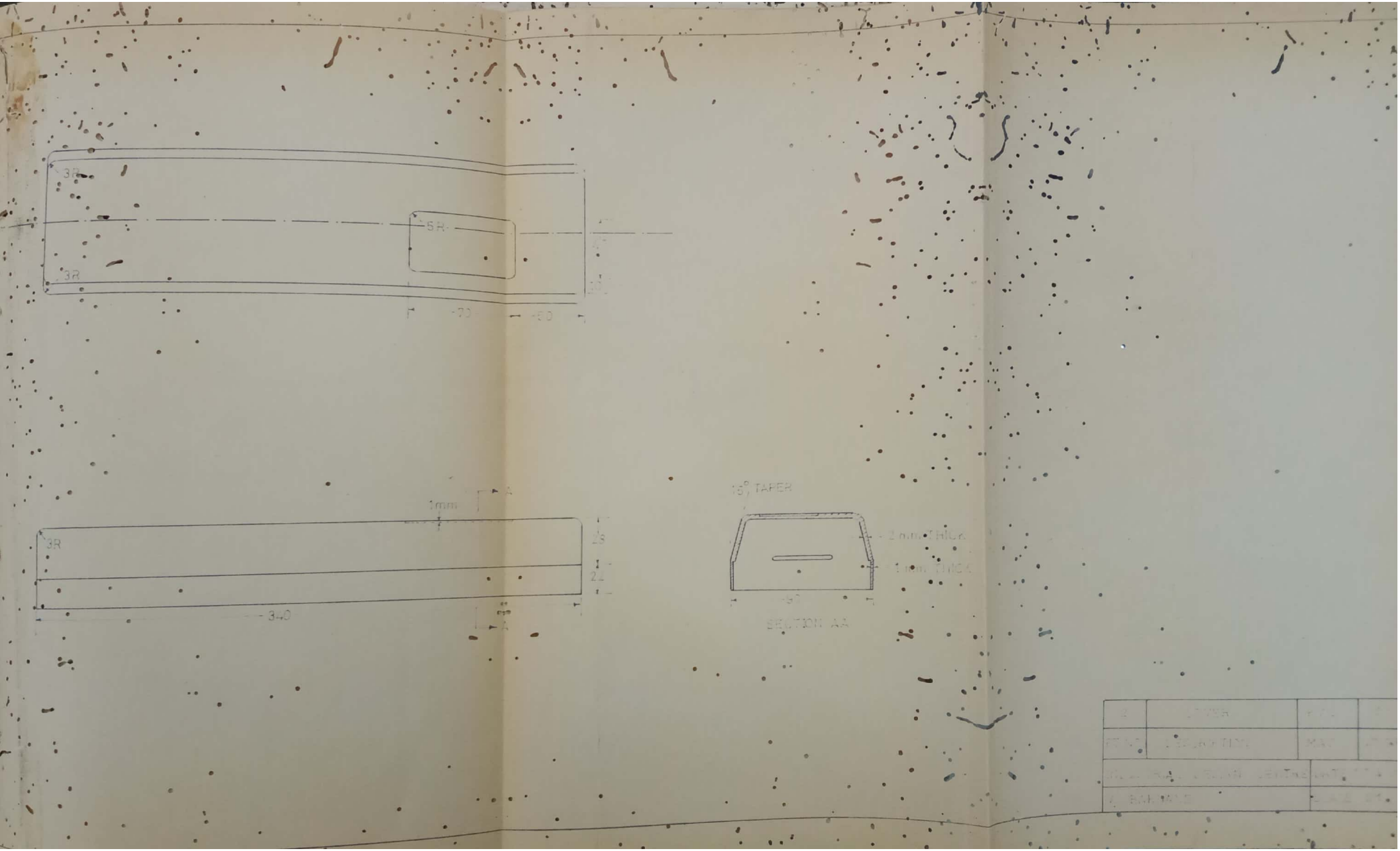
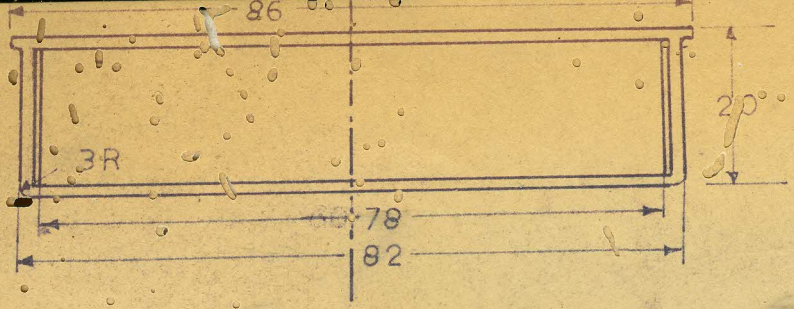
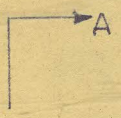
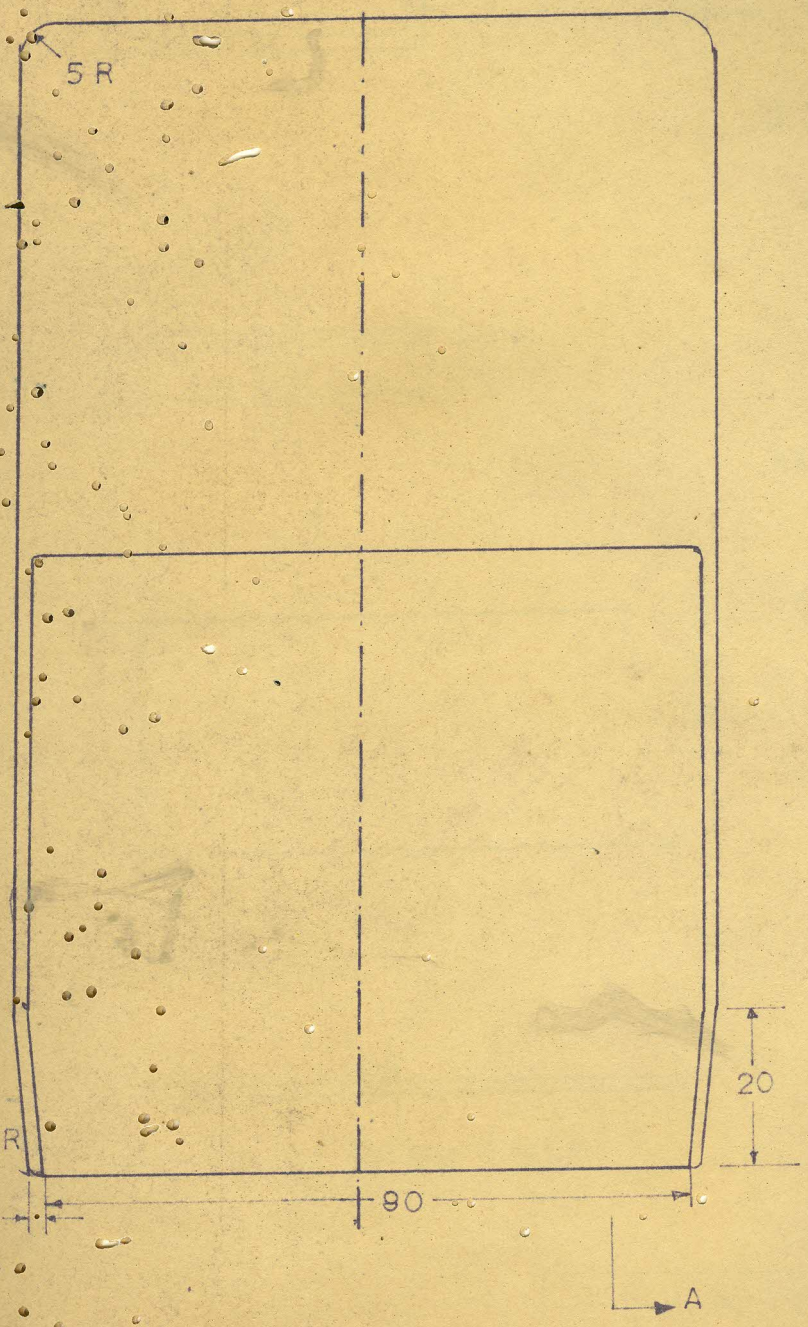
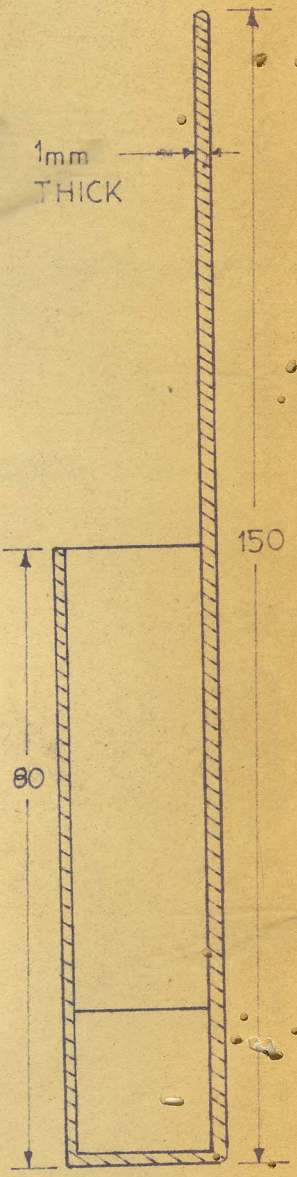
V. L. BARVALE		SCALE 1/1	











SECTION AA

3	COMPASS BOX.	P.V.C.	1.
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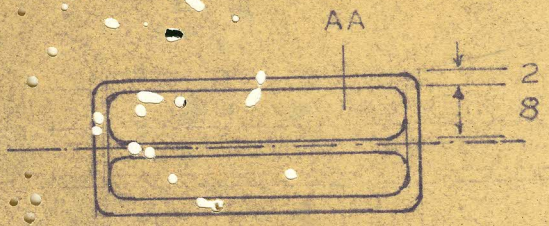
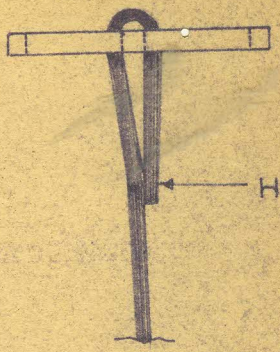
V. L. BAKHALE		SCALE 1:1	

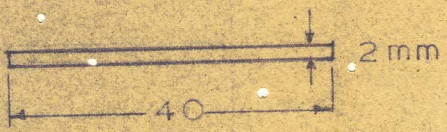


SECTION AA

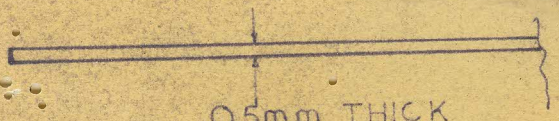
0.5mm THICK



BELT BUCKLE JOINT



(5)



5	BELT	PVC	2
4	BUCKLE	M.S. Cr	6
PT.NO	DESCRIPTION	MAT	NO.OFF
INDUSTRIAL DESIGN CENTRE		DATE 7-4-71	
V.L.BAKHALE		SCALE 1:1	