BREAD TOASTER FOR CATERING ESTABLISHMENTS

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Design of Electric Bread Toaster

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 a Bread Toaster " by Siddha Arun K., is approved for the postgraduate diploma in Industrial Design.

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My acknowledgments to

Various catering colleges, hotels and restaurants in Bombay.

Shri U. A. Athavankar and other staff of Industrial Design Centre.

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and my friends.

Contents

1. PROBLEM STATEMENT

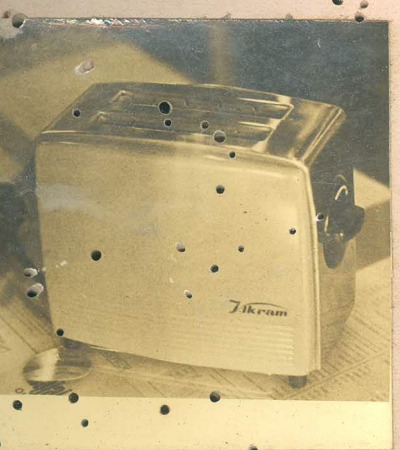
To design a electrical bread toaster for catering establishments.

2. INTRODUCTION

Toasting is a process of dehydration of bread. Toasting is primarily done to make the bread more tasty. Simple bread slices can not be eatern without either butter or jam but a toast can be eaten independently. A oven hot toast tastes better than ordinary bread slice or a cold toast. In the case of toaster heat is given by means of radiation.

In these fast moving days bread has become one of the most important food items. It is a ready made food article and does not require much further preparation and it is cheap. The busy housewife of today or the working lady finds it suitable to serve bread either at break fast or during the meals. So it is time saving as well as cheap. However in India the bread has remained as a secondary article and not the main one.

Therefore it can be seen that there is a heavy demand for a toaster which can serve the need of a restaurant or a hostel mess.



At present a person has to wait for quite a long time to get a hot toast in the restaurants as well as in the hostel mess. This has been seen by myself and also has been head from

from many people. The reason behind this waiting is the non-availability of suitable toaster for such catering establishments. Hence I have chosen this problem.

With the increase of hotel going people and the increase in hostel messes, the demand for such a toaster will be always on the increase. Hence I think this attempt in designing such a toaster will get a warm welcome.

3. INFORMATION

3.1 General Information

3.1.1 The results obtained, when heating test is carried, on four different types of bread, are as follows:

3.1.1.1 Britannia Bread

Colour	Time
White	1 min. 30 sec.
Light brown	2 min. 30 sec.
Dark brown	3 min.

3.1.1.2 Modern Bread

White	1 min. 25 sec.
Light brown	2 min. 15 sec.
Dark brown	2 min. 55 sec.

3.1.1.3 Home made bread

White	1 min. 35 sec.
Light brown	2 min. 20 sec.
Dark brown	3 min. 05 sec.

3.1.1.4 Old bread

White	1 min. 10 sec.
Light brown	2 min. 10 sec.
Dark brown	2 min. 50 sec.

From the above data obtained it is clear that the average time taken to burn the toast to dark brown is 3 minutes.

3.1.2

The information received from the hotel survey, tells that their requirement of toasts at a time is 4 to 6 slices.

3.1.3

It is very difficult to find out the exact demand of toasts at a time in the hostel mess as the students come irregularly during the break fast time. At some particular time there is a maximum number of students in the mess. This is called peak time. So the capacity of the toaster should be such, so as to satisfy the demand at its peak time.

The surveys conducted in different messes are in the form of charts

Minutes -- (Each column = 5 minutes)

	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
1	6		1	2	5	2		1	1						4	1		6
2		4		5	1	2	2			3		1			1			1
3		3			2	1												2
4	3					1												
5	1			1	1													

Minutes -- (Each column = 5 minutes)

	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
1	3	1	2	1	2	4												
2			4	2		1		1	2		3					4	3	5
3	3		1		1	3										4		
4						1												1
5			1			2												1

1	1						2		4		3							1
2	1	3	3	2		1	3	2	1	3	5		1	2	1			
3	4			1		2	4	3	2	5	2	3			2	1	3	1
4					1	1	3	1	2	1	1	5		3				2
5					2		3	2	3			1						

V.J.T.I. Mess

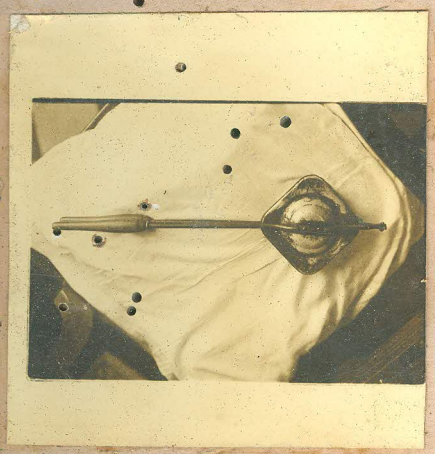
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
1	3		4		2		3	2	3		1	3	2	1	1			
2		1		6		4	4	2	4	2	5		6		2	4		2
3				1	3		1	2	1		1	1						3
4						2	4	3	1	3	2							3
5	1						1	2										3

1			3	2			3	2	2		6				2		3	2
2			4	4	1		4	2	4	4	2	2	1	1	3	4		1
3						2	6	2	1	1	1	1			4	1	1	1
4			1			4	1	1	1	5					1	1		
5								3						1		1		

Note: The figures in the chart represent the number of students coming in the mess per minute.

3.2

French Toaster: This toaster is like a box closed from all sides. In between two bread slices some fillings like tomato, butter etc. are filled and then they are placed in the toaster. After closing the bread slices by some pressure, they are heated to get the French toasts.

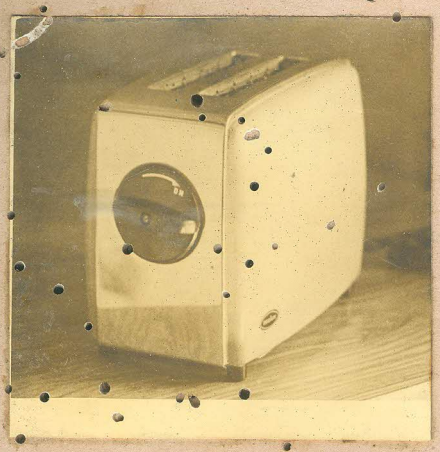


3.2.1 In this toaster shown in the figure, only one French toast is prepared at a time.

3.2.2 The toaster and heating unit are seperate.

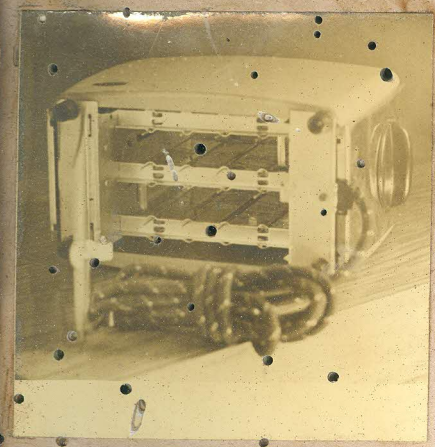
3.2.3 Even heating is difficult as it is heated on the heater or on other heating devices which are seperate unit.

Price - Rs. 5 to 7

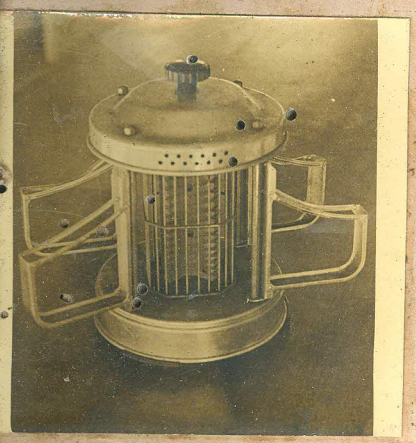


3.3

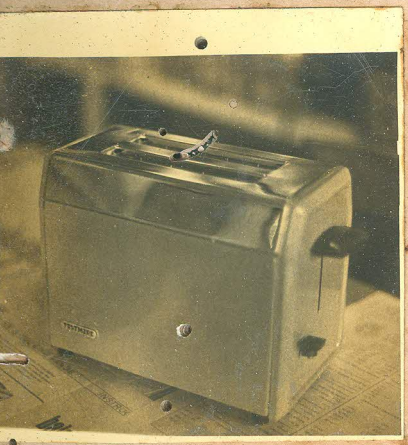
Two slice toaster: There is a variety of this type of toasters. At a time two toast can be prepared in five minutes. Some of these toasters are semi automatic and some are automatic. In semi automatic toaster when the



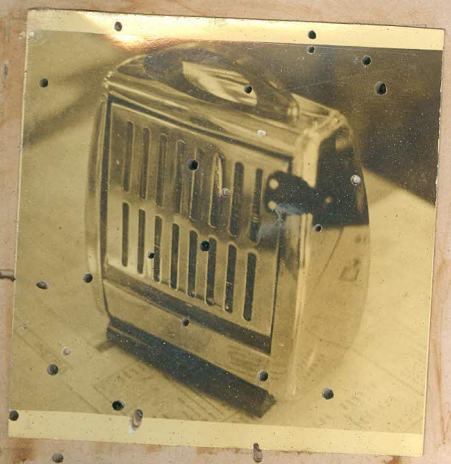
bread slices are pushed down then only the supply is switched on but removing of the toaster is done manually but in automatic toaster both the operations are done automatically and the toast pop-up after certain period of time.

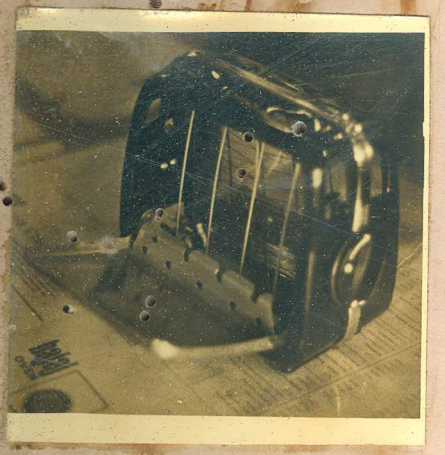


In some warming pach the temperature can be pre-set to one of three maximum values e.g. 80°C, 70°C, or 60°C. When the pre selected temperature is reached, the current is automatically switched off by means of bimetallic device. When the temperature drops the current is switched on again. The setting for this various temperatures are obtained by varying the degree of pre-heating of bimetallic strip. With lowest pre-heat setting highest temperature stage is obtained. In addition a bimetallic safety device is provided, which breaks the circuit in the event of excessively high temperature being reached.



The figure shows the two slice 'Racold' toaster. Heating elements are provided on the either sides of the toaster. Two sides are chromium plates. The toast are removed by means of a lever which is operated by the knob fixed on one side of the toaster.





In this type of toaster only lower half portion of the slice becomes brown so every time the slice should be reversed i.e. upside-down.

Takes more time to make first two slices and once the unit becomes hot this time is reduced.

Uneven burning of the toast.

If the slice is kept touching to one side of the toaster then that side becomes brown and the other side remains white only as this side is away from the heating elements.

The colour of the two slices, which are burnt simultaneously, may not be same.

It is very difficult to know whether the slices are burnt properly or not unless they are removed and seen.

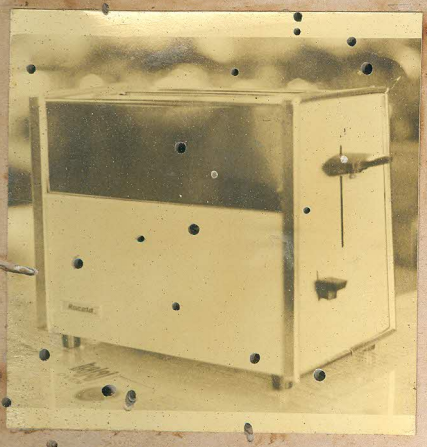
The sides of the toaster are very hot so one should be very careful while toasting.

No arrangement, to keep the toast warm atleast for some time is provided.

No arrangement, for cleaning is provided in this toaster.

Many times toasts get stuck up inside it.

It is very compact unit.



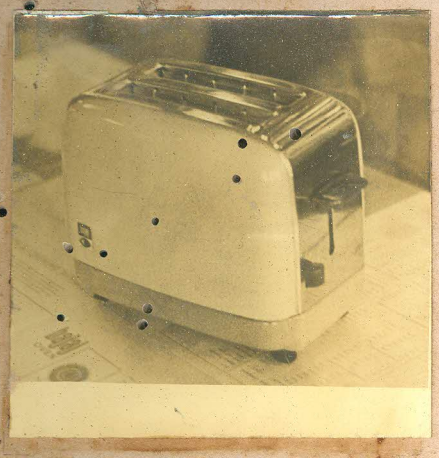
This particular toaster is neither semi automatic nor automatic.

Prices

Racold - Rs.70/-

Bajaj - Rs.72/-

Murphy Ravi - Rs.55/-



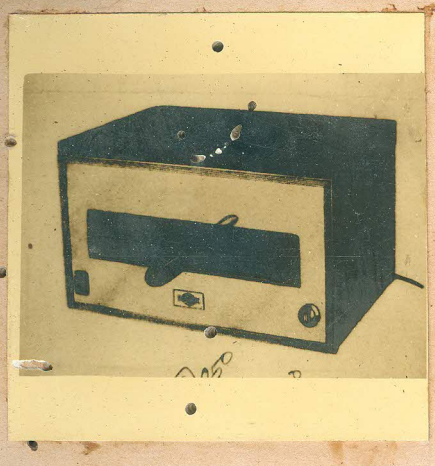
Rate of production is 1300 pieces per month

Sell is 125 to 150 pieces per month in Bombay

Automatic 4 slices

imported toaster - Rs.750/-

3.4



Commercial toaster: These toasters are used in the canteens, hostel messes. Ampex and Kleertone, these two companies manufacture commercial toasters. Its capacity is ranging from 8 to 24 slices at a time.

The photograph shows 'Amplex' commercial toaster

Price - Rs.250/-

Capacity - 8 slices

Main features of the commercial toaster

3.4.1 Heating elements are provided only on the top. So slices may have to be reversed.

3.4.2 Unit is bulky.

3.4.3 No arrangement to know whether the toasts are burnt properly or not.

3.4.4 Some amount of heat may always be wasted.

3.4.5 Porcelin used in it makes the unit bulky and it makes us to handle it very carefully.

3.4.6 Time takes for few slices is more as less power is supplied.

3.4.7 No handle or grip is provided to move the toaster from one place to another.

3.4.8 In some toaster heating elements are not provided with some covering grill so while inserting the tray it may strike against the heating elements, causing them to break.

3.4.9 Some heat may be wasted as the unit is not closed from the front side.

Kleertone 24 slices toaster - Rs.400/-

Ampex 8 slices toaster - Rs.250/-

3.5

At present, in many hostel messes, they are not using the commercial toaster due to lack of a suitable toaster. The photograph shows the method of preparing the toasts used in the hostel messes. It is a circular metal plate which is heated by means of a heated the bread slices are placed on the top of the plate. These slices are arranged in a circular manner in order to accommodate maximum number of bread slices. A person has to pay full attention while burning the toasts. He has to reverse the bread slices very often.

In this type of toasting the toasts are not burnt evenly.

One person has to be there for attention.

One person can not do two things at a time i.e. toasting as well as applying butter or jam.

This is very crude method of preparing the toasts.

This method is not very safety.

This requires more space.

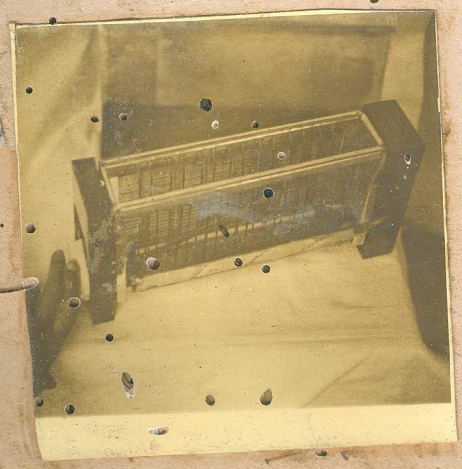
No arrangement is there for keeping the toasts warm for sometime.

But in this type of toasting you can get 20 25 toasts at a time.

You can clearly see whether the toast are burnt properly or not.

Once the toasting is over, the circular plate can be used for chapatis or for other purpose.

This is very cheap method of toasting.



4. ANALYSIS

4.1

Structural Analysis

4.1.1

Main frame structure: Two slice toaster: This is made up of mild steel strips. These are connected to each other by means of rivetts. It is 2 mm thick.

Commercial toaster: This structure is also made up of mild steel strips of 3 mm thickness. They are connected to each other by means of rivetts.

4.1.2

Two slice toaster: Mica: is used in this type of toaster as an insulator. This is available in the form of thin film. This is fixed to the main structure with the screws. It is fixed on either sides. Resistance/square = $3.x10^9$.

Commercial Toaster: Procelin is used as an insulator. It is moulded in required form. This is fixed only on the top side by means of screws. Its thickness varies as per the requirements. It is very heavy and easily breakable.

4.1.3

Two slice toaster: Heating elements: Nichrome wire (Ni 60% + Cr 16%) is used in this toaster. It is very thin and flat. This is rectangular in section. It does not get oxidised when heated in the atmosphere. This wire is not available in India. Its resistance is 10 to 12 ohms/foot. This wire is wound on the mica sheet and ends are taken out to the main supply.

Commercial toaster: Heating elements used here is Nichrome wire. This contains Ni 60% + Cr 16%. This wire is called in a coil and is fitted in the grooves provided in the

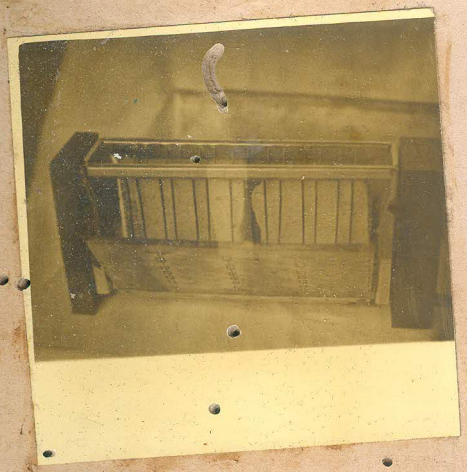
porcelin block. Its section is circular.

Properties of Nichrome:

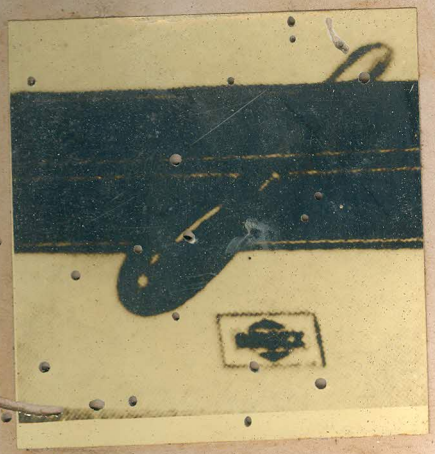
Resistivity at 20°C = 675 ohms. emils/foot.
Temperature coeff./°C = 0.00015 = 20 - 500°C
Temperature range. Linear expansion-0.000017
temperature coefficient per °C = 20 - 1000°C
Temperature range.
Melting point - 1350°C Tensile strength at
20°C = 95,000 p.s.i. Specific gravity = 8.247
Weight lb/in^2 = 0.2979.

4.1.4

Two slice toaster: Lifting mechanism: As shown in the figure there is one lever which is bent at certain angle. It is made up of mild steel strip of 3 mm thickness. It is pivoted at the angle. At the longer end of the lever, a horizontal rest is connected, which moves upwards and downwards. This is made up of mild steel. Two rollers are provided at the two ends which helps in sliding the rest smoothly. Two slots are provided at the side plates through which these rollers move. The top portion of the rest is flat and of 2 cms width.



Commercial toaster: Here no lifting mechanism is provided. Instead of that lifting mechanism, it is provided with the tray.



This tray can be inserted in the slot provided in the front. Tray is of rectangular shape. This is in the form of grill. It has got one handle for holding the tray. The handle is made up of bakelite, which is heat resistant. The grill is made up of small circular rods which are welded at the joints.

4.1.5

Two slice toaster: Grill: These are circular rods of brass. They are 2 mm in diameter. They are provided on the either sides of the toaster from inside. This form grill which covers the heating elements. These rods are fixed by rivetting their ends. They are about 2.5 cms apart. These are fixed on the main structure.

Commercial toaster: A very fine sieve is provided on the heating elements. This is fixed over the heating elements on the top portion of the toaster, from inside.

4.1.6

Two slice toaster: Front and back plates are made up of mild steel sheet. They chromium plates. Its thickness is 2 mm. At one end they are bent and at the other end they are screwed to fix on the main structure.

Commercial Toaster: Front of this toaster is made up of aluminium. It has provided a slot in the front. On this front, a knob, product graphics and an indicator is fixed up.

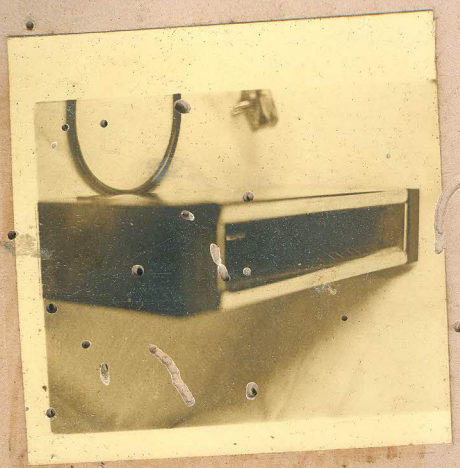
4.1.7

Two slice toaster: Side plates: These are black in colour. They are made up of bakelite which is heat resistant. In the one side plate a slot is provided through which the knob moves upwards and downwards. Its size is suitable to hold the toaster in two hands. These are rectangular blocks.

Commercial toaster: The sides are made up of mild steel sheet of 2 mmm thickness. Its sides are store enamelled pain finished. These are fixed to the main structure by means of screws.

4.1.8

Two slice toaster: Knob: The knob is made up of urea. It has got slightly yellowish colour. It moves through the slot provided in the side plate. It is fixed to the lifting lever by means of press-fit. It has provided slight curve on the top surface.



Commercial toaster: The knob is of black colour. It is made up of bakelite. It is made up of bakelite. It is fixed on the lower

right corner of the front side of the toaster. It is also press-fitted.

4.1.9

Two slice toaster: Bottom of this toaster is made up of bakelite. This is black in colour.

Commercial toaster: Bottom is of mild steel sheet.

Indicating lamp for commercial toaster is fixed at the lower left corner of the front side of the toaster. This is red in colour and rectangular in shape.

4.2

Functional Analysis

4.2.1

Mechanical Analysis

4.2.1.1

Two slice toaster: Main frame structure. It is very rigid and it gives support to all other parts of the toaster: Mica, side plates, front plates, grill is fixed to this main frame structure. The thickness of the bread slices decides its size.

Commercial toaster: Main frame structure: Sides, front plate, porcelin, etc. are mounted on this main frame structure. It is very rigid and thus gives support to all other parts. It houses tray, porcelin, nichrome coil etc. inside it.

4.2.1.2

Two slice toaster: The function of the mica is to give support to the nichrome wire. It acts as an insulator. So the heat is prevented from going to the side plates. Thus it saves the amount of heat and increases the toasting efficiency.

Commercial toaster: Porcelin acts as a housing for the nichrome coil. It is also a good insulator and thus saving the heat. It protects the nichrome coil. As it is electrically resistant the toaster is very safety.

4.2.1.3

Two slice toaster: Nichrome wire: When the current is passed through the high resistance nichrome wire it starts getting heated up. This heated red hat coil gives its heat to the bread slices around it and burns it to the toasts. Thus its function is to supply the heat energy by means of radiation to the bread slices.

Commercial toaster: Nichrome wire, which is coiled, is used here. Its function is to supply the heat to the bread slices to make the toasts. Amount of heat produced depends upon the properties of nichrome wire and wattage supplied.

4.2.1.4

Two slice toaster: When the knob is pushed downwards the other end of the bent lever comes up, as it is pivoted at the angle, and the rest fixed at the other end also comes up. So when the bread slices are kept

on this rest and heated, they burn into the toasts. After pushing down the knob the toasts, along with the rest, come up.

Commercial toaster: Tray is inserted through the slot provided in the front plate of the toaster. First, bread slices are kept on the top of the tray and then it is inserted through the slot. It is then heated inside by the heating elements provided on the top of the toaster. The handle provided for the tray is for holding the tray in the hand. As the handle is made up of bakelite it does not become hot. Tray has provided the grill, so there is no obstruction for the heat to reach to the bread slices and thus efficiency of toasting is increased.

4.2.1.5

Two slice toaster: The grill is provided for two reasons. This keeps the toast or bread slice at some particular distance from the heating elements. Also it helps in preventing the touching of bread slices to the nichrome wire. Thus it protects the nichrome wire and increase its life. Due to these rods the bread slices can come up and go down smoothly.

Commercial toaster : Many times, the tray,

while inserting in the slot, may strike against the heating elements on the top side, as it has not provided the guides. This will break the nichrome coil and also there is possibility of getting shock. In order to avoid this a very five sieve covers the heating elements. Heat is not obstructed as the sieve is provided.

4.2.1.6

Two slice toaster: Front and back plates cover the nichrome wire and mica. Thus makes the unit more safety. Also it gives better out look to the product. Thus these plates protects the inner parts of the toaster.

In the case of commercial toaster the sides houses all the delicate parts like porcelin, nichrome wire etc. inside it. Unit can be handled by holding the sides. Due to fine finish and good colour the unit becomes more attractive. It gives rigidity to the unit.

4.2.1.7

Two slice toaster: The sides are provided which are made up of bakelite. So the toaster can be lifted even when it is not. Due to suitable dimensions of these plates, toaster can be hold in the hands very comfortably. The knob is covered by these plates as the

slot is cut in one plate. Product graphics is marked on this plate.

Commercial toaster: The front plate is made up of aluminium. The slot provided on this, allows the tray to move in and out of the toaster. This covers the inner parts of the toaster. Indicating lamp and knob are mounted on this pannel. As it is made up of aluminium, it gives good appearance to the product.

4.2.1.8

Two slice toaster: Knob: This knob is used for removing the toasts. When the knob is pushed down, the lever is operated and the toasts come up. As it is made up of urea so it does not become hot even when the toaster is hot.

Commercial toaster: Its function is to change the wattages. It has provided with the three stages. When it is rotated, to get particular stage, the wattage is changed and thus the amount of heat is also changed. When only few toasts are to be burnt at that time very small amount of power is supplied.

4.2.1.9

Two slice toaster: The bottom is provided mainly for resting of the toasts. As it is

made up of bakelite, it can be placed anywhere as it does not become hot when the toaster is switched on. This helps, to prevent the ground or any surface from getting heated up. In the case of commercial toaster the bottom acts as a rest for the toaster. Due to this bottom the toaster becomes more stable.

In commercial toaster indicating lamp is provided. This shows whether the unit is switched on or switched off. When the lamp is on the unit is also switched on. Thus it helps in knowing whether the unit is switched on or switched off very quickly.

4.2.2

Ergonomical Analysis:

Two slice toasters: The knob shape is quite ergonomic but it is fitted in a slot which required special attention to operate it. The knob is operated by three fingers and has to be pressed down slowly.

Width of the toaster is quite small and the toaster can be lifted by the help of sides.

Commercial toaster: The handle of the tray is quite comfortable to operate however it is slightly difficult to fit the tray inside as there is no definite guide fot it.

The knob is used for changing the wattage. It has to be operated everytime the tray is put inside or taken out. It is quite comfortable in shape. It does not require much force. The size appears to be slightly small.

There is no handle provided to lift the toaster. It is quite bulky and difficult to handle.

4.2.3

Formal Analysis

Two slice toaster: It has got very simple geometric form. It is very compact and clean. The front and back plates are chromium plated and the two sides are made up of bakelite. There is very good visual contrast between chromium plated surface and bakelite surface. and between side plates and knob which is made up of urea. Bakelite sides are black in colour and the knob is white in colour.

The shape of the toaster is quite consistant with the shape of bread slice.

Commercial toaster: It is made up of simple straight geometric shape. However it looks very bulky and unattractive. Shape of the handle of the tray does not suit the overall shape of the toaster.

The colour scheme is not good. Front is aluminium and the side plates are light green colour. Hence there is no good contrast in it. The handle is of black colour does not match with the other colours. The front slot gives the feelings of disturbance. The knob and the indicator are placed in the lower corners and the product graphics is placed at the

centre below the handle. Hence there is crowding of elements in the lower part of the front plate.

4.3

Economical Analysis:

Two slice toaster: The cost of this toaster is Rs.70/-. However there are toasters available for Rs.50/- each, of the same capacity. This toaster has got a better look than the other similar one. There is a good demand for both of them. However this additional cost is justifiable because of better look and good after sale service.

However the inclination of the people is to buy the cheaper one. Hence if the cost of this is reduced it will have much better demand.

Commercial toaster: These toasters are available in the range of Rs.250 to Rs.400 and capacity from 8 to 24 slices. Big restaurants and messes can afford it. The toaster of capacity 24 slices can produce the same number of toasts in 20 to 25 minutes as the ampex 8 slice toasters in one hour consuming almost the same power. Hence 24 slice toaster will be more economical in the long run than 8 slice toasters.

The ampex toaster appears to be costlier with regards to its capacity.

4.4

Sociological:

Two slice toasters: In the middle class family these type of toasters appears to be a prestige point. It is of great help for the busy house wife or for the working lady. She can make the toasts without constant care and hence can engage herselt elsewhere in the kitchen atleast for some time. The toaster has helped in mechanising the kitchen and hence keeping it more clean.

The toaster has helped in serving light eating material quickly and hot. The toast can be eaten at any time in the day and as this process has become very easy more and more bread is used in our daily food.

Hence now a days it has became a near necessity.

Commercial toaster: Such toasters have made it possible to serve good and hot toasts in the restaurants as well as in the hostel messes. The toaster burns the bread uniformly unlike other methods of toasting. Hence it is a favourite dish for hotel going people.

In the hostel mess break fast has to be served to about 100 to 150 students in a span of

one hour. Hence toasts can not be made before and kept, neither can they be made just when required. The commercial toasters with its capacity comes to our help. It can give toasts when required and other times it will not be working and so we can get hot toasts.

5. HYPOTHESIS

5.1

Toasts should burn evenly i.e. the equal amoun of heat should be supplied to all the portion of the bread slice.

5.2

Cleaning arrangement should be provided and this cleaning should be as easy as possible.

5.3

The time for burning each lot of the toasts should not be more than 3 minutes.

5.4

The amount of power supplied should not be more than 1200 to 1500 watts for 8 slice toaster and 800 watts for 2 slice toasters.

5.5

The sides of the toaster i.e. cover should not become hot. Its temperature should be less than 37°C.

5.6

Unit should be as compact as possible.

5.

5.7

Unit should accommodate all standard sizes of bread slices.

Sizes - 10.5 cms x 9.5 cms x 1 cm

9 cms x 8 cms x 8 cms.

5.8

The unit should satisfy the demand of hotel (4 to 6 slices at a time) as well the demand of hostel messes (12 to 14 slices).

5.9

The cost of the 8 slice toaster should not be more than Rs.200/- or 12 slice toaster should not be more than Rs.300/-.

5.10

Maintenance should be as easy and cheap as possible.

5.11

Instructions about its use, maintenance and safety should be given.

5.12

Electrical connections should be safe.

6

Synthesis and Communications

6.1 •

Decision of the Solution.

6.1.1

Capacity

From the survey, conducted for the hotels and restaurants, it is found out that their requirements, of the toasts at a time is 4 to 6 slices.

In the hostel mess the students come irregularly to the mess. So the survey is conducted which is already given in the form of charts. Those charts show the number of students coming in the mess per minute.

The average number of students coming in the mess per minute, is found out from the previous charts.

When the number of students coming in 5 minutes are added together, the total is 85 (as show in the chart attached here).

The number of intervals of 5 minutes = 18

So the average number of students = 5

The figures more than 5 or above average and figures less than 5 are below average.

It is clear from the above figures that average minimum number which is 3 occures 9 times.

Average number which is 5 occures 4 times.

Average maximum number which 7 occures 5 times.

Assuming that each student requires 2 toasts, finally it is decided that the capacity of the bread toaster must be of 12 slices at a time. This capacity of the toaster satisfied the demand for the toasts in the hostel mess even at the peak time.

Thus the requirement of the toasts for the hostels and restaurants is 4 to 6 slices and the requirement of the toasts for the hostel mess is 12 slices at a time.

6.1.2

Different solutions tried

6.1.2.1

In this particular solution shown in the figure, the toaster has seperate compartment for each slice. The knob is provided which operates the rod passing through the lower corner of the toaster and then the toasts can be fed or removed. But this solution has some drawbacks.

As it increases lengthwise, so far larger capacity it becomes very bulky.

Feeding is also very difficult and it takes more time for feeding operation.

The number of parts are much more in this case as it is divided into number of compartments.

It may be difficult to operate the knob for the large toaster.

Due to more number of parts its cost is more.

6.1.2.2

The figure shows the sliding type toaster. The slice holder moves in the heating part of toaster. When toasts are ready other part of the slice holder is pushed in and the previous one comes out simultaneously.

The problems in such type are almost similar to previous one.

If the need is of 10 to 15 slices then the length of the toaster becomes too much.

Feeding is complicated and also takes more time.

Its cast may be more.

Its appearance may not be good.

It requires as many compartments as its capacity is.

6.1.2.3

This toaster consists of a tray of a capacity of 12 slices. This tray is of sliding type and passes through the slot provided in the front. Heating elements are provided on the top and the bottom side of the tray. The slices are placed in a horizontal position. A knob is provided which controls the power supply. Two cover are provided one on the top and one at the bottom. Side grips are provided for lifting the toaster. A cover is provided for the slot on the front side.

Int this type of toaster opening and closing may not be easy due to its more width.

Feeding operation is easy.

Operation is dependent: In this type of toaster the heating elements are divided into two compartments. They are operated seperately i.e. when few toasts are to be baked at that time only one compartment is switched on. But as the toaster has no partition which will seperate the two heating elements, it is not possible to keep one elements at "WARM"

and one at "ON" position. Thus whole toaster has to be kept either on "ON" position or "WARM" position.

In the case of 6 slice and 12 slice toasters the trays are not standard.

It requires more floor area.

It grow lengthwise so it occupies more and more floor area as its capacity is increased.

Top surface can be used for keeping bread or toasts.

For the few toasts, the same amount of power is to be supplied and if less power is supplied then the toasting time is increased. If it is divided into two compartments then the trays must be of half the size and also one partition is necessary which makes the unit complicated.

Its size is not suitable and appearance is not good.

6.1.2.4

This toaster mainly consist of a frame structure, two sliding trays of save size, two seperate knobs, heating elements on the top as well as at the middle and at the bottom.

It is divided into two compartments, one is on the top and one is at the bottom. Cover is provided for both the compartments.

This design has got some advantages over the previous solution explained under 6.1.2.3.

There is a convenience of operation i.e. opening and closing is very easy as the width of the trays is lesser than the width of the tray of the previous toaster.

As this unit is divided into two compartments so the operation of the toasting is independent.

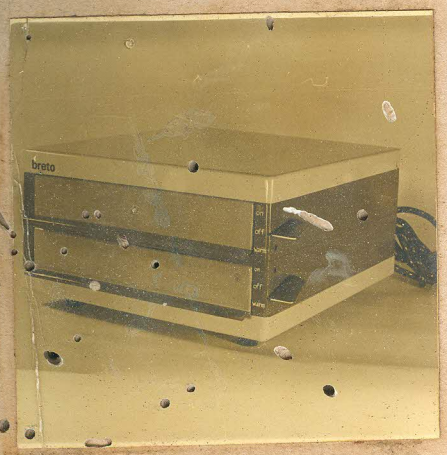
The trays are standardised.

It requires less floor area.

It grows vertically so even for more capacity it occupies the same floor area.

It is good in appearance and very compact.

The lost solution finds to be more suitable and functional as regards to its feeding convenience, less toasting time, compactness, ease of operation and other features. So it is sensibel to develop the same one for fulfilling the needs of the hotels and the hostel messes.



6.1.3

Concept: The basic principle of heating the toasts remains the same, that is, heating elements are provided on the either sides of the bread slices. The heating elements are supplied with the electric power. When the current passes through the nichrome wire it starts becoming red hot and gives the heat by radiation to the bread slices and thus the bread slice gets burnt to the toasts.

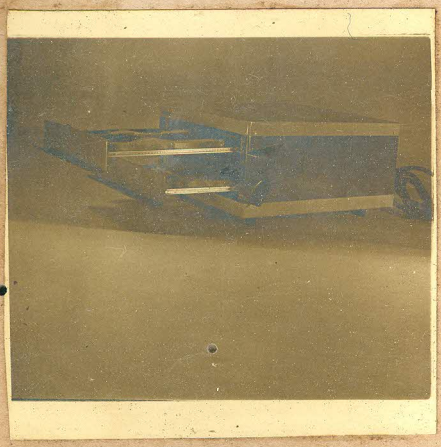
In this proposed design the bread slices are placed on the two trays (lower and top one). This tray can be moved in and out with the help of two sliders. When the current is passed through the wire by rotating the controlling knob the bread slices start getting heat. As they are in a horizontal position, the heat which flows upwards, is completely utilised in heating the bread slices. When the toasts are ready the supply is cut off by operating the knob. The main frame supports the porcelin blocks, mounted with heating elements, the top and bottom cover, side plates etc.

6.1.4

Main features of the toaster

6.1.4.1

Arrangement for French toaster: in this toaster an arrangement for making French toasts is made. Only the tray is to be changed and on this tray the boxes packed with bread slices and fillers like, tomato, jam, butter, etc. in between two bread slices, are placed. These boxes are also of standard size. Their overall dimensions are 11 cms x 32 cms x $2\frac{1}{2}$ cms. The tray along with these boxes are inserted through the front slot and then they are heated there. These boxes can be sold seperately.



6.1.4.2

Ease of feeding: As the trays are sliding horizontally they can be very easily moved in and out. The bread slices can be spreaded very easily. This reduces the feeding time. The tray is provided with the guides so there is no possibility of falling down of the toasts while pushing in the tray. One dimension 9.5 cms x 10.5 cms and about 9 slices of the dimension 8 cms x 9 cms.

6.1.4.3

Even burning of the toasts: The coiled nichrome wire is used as a heating element. So the heating area is more. These coils are fixed at distance 1 cm apart. So the heating is uniformly done. The heating elements are compartmentalised. So even it is broken, instead of changing whole coil, a part of heating elements can be changed. Thus the replacement of them is very easy and cheap. The distance between the heating elements and the two surfaces of the bread slice is 2 cms. The distance between two sides of the coil is 1.5 cms.

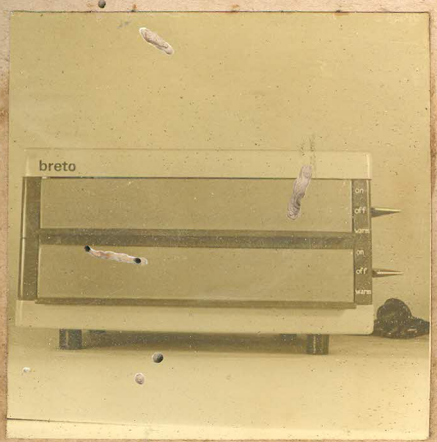
6.1.4.4

Easy cleaning: The tray is provided with a very fine sieve. Due to this provision the small particles do not fall on the heating elements and thus the need for cleaning is reduced and also the life of the heating elements is increased. The trays can be very easily taken out to clean them.

6.1.4.5

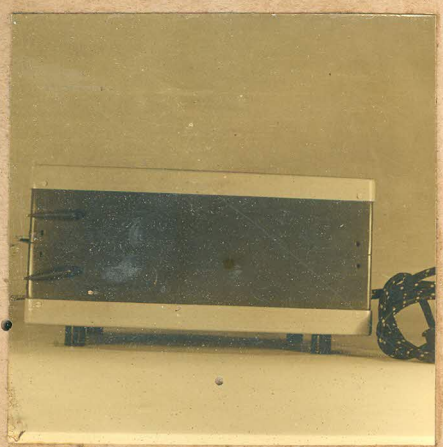
Time for toasting is reasonable i.e. 3 minutes. Du to proper supply of power, suitable heating elements and their proper arrangement

burns the toasts evenly and quickly. When only few toasts are to be prepared at that time only one i.e. upper or lower unit can be operated seperately.. The arrangement for keeping the toasts warm is made by adjusting the resistance in such a manner so as to reach the temperature of 45°C. Slowly within 10 to 12 minutes. So only for 10 minutes the toasts can be kept warm. After this temperature will increase still more to burn the toasts.



6.1.4.6

Compactness: The toaster is very compact. Its overall dimension are 31 cms x 18 cms x 33 cms. Unnecessary dimensions are eliminated. All the parts are proportion with each other.



6.1.4.7

All the parts are standardised except back plate. So one can have 6 slices, 12 slices, 18 slices, 24 slices, toasters. Due to this standardisation the need of hotels i.e. 6 slice toaster as well as the need of hostel mess i.e. 12 slice or 18 slices or 24 slices toaster is satisfied. Also due to these standard parts the number of operations during its manufacturing are fixed. Thus this

standardizes the number of manufacturing processes and hence the total cost is reduced.

Standardised parts can be mass produced also they can be taken readymade.

6.1.4.8

Economy: The whole concept is made much simpler, eleminating many of the unnecessary parts. Due to standardization of all the parts the cost is reduced. Very simple manufacturing processes with less complications are used, leading it to the reduction in the cost.

Top and bottom cover: Bending process is used as it is cheap and also the demand for such type of toaster will not be much. If the demand is much, then press work can be used in which the cost of the die is quite high. Corners are welded and finished.

Porcelin: Moulding

Nichrome coil: Ready made

Side plates: Stamping and aluminium guides are attached to the plates, by means of rivetts. Bending operation is also involved in it.

Bakelite sides: Compression moulding, as
Knobs sides on either sides are of same dimension and nature so only one die can be used.

Trya: It is made up of aluminium rods which are fixed to each other by means of rivetts.

Main frame: Welding

Painting: Whole body is to be painted.

Reasonable power (2.5 to 3 kw) is supplied, Maintenance is very less and cheap. Possibility of breakage of the heating elements and porcelin is reduced by taking special care i.e. by giving suitable supports for porcelin on the main frame. Also the tray is provided with the guides so there is no possibility of the tray to strike against the heating elements. All these will lead to the substantial economisation.

6.1.4.9

Safety: The electrical connections are covered by the bakelite plates. The connection to the main supply is taken from the back of the toaster so it is away from the person making the toasts.

The front cover has provided a bakelite knob

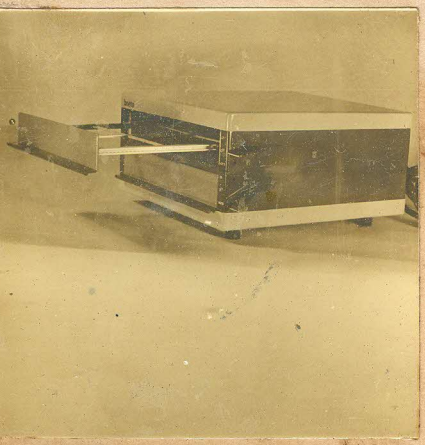
which is heat resistant. So even when the toaster is switched on, a person can touch the knob comfortably.

The controlling knob is fixed at the one side of the toaster, away from the front panel or top cover which is hot.

The tray has provided a lock. So it does not come out completely when working and thus one can easily move the tray in and out.

6.1.4.10

Simplicity: The toaster is very simple. Unnecessary parts are straightway eleminated.



It consists of main frame structure on which other parts are fixed. The overall shape is geometric. A very simple and functional sliding type feeding system is used where feeding and removing of the toasts is done comfortably. Knobs with simple shape are used. They are located at proper place in order to made the operation very easy and convenient.

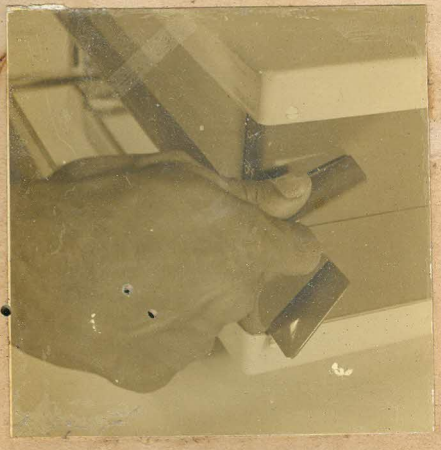
The sieve is provided on the tray which prevents the falling down of the small particles from the bread slices. The tray can be cleaned with ease.

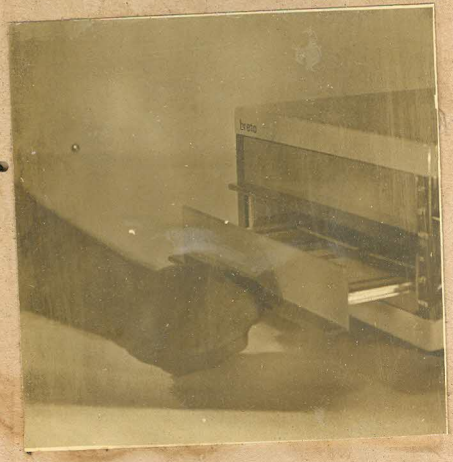
The four rests of cylindrical form are pro-

vided at the bottom. So the lifting of the toaster is done comfortably. The rests are of simple geometrical form.

6.1.4.11

Formal aspects: The knobs for controlling the power supply is to be held in two fingers. This grip is quite comfortable. It has given suitable curves to match with the profile of the fingers. They are located at such a position, so that even when the tray is pulled out, the knobs are within hand reach. The front surface of the bakelite plate where "ON" "OFF" "WARM" is written is in the same plane as that of the marked line on the knob. So both the things are seen simultaneously without any strain. The knob is of rotating type. It rotates in three steps through an angle of 60°.





The graphics "ON" "OFF" "WARM" is written on the front side of bakelite plate in a vertical manner. These letters are of suitable size so that they can be read with less strain on the eyes. They are written with a contrast colour on the bakelite sides. Verticle letters of simple type are used.

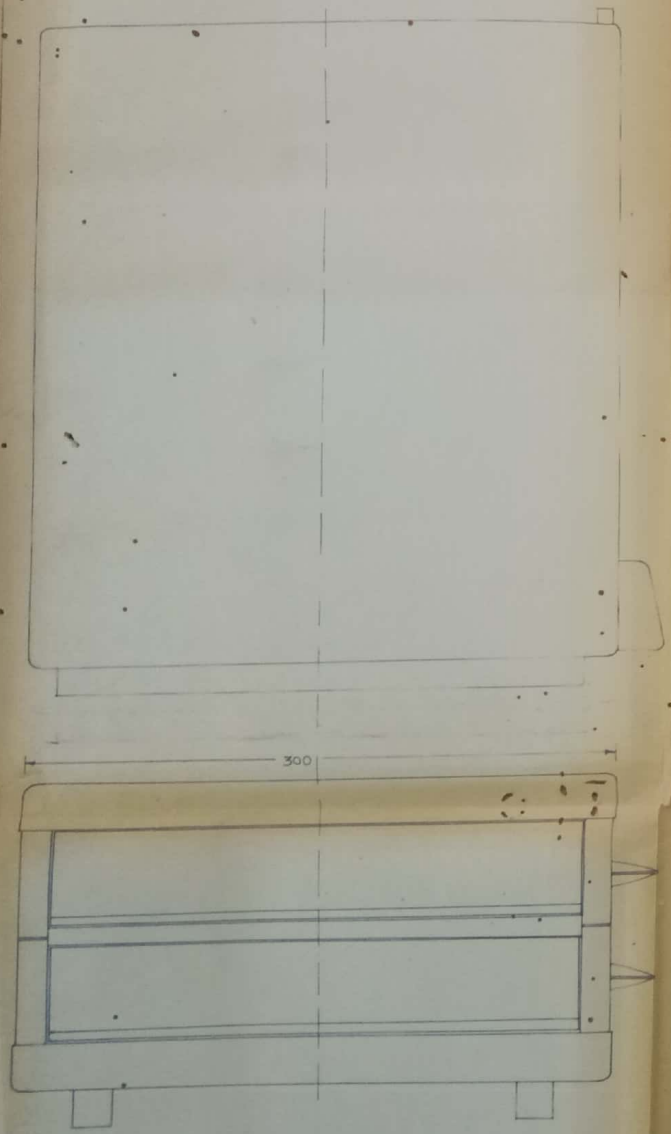
The knob for pulling the tray out has provided a bakelite covering in order to prevent it

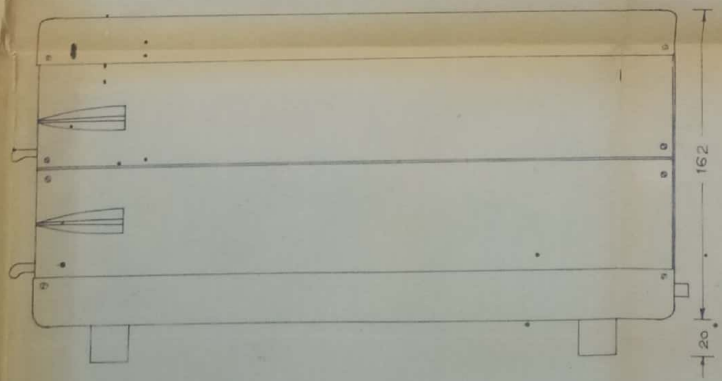
from getting heated up. Its width is equal to the width of the cover. So it flushes with it. It is held in two fingers quite comfortably. Many times fingers slip while pulling the tray out. This is taken care off by giving a suitable curve to the knob.

The colour of the product is suitable for any colour of the kitchen.

6.1.4.22

Automisation: For burning the toasts exactly to certain definite brown colour, it needs definite temperature. Also sometimes it is required to keep the toasts warm for sometime by maintaining constant temperature. This is achieved by using thermostat. A bimetallic strip is used which actuates the lever to cut of the main supply by its movement. In the bimetallic strip the two metals of different coefficients of expansion are used. But this type of toaster is not suitable for Indian condition.





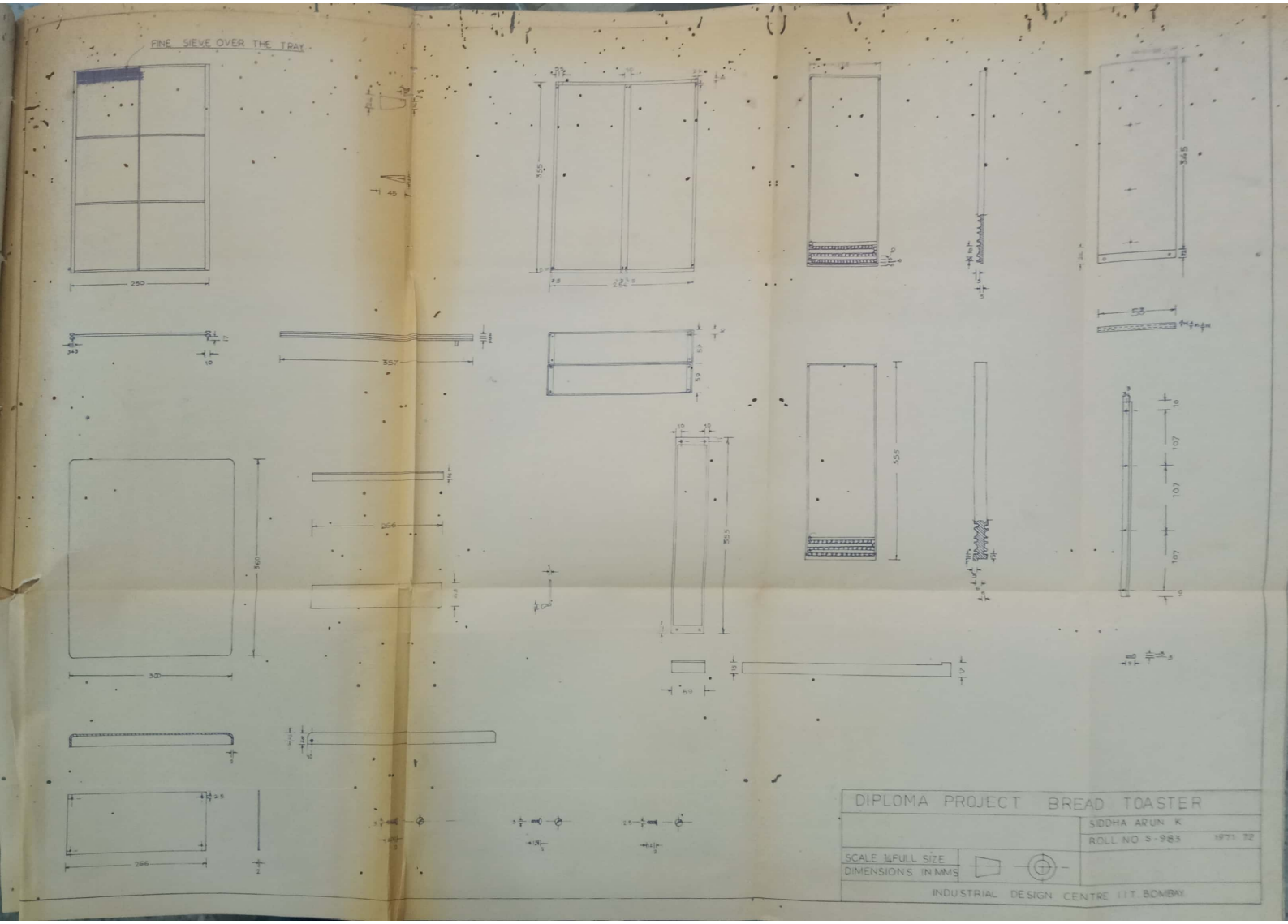
ITEM	DESCRIPTION	MATERIAL	NO OFF
16	RESTS	BAKELITE	4
15	MIDDLE HOUSING FOR H.E.	PORCELIN	1
14	KNOB	BAKELITE	2
13	SCREW FOR 6,5 !	M.S.	16
12	RIVETTS	ALUMINIUM	8?
11	SCREW FOR 9	M.S.	4
10	COVER FOR 9	MICA	1
9	BACK COVER	M.S.	1
8	COVERS	M.S.	2
7	TOP-BOTTOM PORCELINE.	PORCELINE	2
6	SIDE COVERS	BAKELITE	4
5	INNER PLATES	M.S.	4
4	GUIDES	ALUMINIUM	4
3	FRONT COVERS	M.S.	2
2	TRAYS	ALUMINIUM	2
1	MAIN FRAME	M.S.	2

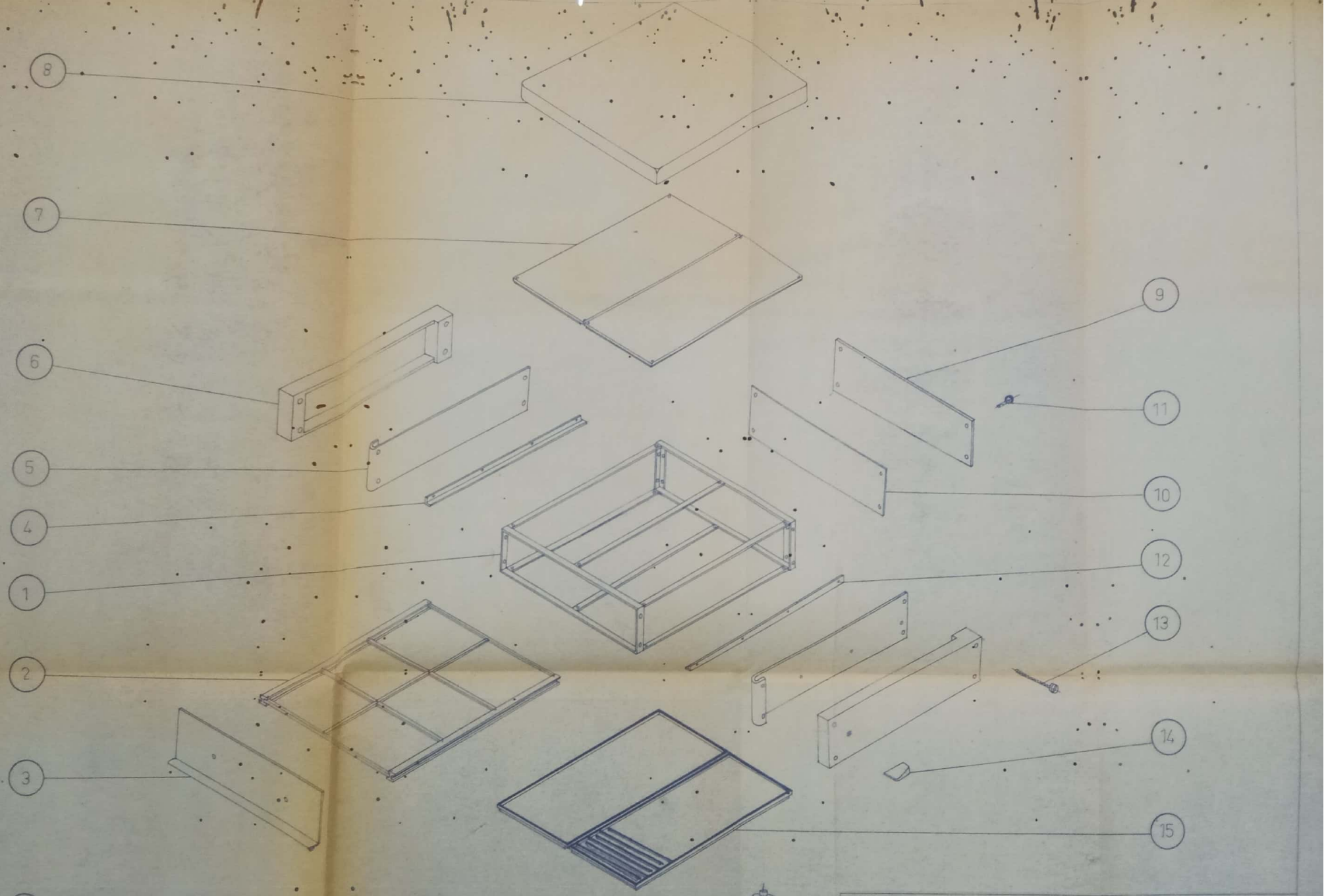
DIPLOMA PROJECT BREAD TOASTER

SIDDHA ARUN K.
ROLL NO S-983 1971-72

SCALE ½ FULL SIZE
DIMENSIONS IN M.M.S

INDUSTRIAL DESIGN CENTRE I.I.T. BOMBAY 76





DIPLOMA PROJECT BREAD TOASTER

SIDDHA ARUN K

ROLL NO 5-983 1971 72

EXPLODED VIEW

INDUSTRIAL DESIGN CENTRE I.I.T. BOMBAY