

REDESIGN OF DOMESTIC ELECTRICAL
HARDWARE

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1974

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REDESIGN OF DOMESTIC ELECTRICAL
HARDWARE

Diploma Project

Submitted in partial fulfilment of
the requirements of the Postgraduate Diploma
in Industrial Design

by

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Industrial Design Centre
Indian Institute of Technology
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Guide

Shri M.C. Chattopadhyaya

Co-guide

Shri Gopinath Rao

Approval Sheet

Diploma Project entitled

REDESIGN OF DOMESTIC ELECTRICAL
HARDWARE

by Anupam Gupta is approved for
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Industrial Design

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No task is tougher than doing it yourself.

I had a taste of it myself.

It would have been impossible for me to tackle this apparently simple problem in a proper manner but for my Guide and Co-guide. At this stage I can just express my deep gratitude to Shri M.C. Chattopadhyaya and Shri Gopinath Rao for all the guidance, help and encouragement they provided me.

It would have been impossible to present this report without the immense help of Shri S.R. Gursahani and moral support of Shri L.Jethwa.

I would also like to thank VOLTAS LIMITED for sponsoring me, bearing my expenses and exposing me to a totally new field.

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1.0 SELECTION OF THE PROBLEM

Diploma project Problem should offer far extended expanses of fields for exploratory work, stringent constraints for compliance of the product with its neighbours, a need for a hair splitting analysis and yet not bog down any creative effort that the designer may choose to put in. Satisfying all these main conditions is an uphill task, a task which is rendered even more difficult by the facts that

- (i) there should be a need for design
- (ii) there should be economic and social value
- (iii) there should be contemporary social relevance
- (iv) there should be adequate challenge for the designer

while selecting the problem one cannot afford to ignore the facilities available, nor can one ignore the strict chronological condition imposed by the academic nature of the exercise. Similarly the background and past design experience of the designer cannot be overlooked. Also, probability of achieving a plausible solution should be examined, at least casually, at the very beginning, although reaching a solution may not be the only objective.

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It is also important that the problem be such that the designer can make an intelligent use of his knowledge, talents and aptitude.

Last, but not the least, the incentive of design being taken for actual production also exists and hence cannot be ignored at this stage.

1.1 THE PROBLEM ITSELF

The problem chosen is

REDESIGN OF DOMESTIC ELECTRICAL HARDWARE

Elaborating the title the first word that comes up is Redesign.

Redesign because a number of designs exist.

Domestic implies that it is to be used exclusively at places of domicile or residence.

Electrical means pertaining to electricity.

Hardware originally meant 'Ironmongers' products. Now they mean all products sold by a 'Hardware' merchant.

So the problem is one of redesigning electrical equipment such as wiring equipment, plugs, sockets etc. .

1.2 NEED FOR DESIGN

Even a superficial examination of existing products reveals many flaws which quite inexplicably exist in almost all the designs presently in the market.

As the product itself exists and is extremely common place past experience reveals that the existing designs have many times failed to perform the function due to defects in design.

The product is such that safety of user is of utmost importance whereas there are numerous cases of accidents, even fatal, which have resulted because of shortcoming of design.

The product is such that interchangeability is infinite. Hence stringent standards exist and have to be complied with, while redesigning, for the product to find useful patronage and a market.

Besides desirable interchangeability there is some undesirable interchangeability also. It will be required of the design to render attempts at undesired interchangeability futile.

A major percentage of users are hesitant while using these products and consider them dangerous. This is enhanced by the fact that a major cross section of users is uneducated and still considers electricity dangerous. In such special conditions, redesign of the product is needed to dispell the psychological fears and instill confidence of safety in users.

Almost all the designs specify brass parts. This material consists of a high fraction of copper a metal for which this country relies totally on imports and pays for in gold in circumstances of economic desperation even.

An alternative material should hence be specified. The present designs cannot function well with alternative materials and hence the need for redesign.

The products look 'like nothing else on this earth' and present a very uncanny sight on bare, simple elegant walls by the very use of complicated forms used. They some how dont blend with the rest of the picture.

These are sufficient, reasonable, and logically justifiable arguments to support need for design.

2.0 INTRODUCTION TO PROBLEM

As stated earlier the problem is to redesign switches, plugs, sockets and appliance couplers used in homes.

2.1 USES

Let us examine the appliance for which these are used. This might be able to throw some light on requirements. The electrical appliances or gadgets used in homes can be classified into the following categories.

1. Lightings.
2. Heating equipment.
3. Motor driven appliances.
4. Electronic.

2.2 LIGHTING EQUIPMENT

1 Incandescent bulbs

Holder mounted

- a. Permanently fixed on walls or ceilings.
- b. Semi-permanent portable types as in table lamps etc.

Service conditions dry. In case of

- a. No human contact
- b. Infrequent human contact

2 Fluorescent Tubes

Permanently fixed in fittings on walls or ceilings.

No human contact save while cleaning or servicing.

Lighting equipment fixed on walls generally carries a switch only. In some cases where the light source has been added after the wiring was done, a plug and socket is used, generally in conjunction with a switch.

Lighting equipment is used only when daylight is not sufficient. Many a time the light switch is operated in absolute darkness as in the case of staircases, toilets, stores etc. , and the switch has to be x felt and the tactile sense only guides the operation of switching it on.

Repair, servicing or maintenance work is the only thing for which ~~the~~ light sources are touched and that generally takes place during day time - at a time when there is no current flowing to it.

2.3 HEATING EQUIPMENT

The heating equipment used in homes is of the following types

1. Room heaters
2. Electric Irons
3. Water heaters and Geysers
4. Hot plates, Stoves and ovens
5. Toasters, hair dryers

The power requirements vary from 100 W for a hair dryer to 3 k W for an oven and storage type water heater. Most of these equipments are not 'built in ' and hence carry plugs to be inserted in sockets for supply. Save hair dryer all have a metallic body which can conduct electricity and human contact is quite frequent. Presence of water is also not ruled out. The chances of shock are very many and hence earthing is a must. In most of the cases the gadgets dont carry a built in switch.

2.4 MOTOR DRIVEN APPLIANCES

Motor driven appliances can be categorised into three categories

1. Fixed
2. Semi portable
3. Hand held

Fixed devices are fans, airconditioners, refrigerators, exhaust fans etc. .

Their power consumption can range from 40 W to 3.5 k W. Fans are generally with their individual outlet during house wiring only and hence carry switches only in the circuit, whereas refrigerators and airconditioners tap power from a socket through a plug. They carry their own switches.

Semi portable devices like kitchen aids, table fans etc. have to have a plug. The surroundings may have water in many cases.

Fully portable hand held appliances like hair-dryers etc. carry plug which may accidentally be pulled out because of the user moving out further than the cable allows. The plugs connected to these devices generally carry the weight of the cable and may experience additional forces also.

2.5

Electronic equipment like Radios, TVs, amplifiers are generally low power appliances and carry their own switches, are generally stationary and in dry surroundings.

3.0 EXISTING SYSTEMS

For examining the present solutions the problem is divided into three parts

- a. Wiring
- b. Switch boards
- c. Switches, plugs and sockets

3.1 WIRING

For wiring three systems exist

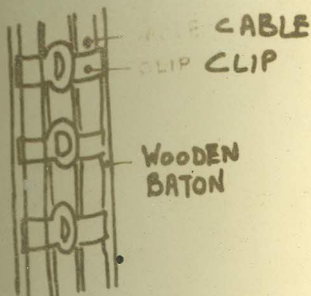
- i. Open type
- ii. Protected type
- iii. Conduit type

3.1.1 OPEN TYPE WIRING SYSTEM

Structurally it consists of a wooden baten retained on the wall with the help of nails on which clips are fixed with small nails. The clips in turn retain the cable.

Features of this system

- a. Low cost because of lesser labour needed for installation and low cost of component
- b. Needs no preplanning and can be added to or subtracted from at any time.
- c. Subject to outside influence and tampering.
- d. Effected by humidity and cable life decreased.
- e. Very unpleasant to the eye.



3.12 CLOSED TYPE WIRING SYSTEM

Structurally it consists of wooden strips having grooves for wires or of a hollow box cross section with a wooden lid. This is retained on the wall with the help of screws or nails.

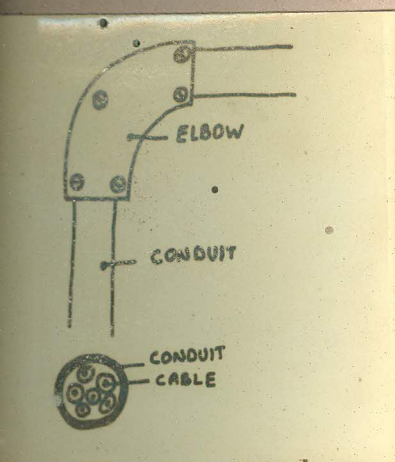


Features of this system are

- a. Protects cables from mechanical injury caused by outside influence.
- b. Inflammable.
- c. Needs no pre-planning.
- d. Easy to instal.
- e. Humidity effects cables.
- f. Wood decays after some time. Also, insects can interfere with wiring.
- g. Appears as a projecting strip on a wall.

3.13 CONDUIT TYPE WIRING SYSTEM

This system is different from the first two in that here wiring is not visible from outside. Here a metallic conduit is embedded in the wall which contains the cables.



Features of this system are

- a. Not visible from outside - walls look clean;
- b. No effect of humidity of atmosphere on cables.

- c. No mechanical injury to cables possible.
- d. Unaffected by insects etc.
- e. Needs pre-planning.
- f. Very difficult to locate faults in wiring and extremely difficult to replace cables.
- g. Not possible to add to it easily.
- h. High cost because of operations of digging the wall etc.

3.2 SWITCH BOARDS AND BOXES

Switch boards house switches and sockets at ends of wiring systems. They are of the following types.

3.21 WOODEN

These project outside a wall as they are nailed or screwed to a wall. They are of a box type construction hollow from inside. Switches and plugs are screwed on the front face which has holes for cables under switches and sockets for them to reach terminals of switches and sockets. These are generally used either with OPEN or CLOSED type wiring.

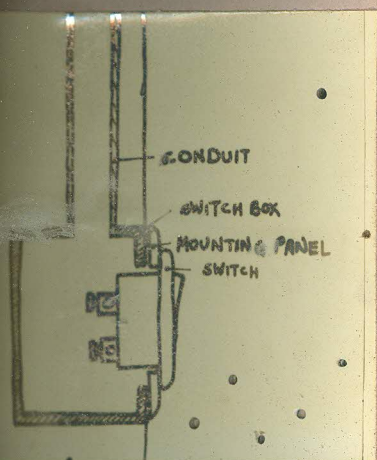


When flush type Piano switches are used, the front faces have cutouts to pass the body of switches and sockets which are screwed on from top.

Generally the front plate is removable. In some cases it is made of polystyrene. In most cases rather than screwing plugs and switches they are fixed with nuts and screws.

3.22 METALLIC

These are generally used with conduit type of wiring and consist of an open box recessed in a wall with the cover housing the switches and sockets. The conduit ends on one of the sides and through a hole the cable enter. The front plate may be made of



- a. Mild steel sheet.
- b. Polystyrene.
- c. Plywood.
- d. Hard board.
- e. Perspex.

These generally contain the fan regulator also.

Its features are

- a. Sturdy construction.
- b. No mechanical injury possible.
- c. Digging out of a hole in wall a must which must be finished after placing of box.

3.3. SWITCHES

The switches used in homes are basically of the following types.

3.31 FLUSH SWITCHES - PIANO TYPE

As the name suggests these switches are almost flush with surfaces on which they are mounted. These are becoming extremely popular as they occupy less space and because of their clean neat looks.

The surface on which they are mounted should have a cutout for their body.



3.32 WALL MOUNTED SWITCHES

These switches project out and are mounted on boards etc. with the help of screws. The terminals don't project out. The wires go inside hollow tubes and are retained by screws instead.



3.4 SOCKETS

Sockets are devices from which power is tapped through plug. Sockets are available for two pin plug and three pin plugs. Three pin plugs have the extra pin for earthing. They are basically of two types, similarly as switches.

3.41 FLUSH MOUNTED SOCKET

This type of sockets are generally used with metal boxes sunk in the wall along with flush type switches. Terminals protrude out of the body.

3.42 BOARD MOUNTED SOCKETS

Here terminals are inside and cables enter through holes.

They are to be mounted with screws. The front cover is removable for service and carried a screw in the centre for assembly.

3.43 COMBINATION SOCKETS AND SWITCHES

These have a built in switch and socket.

These are generally used with lines meant to supply more than 10A.

3.5 PLUGS

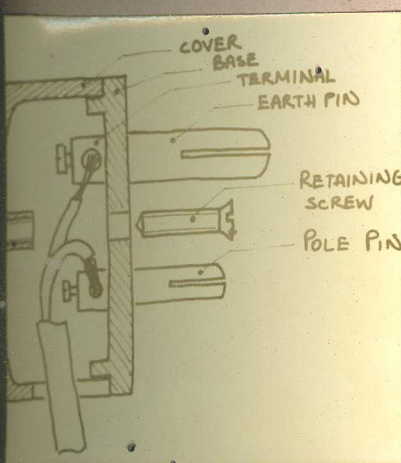
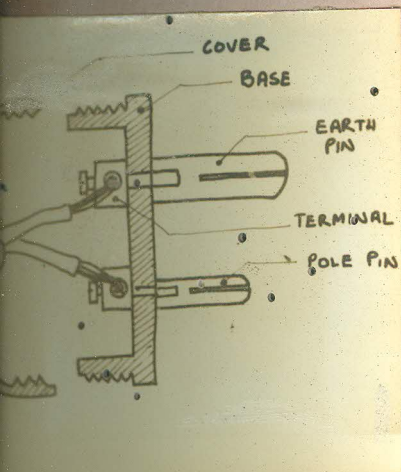
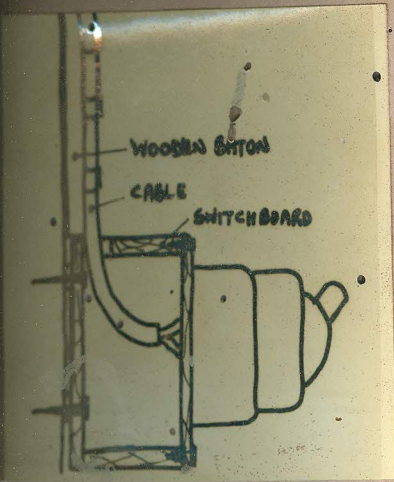
There is a vast number of types of plugs available. As there are no specific names here they are listed without names, just by numbers.

3.51 TYPE - 1

These are very popular because of their interchangeability. They are generally in two pieces - one screws on the other on built in threads. The cable passes through a hole in top half.

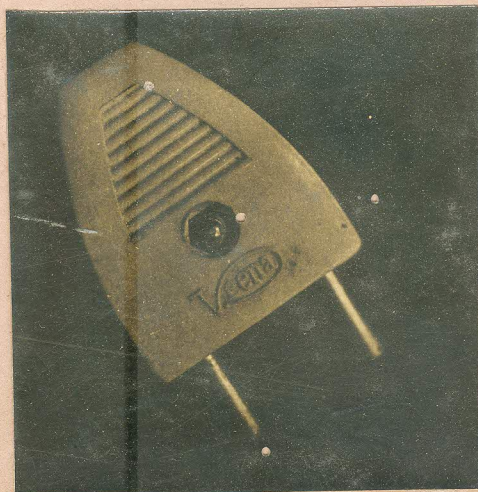
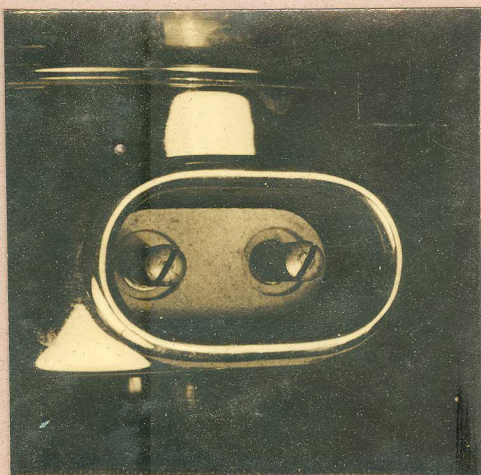
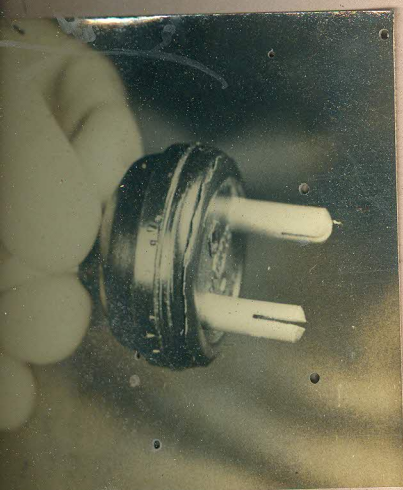
3.52 TYPE - 2

These are also made in two halves but they are retained by an extra screw. There is a slot in top half to allow the cable to pass through.



3.53 TYPE - 3

These are molded one piece plugs. The cable is also molded inside the plug and the plug cannot be taken off the cable.



4.0 THE MANUFACTURING END

4.1 THE MANUFACTURERS

The manufacturers are of two basic types

1. Small scale
2. Medium scale

Small scale manufacturers heavily outnumber the other manufacturers. In case of closed wiring systems in fact, manufacturers are innumerable as the only investment needed is for some carpentry hand tools.

The scales of production are

Switches : 5000 to 2,00,000 p.a.
Plugs : 7,000 to 2,50,000 p.a.
Sockets : 4,000 to 2,00,000 p.a.
Switch boxes : 10,000 and above p.a.
Switch boards : 2,000 and above p.a.

Out of 14 manufacturers contacted only one had an engineer employed.

4.2 MANUFACTURING FACILITIES

Manufacturing machines and facilities available were

- Lathe.
- Injection moulding machine.
- Compression moulding machine
- Drilling machine
- Arc welding equipment.
- Grinders.

Quality control was only of manual inspection type with no sorts of gauges or fixtures. No statistical techniques used for quality control.

No material testing facilities available.

No product testing facilities available.

5.0 THE USE END

Here the electrician doing wiring, the house builder, the resident person all three are considered.

5.1 BUILDINGS

The buildings where these products are used can be classified broadly as residential and non residential.

5.11 RESIDENTIAL BUILDINGS

Residential building can be further divided into two heads

- a. Urban dwellings
- b. Rural dwellings

5.111 Urban Dwellings

Urban residential buildings are of many types

- i. Bungalows
- ii. Apartment Buildings
- iii. Low-cost community housings
- iv. Individual Buildings.

The particular criteria of these are

1. Bungalows

- a. Cost no botheration
- b. Looks primary consideration

ii. Apartment Buildings

- a. Repetitive wiring

iii. Low cost Housing

- a. Repetitive wiring
- b. Cost economy desirable

5.112 Rural Dwellings

Rural areas are coming on the point of having electricity as a household mode of energy for lighting purposes atleast.

Houses are of a different type than urban areas.
Cost is important.

Simplicity of installation is of importance.

5.2 THE ELECTRICIANS

The term here is used in an informal sense meaning anyone who handles the hardware with a view of

- a. Installing new equipment for the first time
- b. Replacing old ones with new ones.
- c. Trying to repair faults in existing equipments.

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These so called 'electricians' can be broadly classified as

a. Professionals

b. Amateurs

Professional electricians are those who are called in to install hardware in a new structure, replace faulty ones, change existing ones etc., and enjoy a compensation for their services.

They are equipped with the required technical know how by dint of their experience and in some cases qualification also.

The amateurs are those who do it once in a while. They generally are not aware of full technicalities of handling such equipment and can make errors.

6.0 ANALYSIS

Here the 'usefulness' and 'use' aspects of the different parts of the system are examined.

6.1 WIRING SYSTEMS

6.11 OPEN TYPE WIRING SYSTEM

- Easy to install as just nails are used to fix it to a wall.
- Easy to wire, as the cables have just to be retained in the clips.
- Easy to inspect as the cables are fully exposed.
- Affected by humidity.
- Can be damaged accidentally.
- Insects etc., can cause injury.
- Not fire proof.

6.12 CLOSED TYPE WIRING SYSTEM

- Easy to install - fixed by nails to wall.
- Easy to wire - wires laid out in grooves.
- Easy to inspect - un-screwing off the lid.
- Affected by humidity.
- Cannot be damaged accidentally.

- Wood decay can cause problems.
- Not fire proof.

6.13 CONDUIT WIRING SYSTEM

- Difficult and time consuming installation - requires digging in wall and replastering.
- Almost impossible to inspect as there is no access to the conduit and conduit itself is opaque.
- Accidental injury ruled out.
- No effect of humidity.
- Unaffected by insects etc.
- Fire proof.

6.2 SWITCHBOARDS AND BOXES

6.21 WOODEN

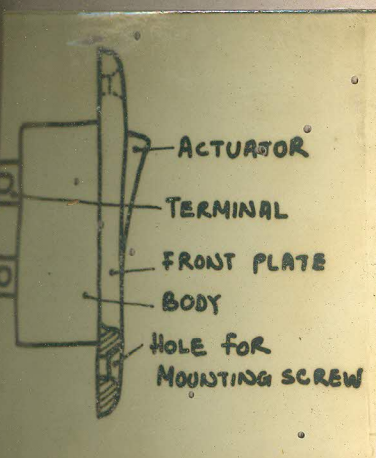
- Easy to install - nailed to a wall.
- Difficult to wire because of a closed box construction.
- Difficult to install flush type switches on it as top surface has to be removed and portions to be cut off for body.
- Can cause injury because of projection.
- Can be accidentally damaged.

6.22 METALLIC SWITCH BOXES

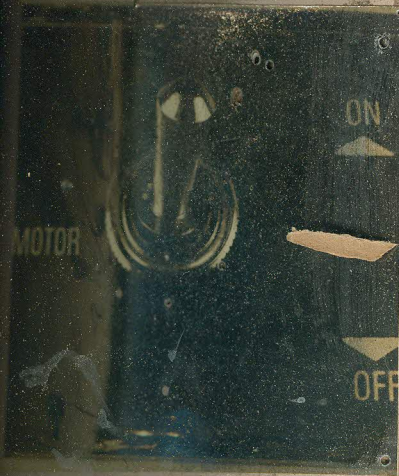
- Difficult to install, as they required digging of wall and replastering.
- Easy to wire because of open box construction.
- Difficult to install board mounting switches on it as the terminals are concealed between top cover and switch or socket.
- No effect of humidity etc..
- Inspection of one switch or socket necessitates removal of whole cover plate.

6.3 SWITCHES

6.31 FLUSH SWITCHES



- Difficult to install as installation is done by screw and nut.
- Wiring difficult as all the switches have to be installed on plate before wiring because wiring is done from one side and switch comes from opposite direction.
- Easy to operate.
- Difficult to tell whether 'on' or 'off' from a distance. This problem is removed in some designs.



6.32 WALL MOUNTED SWITCHES

- Cause difficulty when used with switch boxes.
- Susceptible to mechanical injury because of over hang.
- Difficult to wire because of sunk in terminals.



6.4 SOCKETS

6.41 FLUSH SOCKETS

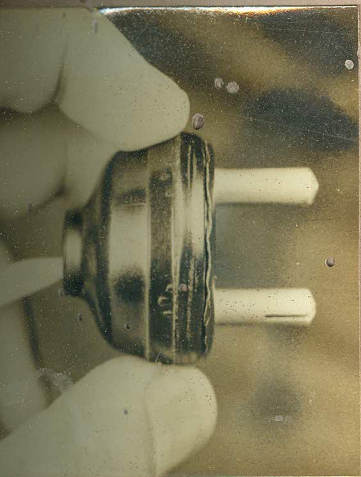
- Difficult to install as installation is done by screw and nut.
- Difficult to use with switch boards.
- Does not provide for dimensional variance on the plug.

6.42 WALL MOUNTED SOCKETS

- Susceptible to mechanical injury.
- Difficult to wire because of sunk in terminals.
- Does not provide for dimensional variance on the plug.

6.5 PLUGS

6.51 TYPE 1



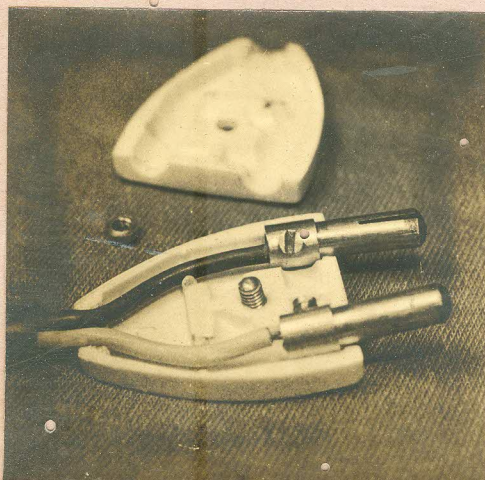
- While pulling the top cover comes off because of low strength at threads.
- Assembly causes difficulty if cable is thicker.
- Load goes directly on terminals.
- Cover hole side can cut cable.

6.52 TYPE 2

- Load does not go on terminals.
- Easy assembly because of two separate halves.
- Cannot be pulled off the socket by pulling cable.

6.53 TYPE 3

- No interchangeability
- Low current ratings for equivalent size because of no space for air circulation.



7.0 STANDARDS

Insulation resistance :

Not less than 100 mega ohms between terminals at 500 V.

High voltage flash :

Resistance to a flash of 1500 rms Volts.

Temperature rise :

Not exceeding 20°C .

Over voltage :

Should be capable of continuous operation at 275 volts.

Over current :

Should stand 30 % more than rated current.

Should not absorb more than 0.5 % moisture at 100 % RH and 45 °C temperature.

Should not soften with heat till a temperature of 100 °C .

Should not have a distance of less than 2.5 mm. between a terminal and any other non-current carrying metallic part or terminal of opposite polarity.

Cable diameters :

5 amp	-	6.35 - 9.52 mm.
10 amp	-	6.35 - 11.11 mm.
30 amp	-	7.94 - 19.05 mm.

8.0 HYPOTHESIS

8.1 WIRING

- Should be able to carry 1,2,4,6 cables.
- Should allow inspection anywhere without making major repairs of wall necessary.
- Should cover cable on all sides to protect it from mechanical injury.
- Should not admit moisture.
- Should be moth and rust proof.
- Should not be affected by insects.
- Should be possible to install on

Concrete walls

Brick walls

Mud walls

Wooden walls

- Should not appear as an added thing's on the wall. In other words should integrated well with the wall.

8.2 SWITCH

- Should be rated at 2,5,10,15 amperes.
- Should permit mounting from the same side as carries terminals to make mounting easy.
- Should not permit moisture in.

- Should have a neat simple form.
- Should not have bright colours.

8.3 SOCKET

- Should be rated at 5,10,15 amperes.
- Should permit mounting from the same side as carries terminals.
- Should provide 'sure' connections.
- Should connect earth first and disconnect earth last.
- Should compensate for manufacturing variances in dimensions.
- Should have simple neat form.

8.4 PLUG

- Should be rated at 5,10,15 amperes.
- Should frustrate disconnection by pulling the cable.
- Should have flexibility in pins to make 'sure' connections.
- Should prevent coming out of the cable from the terminals.
- Should have the earth pin thicker and longer than other pins.

9.0 DESIGN DECISION

9.1 WIRING SYSTEM

The strip that will contain the cables will be of an open box type. There are four sizes to cater for all requirements. This box - strip could be nailed to a mud wall, wooden wall or even a brick wall.

It could also be cast as inset in a concrete wall.

The lid has a continuous 'snap-on' type of construction.

It is to be made of PVC by extrusion.

With slight modifications it could be manufactured from aluminium or even galvanised iron sheets.

The lid is necessarily one of plasticized PVC made by extrusion.

This air tight construction will keep out moisture, insects and moths. It will also protect the cable from any mechanical injury.

There are retaining clips in the box strip to retain the cable in place. These will hold the cable in place in a neat array to ease inspection.

The colour chosen for the box strips is dark grey. This is a neutral colour which will not distract.

The lid will have lighter neutral ^{shades} shades to blend with the wall. It may also have brighter shades to act as contrast strip on the wall.

9.2 SOCKET

The socket has earth pin coming to the surface. The other two pins end up short of the front plate. This would ensure earth connection 'make' first and earth connection 'break' last.

The tubes have flared ends. There are two cross cuts. This will ensure better connection.

The material for the tube is chosen as aluminium. The form, which is a square, provides a neater and cleaner look. The material of construction of the body is polystyrene. It could also be molded out of urea formaldehyde or polycarbonate. The socket is mounted on a plate with the help of screws only. The screws mate with nuts which are molded as inserts in the socket body.

The nuts are on the reverse side of front plate so that mounting of socket is from same side as

the terminals. Also no screw heads are visible from outside. This would discourage any monkeying with it by any one not having full knowledge of the socket.

The colour suggested are lighter tints of primary colours.

9.3 SWITCHES

The switch mechanism chosen is of toggle type. The actuator motion is lateral rather than pivotal to avoid 'hammering' of the switch. Sliding motion in vertical direction is easier to operate because of our tendency to move downwards when we feel the switch in darkness. Besides that, we are psychologically conditioned to presume that higher position is 'off' and lower 'on'.

The actuator has a larger size and a square form. Larger size is chosen to increase distance between two switches and a square form is selected to match the rest of the body.

The switch is mounted on a plate with the help of screws only. The screws mate with nuts which are molded as inserts in the switch body. The nuts are on the reverse side of front plate so that mounting of socket could be done from the

same side as carries the terminals. Also, the screw heads are not visible from outside. This would discourage any monkeying with it by any one not having a proper knowledge of the switch.

The colours suggested are lighter tints of primary colours.

The actuator will carry graphics to suggest the equipment it is connected to.

9.4 PLUG

The plug has a basic square form with a guide for the cable. The cable enters the plug at right angles to the direction in which it enters terminals. This would prevent load transmission on to the terminals.

The form is so chosen that the plug could be manufactured as permanently connected molded plug. Materials could be PVC and Polypropylene. It could also be manufactured as removable plug. There terminals have been altered so that a coin could be used to tighten the terminal nuts. These nuts carry floating captive washers. These washers will ease connecting the conductors at terminals.

The colour chosen are lighter tints of secondary colours.

9.5 MOUNTING PLATE

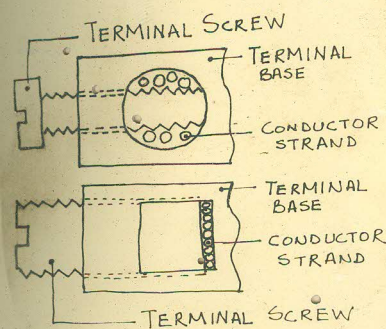
Mounting plate have been designed with 1,2,3,4, 6 and 8 units capacity (unit refering to switch or socket).

The mounting plate will have press out pieces to accomodate switches or sockets. Cutting out of these areas will thus become unnecessary. The holes through which mounting screws pass will also be of press out type. This is done by suddenly reducing thickness from 4 mm to 1 mm.

9.6 THE SYSTEM

The whole system has flat, bold, plane surfaces. This would integrate well with the walls which are flat, bold, surfaces. Circular forms have been avoided because walls are generally rectangular and square in form.

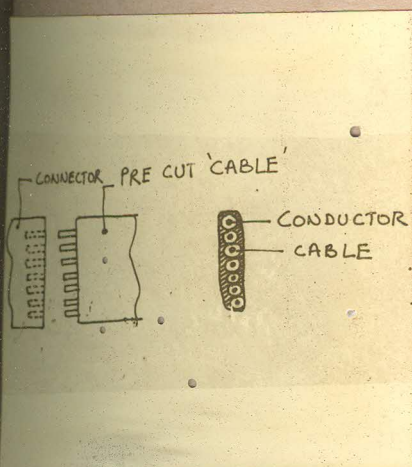
Larger sizes for switches and sockets have been suggested so that these fixtures dont appear as a tiny spot but present their independent existence. The colour chosen are all very light tints to match with the walls. Dark colours on walls



are distracting because walls generally are coloured in lighter shades in India.

Wiring should run all around either at 250 mm from floor or 250 mm from ceiling. It is advised that switch boards be at a height of 1250 mm from floor.

The switch actuators will carry graphics thus enabling a visitor even to switch on the correct equipment.



9.7 ALTERNATE SOLUTIONS

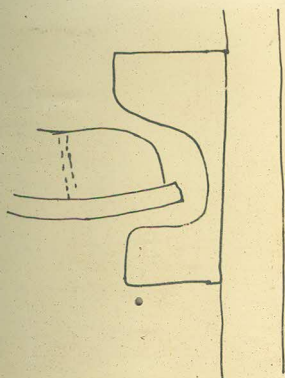
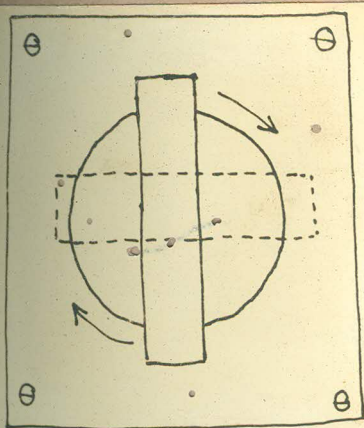
9.71 WIRING EQUIPMENT

The first solution that was thought of had precut - cables molded in a conduit form. At the ends pins were there which were pushed in connectors. At junctions spiders could be use which could give freedom of connections. This could cut installation time drastically but was given up because of high cost envisaged.

9.72 SWITCHES

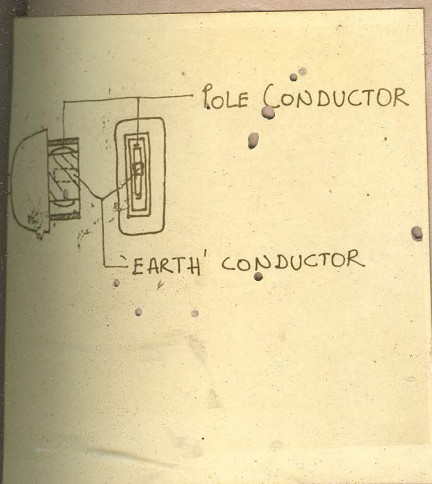
Various forms for actuators were thought of along with various types of motions.

1. Rotary motion with a knob to be rotated.
2. Lateral motion with actuator having a horizontal groove so that it could be actuated by shoe or foot.
3. Push button type of actuator which rotated as pushed.



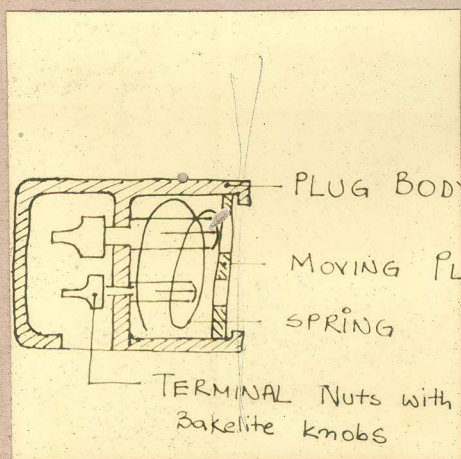
04/Pro 14 C73-74

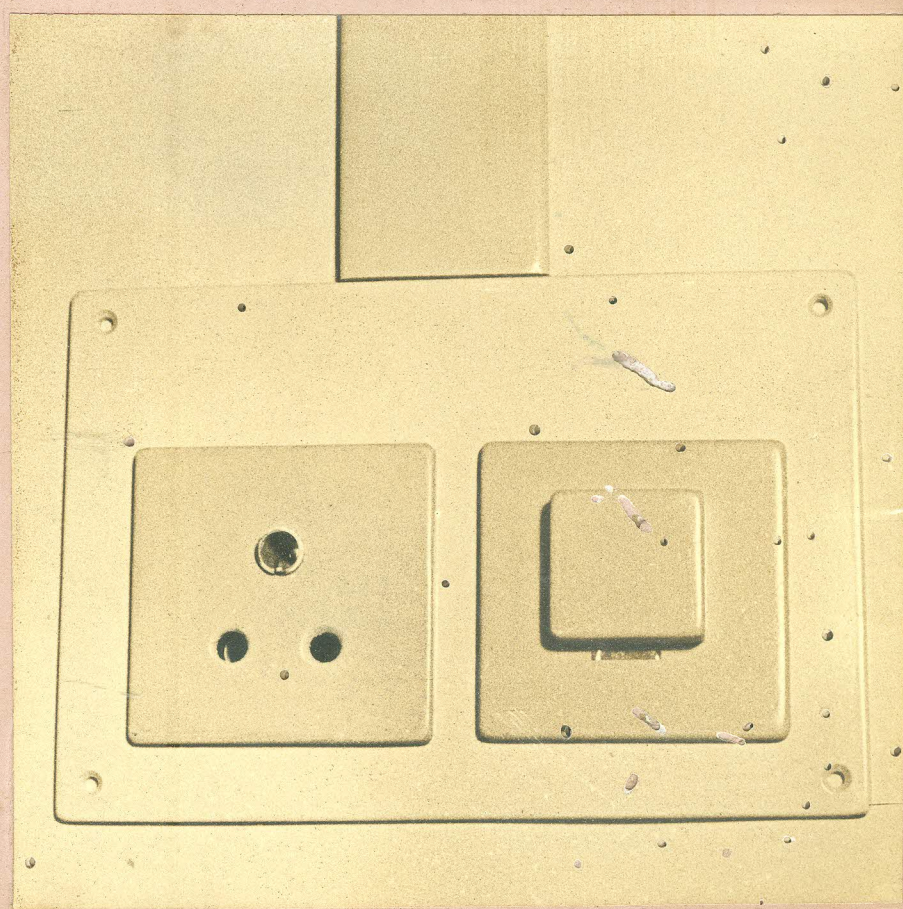
9.73 SOCKETS AND PLUGS

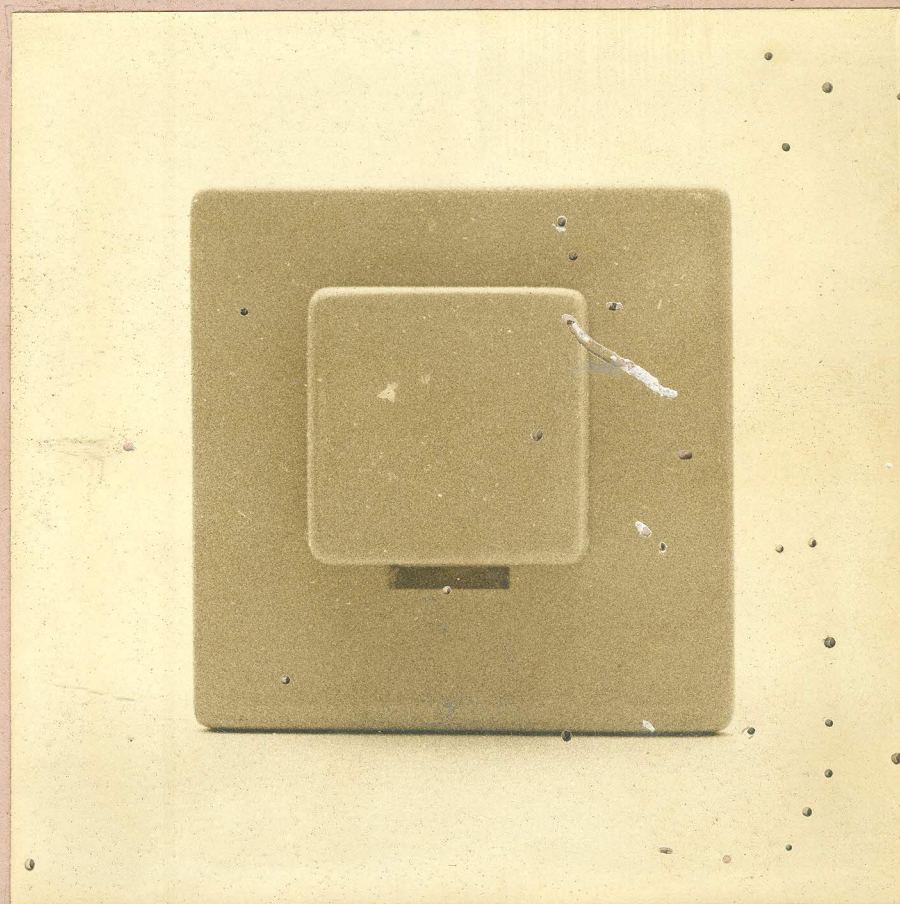
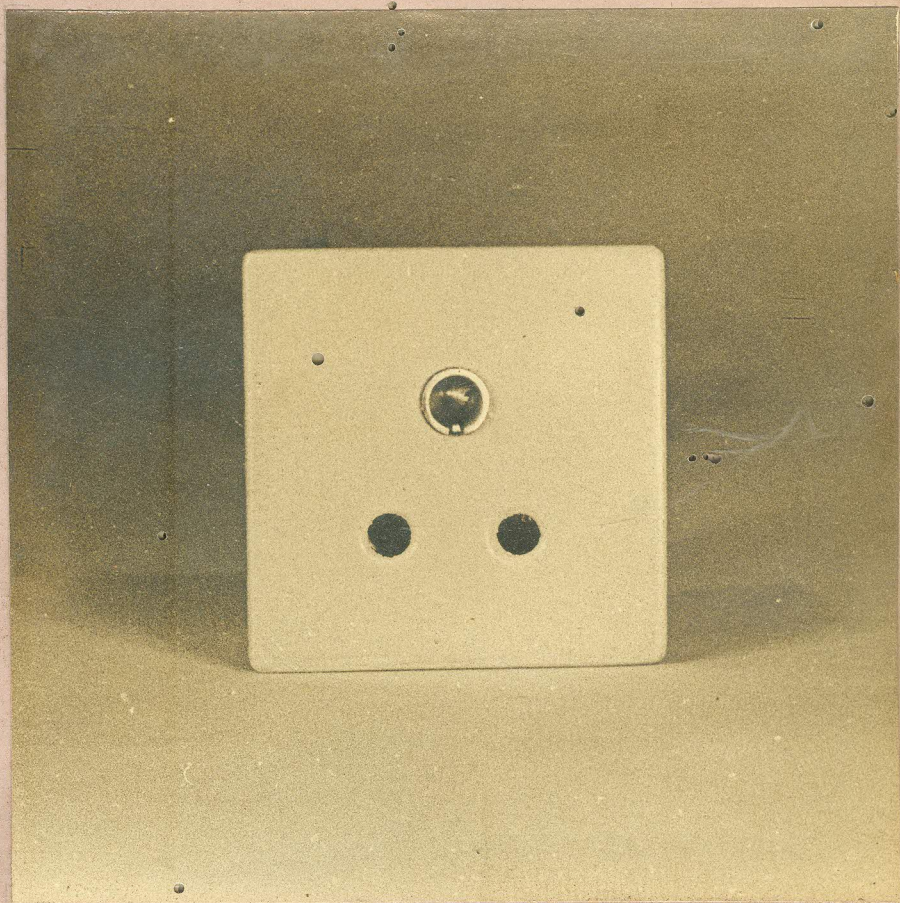


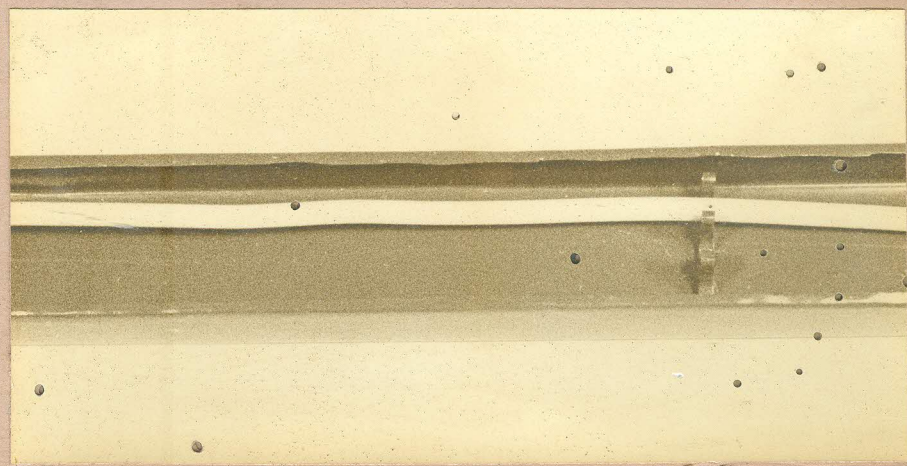
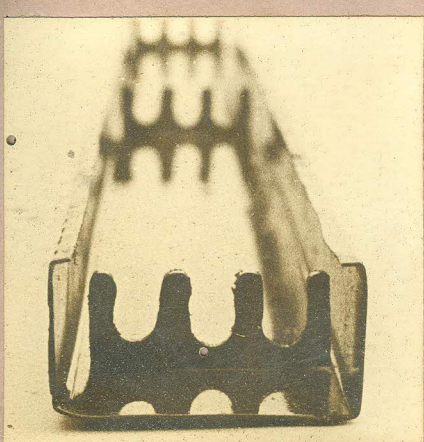
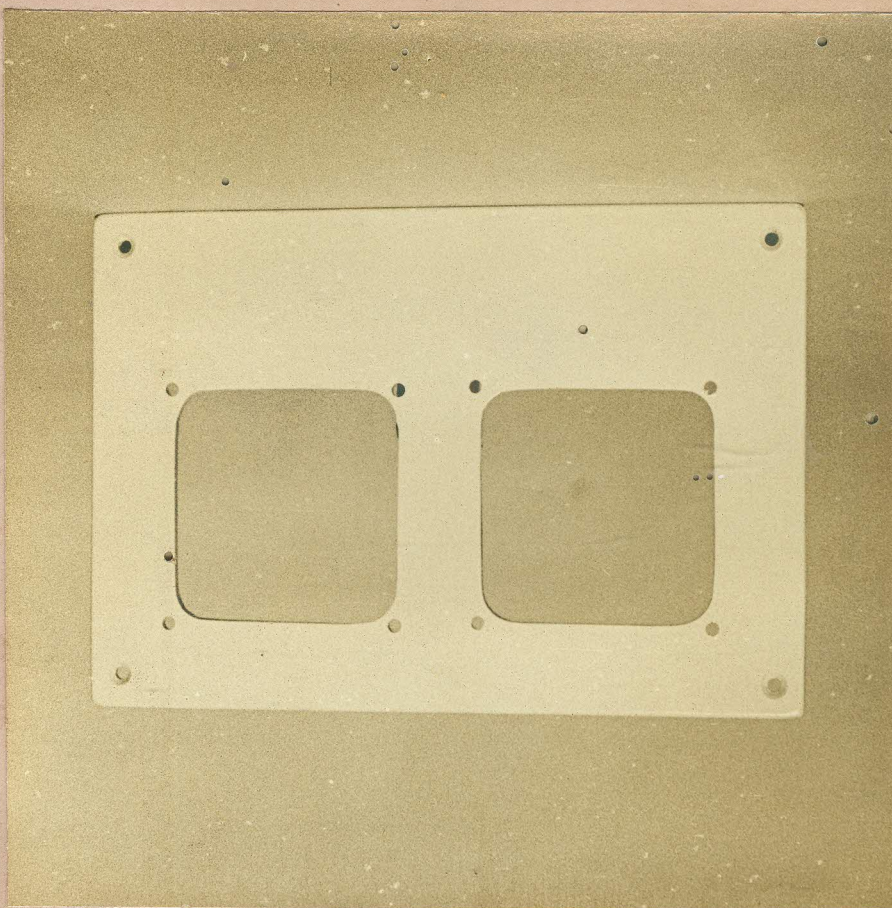
From safety point of view it would have been best to have plug pins concealed. In one solution the plug pins were concealed behind a movable plate which had holes for pins. The plate moved back as the plug was pushed in the socket.

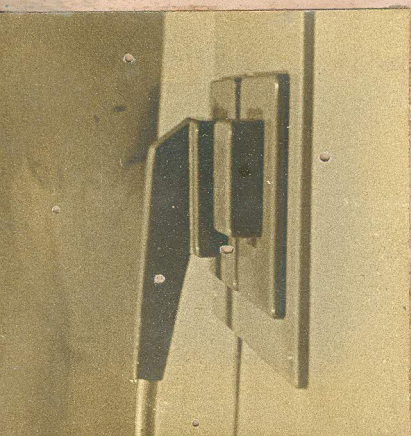
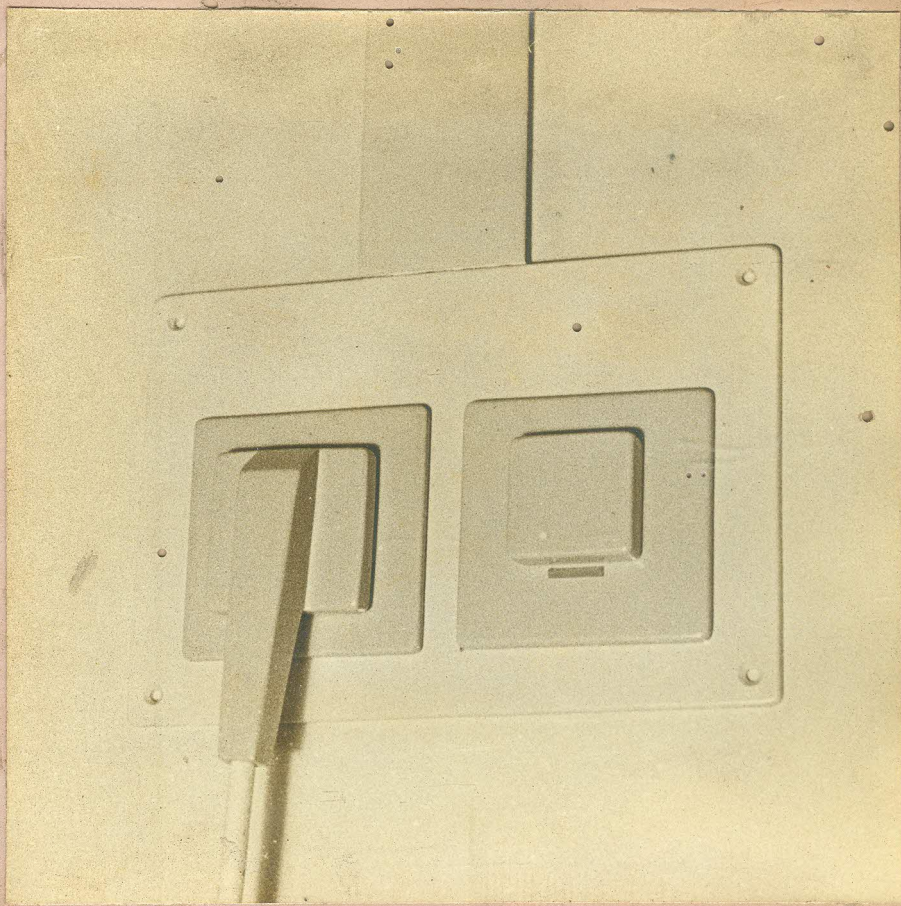
In another solution plug had rectangular pins supported on two side of a rectangular projection. The socket has a corresponding slot.

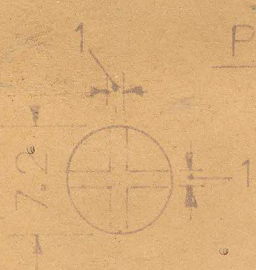
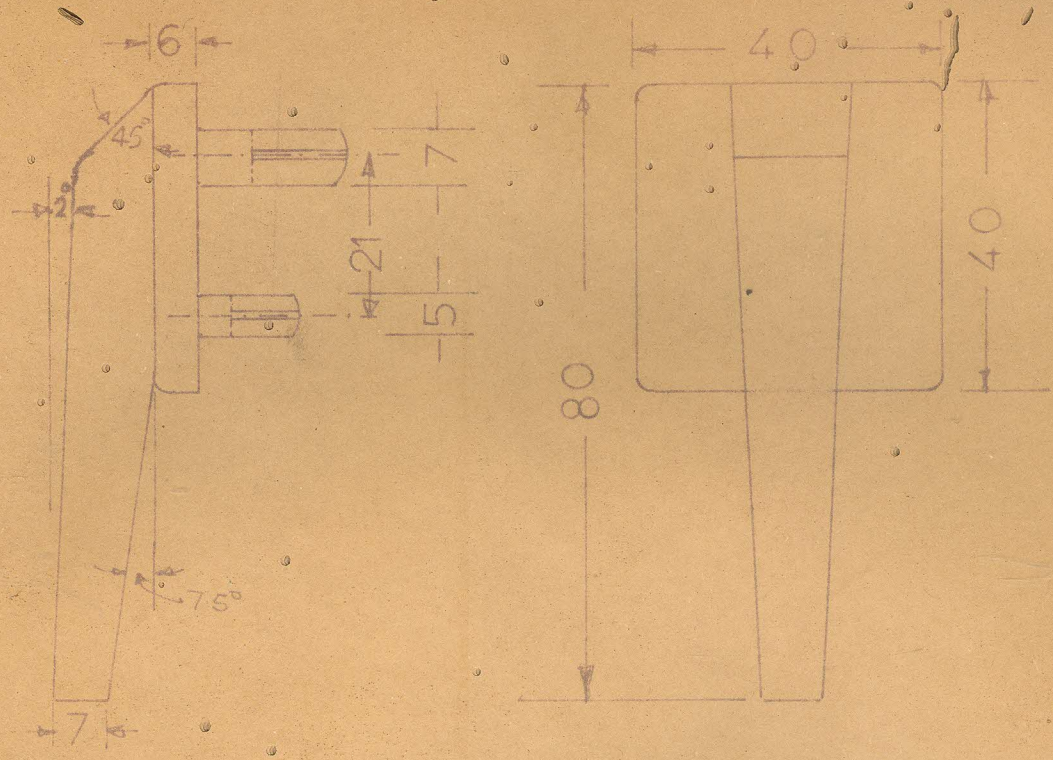




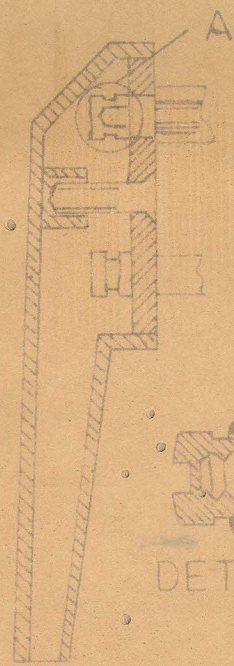
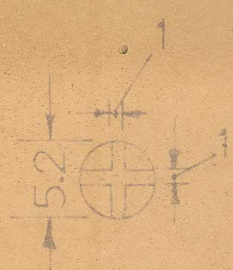








PINS



DETAIL AT A

DOMESTIC ELECTRICAL HARDWARE

PLUG

A GUPTA

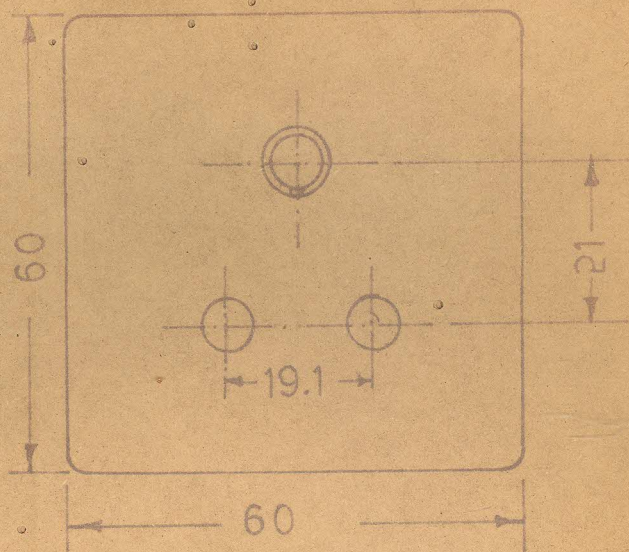
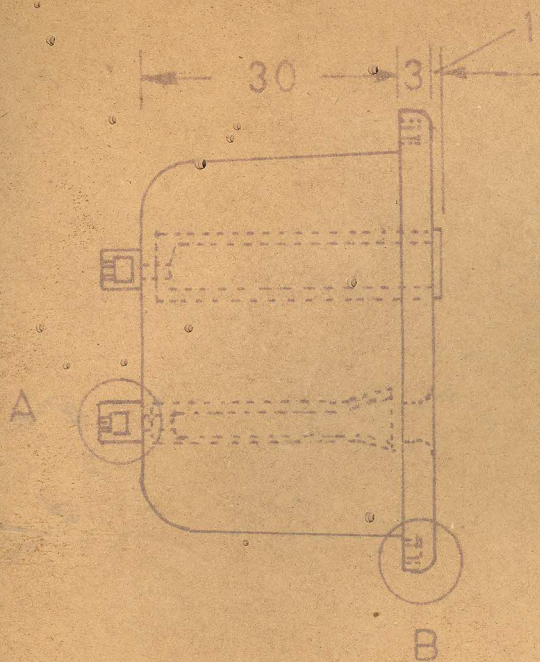
FOURTH BATCH

1972-74

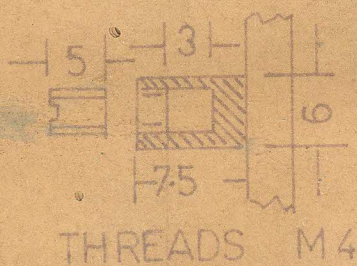
SCALE: FULL

DIMENSIONS IN mm.

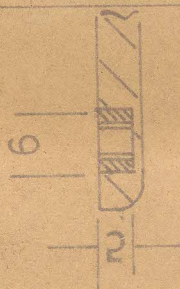
INDUSTRIAL DESIGN CENTRE



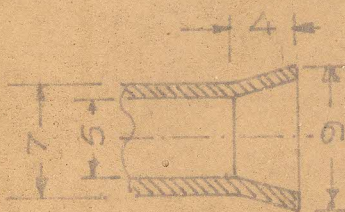
DETAIL AT A



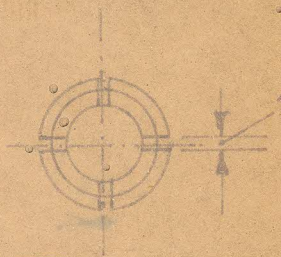
DETAIL AT B



EARTH TUBE



POLE TUBE



DOMESTIC ELECTRICAL HARDWARE

SOCKET

A GUPTA

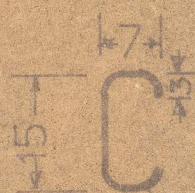
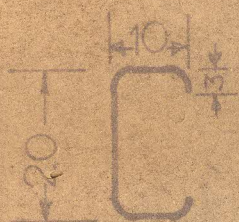
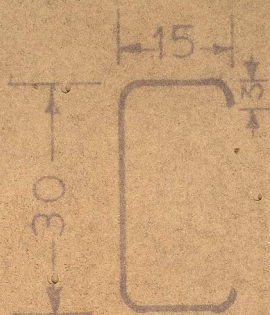
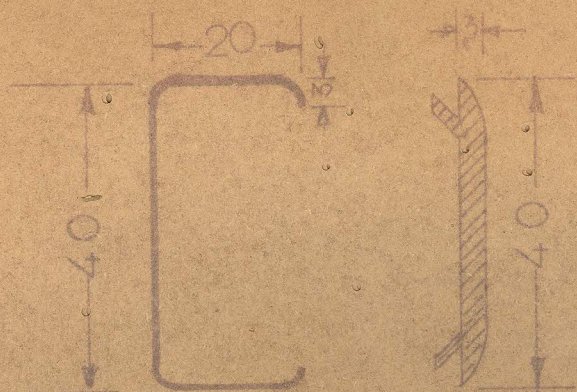
FOURTH BATCH

1972 74

SCALE FULL

DIMENSIONS IN mm

INDUSTRIAL DESIGN CENTRE



8mm THICK

EXTRUDED SECTIONS

DOMESTIC ELECTRICAL HARDWARE

WIRING STRIP & COVER

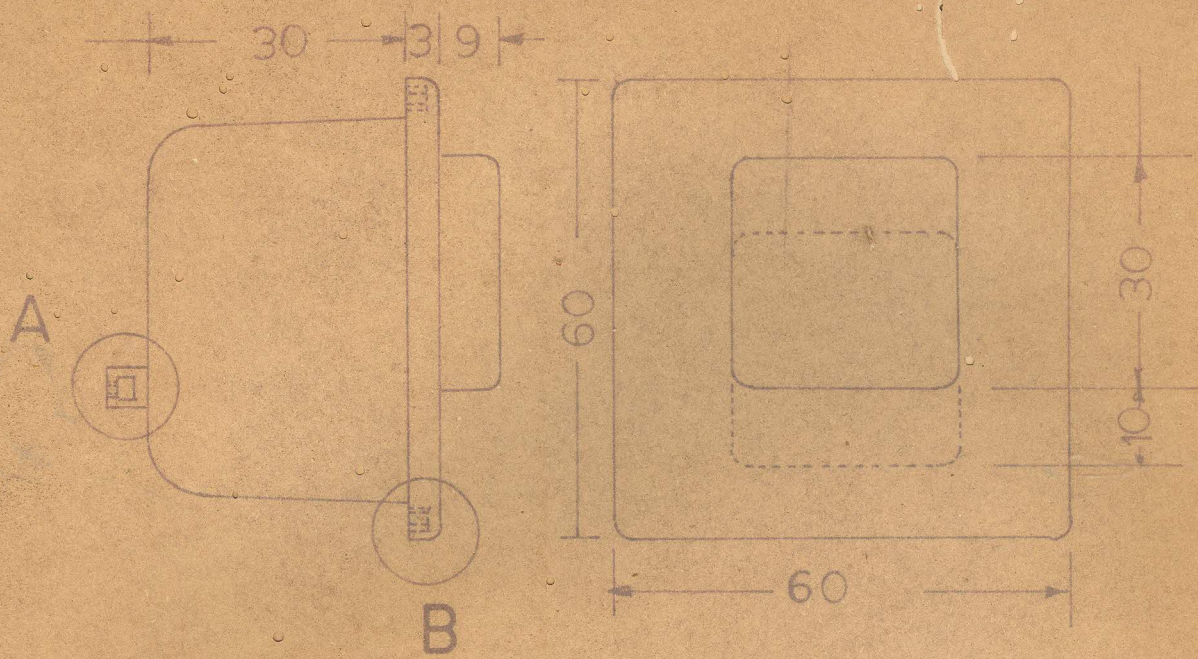
A GUPTA
1972 - 74

FOURTH BATCH

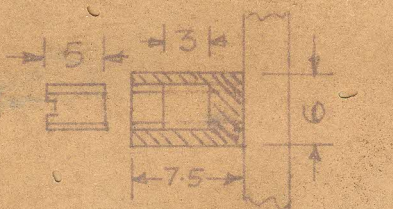
SCALE FULL

DIMENSIONS IN mm

INDUSTRIAL DESIGN CENTRE

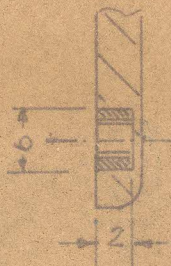


DETAIL AT A



THRE ADS M4

DE TAIL AT B



DOMESTIC ELECTRICAL HARDWARE

SWITCH

A GUPTA

FOURTH BATCH

1972 74

SCALE FULL

DIMENSIONS IN mm.

INDUSTRIAL DESIGN/ CENTRE

