PROJECT REPORT ON A SMALL SCALE UNIT TO MANUFACTURE PLASTIC RADIO CABINETS

SUBMITTED TO THE UNIVERSITY OF COCHIN
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POLYMER SCIENCE AND RUBBER TECHNOLOGY

BY

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Cochin - 22,
16th December 1980. ASWIN KUMAR H.

CHAPTER - I

I N T R O D U C T I O N

This is a project report on the manufacture of plastic Radio Cabinets by injection moulding. Considering all the techno-economic aspects, it is worthwhile to start a small scale unit based on this project report.

Radios are very common now a days and the demand for it is increasing day by day. Earlier only wooden babinets were used for covering radios, which are now fast replaced by plastics.

Plastics comprise of a very large family of materials with wide ranging properties. They can also be tailor-made to meet the specific requirements so that there is always a suitable material available from the family of plastics to meet any exacting requirements of a material of construction. The important advantages by using plastics for radio cabinets instead of wood, are summerised below:

For ease of handling, radios must be covered with a light cabinet and which can be met with plastics. These also help to reduce wear and tear. Maintenance of close tolerances on dimensions and excellant dimensional stability of plastics makes them useful for covering radios. One of the important attraction of radios to a customer is its outer appearance. In this regard plastics can be moulded in a variety of designs and colours to attract customer. Moreover plastics are safe in

use, having excellant resistance to corrosion, durable and above all having resale value.

Among plastics the most important one used for manufacturing radio cabinets are high impact polystyrene (HIP) and Acrylomtrile butadiene styrene (ABS). Both are thermoplastics having high impact strength. Since thermoplastics are easy to be injection moulded and can be reprocessed several times the usability is higher than that for thermosets. There are a few other plastics also which can be used for as housing material but since they are costlier than HIP and ABS, the latter are used abundantly.

For transparent articles like dial glasses SAN is used in abundance. It has got high clarity and impact strength.

At present there is only one unit in Kerala engaged in the manufacture of radio cabinets. It meets about 50% of state's needs. It seems highly worth to start a small scale unit to manufacture radio cabinets.

As the production sector of plastic radio cabinets is not at all organised, it is very difficult to give a clear cut picture of the demand and supply of plastic radio cabinets as such. Nevertheless the production and supply of radio receivers may give a rough idea of the demand and supply of the plastic radio cabinets.

The total licensed capacity for radio receivers in the organised sector is round about 4.42 million sets per annum. Besides a large number of units in the small scale sector are

also assembling radio receivers which accounts for a sizable fraction of the total production. There are round about 2 units in Public sector and 14 units in private sector manufacturing radio receivers in India. A list of the major manufacturers of radio receivers is given in Annexure VII.

The total production figures for radio receivers from 1972 - 78 are given in Annexure VIII. It can be ascertained from the figures that the rate of increase in production during the year 1978 was around 17.6% and the rate is expected to be on a ascend in the future.

From the total production 90% of the radios are covered with plastic cabinets and the usage of it is increasing due to its several advantages as mentioned earlier. Out of the total production in India 70% of the radios are 2 band & 1 band transistors radios and all are covered with plastic materials. More over the Government has exempted 2 band & 1 band radios from license act, it is expected that the demand for such radios will be more in the future. Taking into account of all these facts the demand for plastic radio cabinets will be around 3.9 million sets, in India.

In Kerala the progress of the radio receiver manufacturing industry is just now started. There is only one manufacturer in organised sector for radios viz, Keltron, Trivandrum. In the small scale sector there is Telecs, Trivandrum. Besides there are small unorganised sectors. The production of radio receivers by Keltron is around 1 lakh. Though the production is

not so high compared to total production, the demand for radio cabinets is more and at present about 50% of the requirement is imported from outside state. The rest 50% is supplied by the only manufacturer of radio cabinets in Kerala viz, Trencos Ltd., Trivandrum. The production of plastic cabinet covered radios comes to around 70% of the total production of Keltron. Therefore there is a gap of about 35000 radio cabinets per annum. More over the production of 'Telecs' and a few others in unorganised sector altogether comes to around 30000/annum. Hence there is a excess demand of around 55000 plastic radio cabinets, considering the excess demand of radio cabinets of units other than Keltron to be 20000.

Considering all these facts and above all market from other big manufacturers pf radio receivers, it is worth mentioning that there is lot of scope to obtain market for plastic radio cabinets. It is also expected to have high rate of growth for plastic cabinets manufacturing units in Kerala in the near future.

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CHAPTER - II

L I T E R A T U R E S U R V E Y

As mentioned earlier for the manufacture of radio cabinets the major plastics used are HIP and ABS due to their high impact strength and rigidity. For transparant components SAN is used which has high clarity.

The data regarding the manufacture of plastic radio cabinets is meager. However it will be worthwhile to consider some of the end properties of injection moulded products, relevant to the manufacture of plastic radio cabinets, in relation to the process conditions. A.B. Glanvill has given a good coverage of these properties.

For a better moulding the processing temperature of the material should be correctly chosen. The processing temperature range for various important plastics used for industrial applications are given below:-

Material	Processing temperature range °C	°F
ABS	180-240	356-464
Acrylic	180-250	356-482
Polycarbonate	280-310	536-590
Polystyrene	180-260	356-500
Polypropylene	200-300	392-572
Acetal	185-225	365-437
Nylon	260-290	500-554

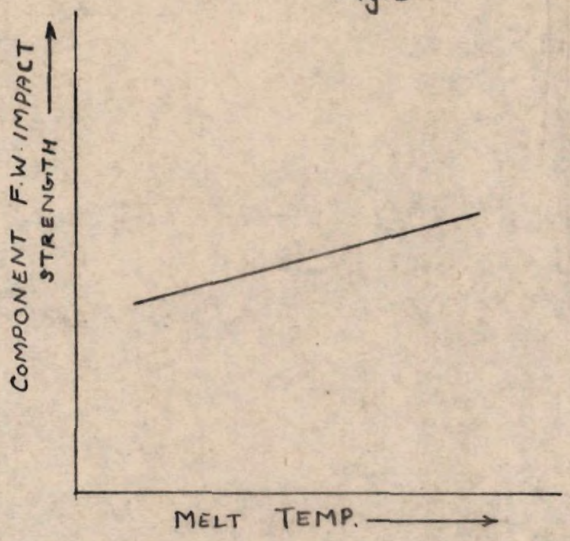
The processing temperature or melt temperature is a important factor to be considered since it governs the major features of the moulding like impact strength glossyness etc. The most important requisite for a housing material is its impact strength. It is found that the impact strength varies as the melt temperature. This is graphically shown in Fig. 1.

The component gloss is another factor which is governed by melt temperature. A smooth and glossy surface is a must for articles like housing for radio receivers and similar equipments. The variation of moulding gloss to melt temperature is shown in Fig. 2.

Heat distortion is also important parameter to be considered for plastic cabinets used for radios. The variation of this with the melt temperature is shown in Fig. 3.

For industrial injection moulded components, it is very essential that all dimensions are within the tolerance limit. Varations in dimensions can occure due to shrinkage of plastic materials. For this allowances must be given to the dimensions of product design when designing the mould for a particular product. For all plastic materials specific shrinkage values are calculated theoratically. However these specific values vary according to the process conditions. The dependence of shrinkage on various processing conditions is shown graphically in Fig. 4.

Fig.1



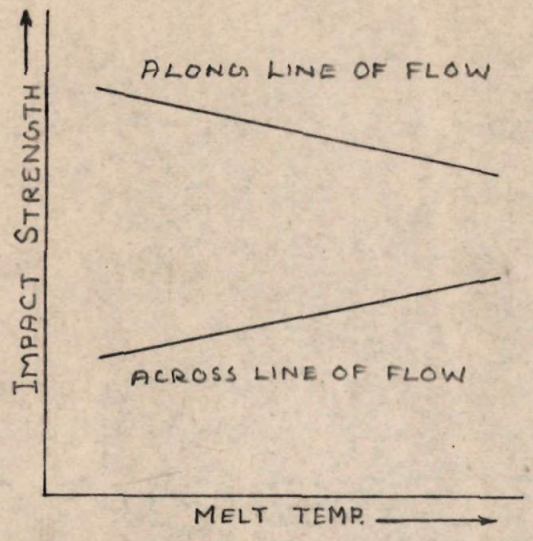


Fig.2

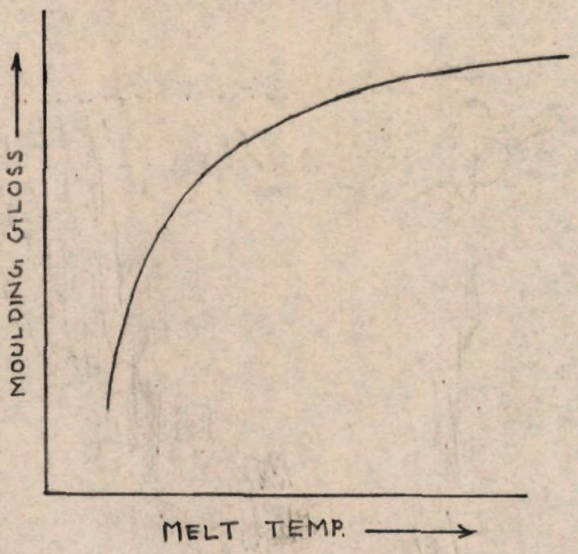
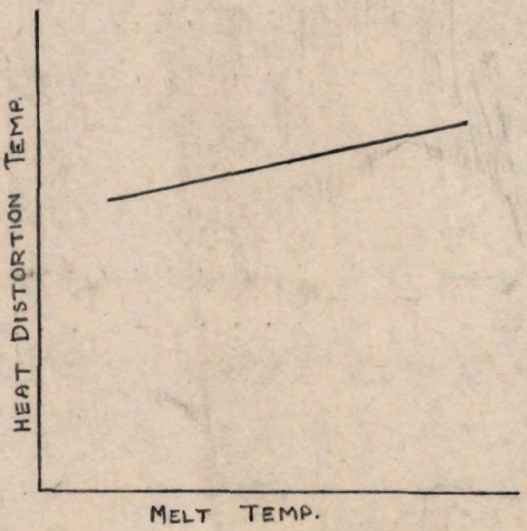


Fig.3



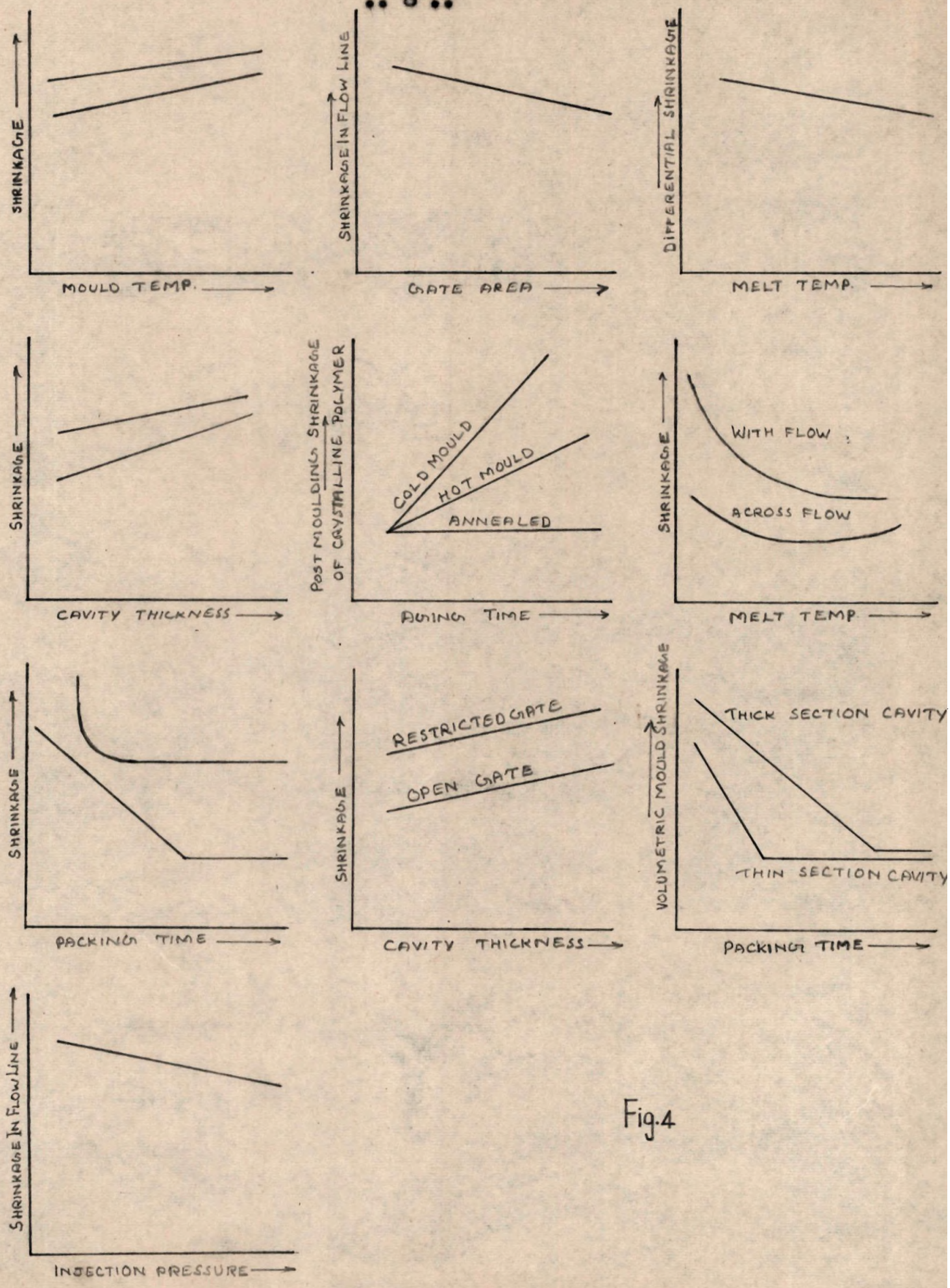

SHRINKAGE
MOULD TEMP.
SHRINKAGE IN FLOW LINE
GATE AREA
DIFFERENTIAL SHRINKAGE
MELT TEMP.
SHRINKAGE
CAVITY THICKNESS
POST MOULDING SHRINKAGE OF CRYSTALLINE POLYMER
COLD MOULD
HOT MOULD
ANNEALED
AGING TIME
SHRINKAGE
WITH FLOW
ACROSS FLOW
MELT TEMP.
SHRINKAGE
PACKING TIME
SHRINKAGE
RESTRICTED GATE
OPEN GATE
CAVITY THICKNESS
VOLUMETRIC MOULD SHRINKAGE
THICK SECTION CAVITY
THIN SECTION CAVITY
PACKING TIME
SHRINKAGE IN FLOW LINE
INJECTION PRESSURE

Fig.4

The shrinkage values for important plastics are given below:-

Material	Mould shrinkage in/in or mm/mm	Mould shrinkage (%)
ABS		
high impact	0.005 - 0.007	0.5 - 0.7
heat resistant	0.004 - 0.005	0.4 - 0.5
medium impact	0.005	0.5
Acetal	0.020 - 0.035	2.0 - 3.5
Acrylic high impact	0.004 - 0.008	0.4 - 0.8
Nylon		
type 6.6 ø	0.010 - 0.025	1.0 - 2.5
type 6	0.007 - 0.015	0.7 - 1.5
Polystyrene		
General purpose	0.002 - 0.008	0.2 - 0.8
heat resistant	0.002 - 0.008	0.2 - 0.8
toughened	0.003 - 0.006	0.3 - 0.6
SAN	0.002 - 0.006	0.2 - 0.6
PTFE	0.050 - 0.100	5.0 - 10.0

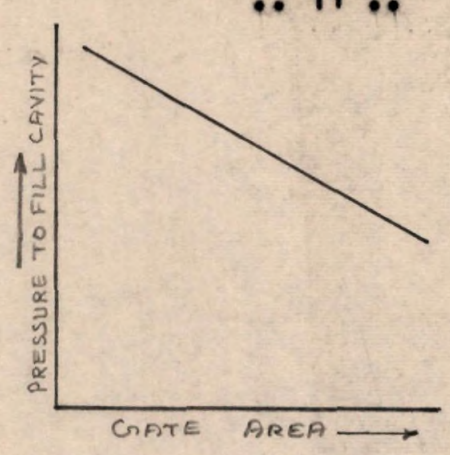
For a better moulding with precise size and shape the clamping pressure used must be sufficient. It also helps reducing waste due to flashings. The clamping force must be always greater than the force given by the product of the live cavity pressure and the projected area of all impressions and

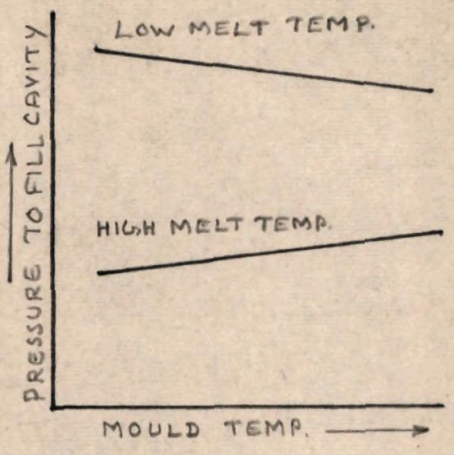
runners. A detailed guide to clamping pressure requirements for screw injection mould of polyolefins and polystyrenes based on flow path length is given in the table below:

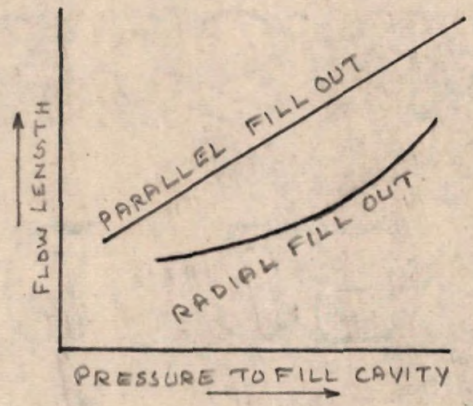
Average component section thickness		Clamping pressure required (lb/in^2 or Kgf/cm^2 of projected area				
		Ratio of flow path length to section thickness				
in	mm	200:1	150:1	125:1	100:1	50:1
0.04		--	9960	9000	7200	4500
	1.02	--	706	633	506	316
0.06		12000	8500	6000	4500	3000
	1.52	844	898	422	316	211
0.08		9000	600	4500	3500	2500
	2.03	633	422	316	267	176
0.01		7000	4500	3500	3000	2500
	2.54	492	316	246	211	176
0.12		5000	4000	3100	3000	2500
	3.08	382	281	218	211	176
0.14		4800	3500	3100	3600	2500
	3.56	316	246	218	211	176

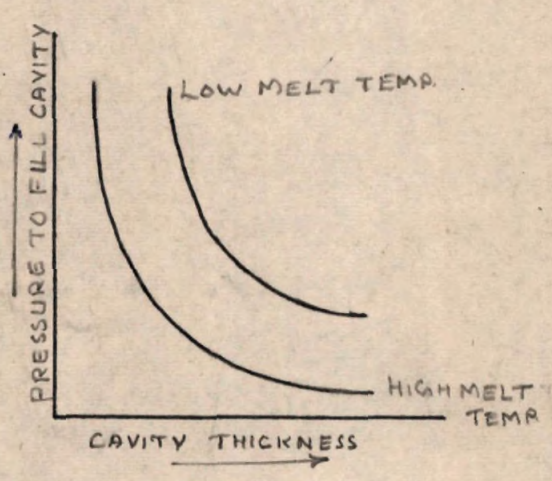
The pressure required to fill the cavity of the mould is a stringent factor during processing which is mainly effected by mould dimensions and resin viscosity.

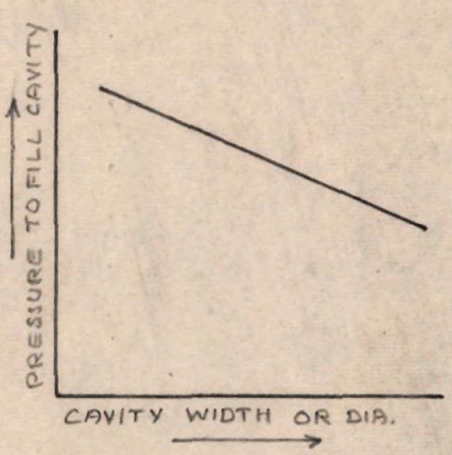
It is theoretically established that at constant flow rate and resin viscosity the pressure required to fill is directly proportional to the mould length and inversely proportional to cavity width or diameter and cube of the mould thickness. It is also found that the pressure required to fill radial fill patterns (ie., centre gated) is exponential. The variation of pressure to fill cavity with other parameters is shown graphically in Fig. 5.

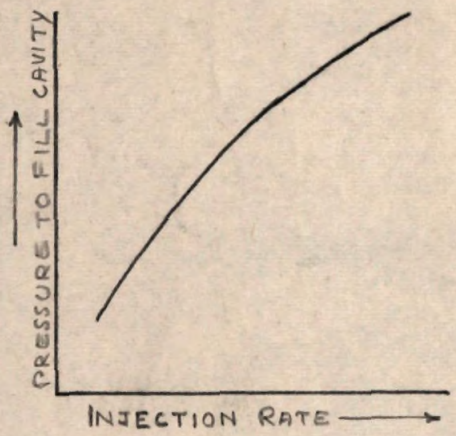

PRESSURE TO FILL CAVITY
GATE AREA


LOW MELT TEMP.
HIGH MELT TEMP.
PRESSURE TO FILL CAVITY
MOULD TEMP.


FLOW LENGTH
PARALLEL FILL OUT
RADIAL FILL OUT
PRESSURE TO FILL CAVITY


LOW MELT TEMP.
HIGH MELT TEMP
PRESSURE TO FILL CAVITY
CAVITY THICKNESS


PRESSURE TO FILL CAVITY
CAVITY WIDTH OR DIA.


PRESSURE TO FILL CAVITY
INJECTION RATE

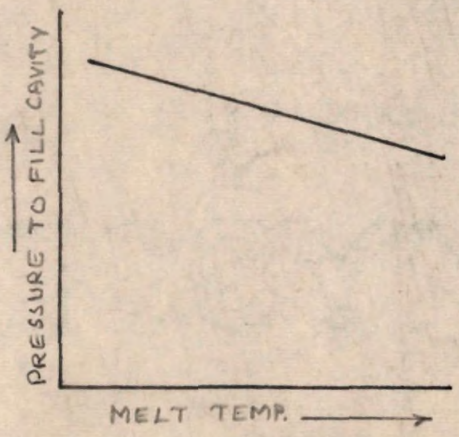

PRESSURE TO FILL CAVITY
MELT TEMP.

Fig.5.

To mould a plastic product, it demands a suitable mould which should form a closed cavity and should be constructed in at least two parts. The one of the main problems emcountered in designing a mould is the thickness of the side walls. The mould cavity retainer plates should be thick enough to reduce the elastic deformations, such as bending of cavity retainer plates and cores. The maximum deflection commonly allowed in such mould is 0.005 - 0.01 in (0.13-0.25 mm) depending upon the size of the tool. The thickness factor is however restricted since light construction is also required for effecient cooling.

Elastic deformation of weak or insufficiently thick solid components may result in,

a) dimensional variations as well as insufficient dimensional stability and reigidity of the moulding.
b) non uniform melt flow which results in flow lines, weld lines, internal stresses or even trapped air.
c) flash formation in excess.
d) the improper operation of ejection system and guide pins.

The selection of the material for construction of the mould must be critical. For the parts which require low rate of conduotivity, stainless steel is used. It is also used for moulds handling corrosive plastics. Berrylium-copper is used for mould components which are required to posses very good heat conductivity such as nozzle for hot runner and parts which must be cooled rapidly. Zinc alloys and aluminium alloys are suitable for test moulds and moulds for small productions.

Nickel-cobalt alloys are used for the manufacture of complicated mould cavities.

Now-a-days standardised moulds are available in various types and offer advantages of low cost, quick replacement and interchangeability and promotion of industrial standardisation.

Generally the moulds are constructed for single impressions. To increase the production and to reduce the mould cost 2 or more impressions mould can also be made. For similar impressions in one mould the designing of the gate size and other related factors is simpler. But where cavities are of different shot weights, the problem is more complicated. In such cases the gate size of one cavity may be established arbitrarily and the remainder sized by applying one of the formulae given below:-

For round gates, $d_2 = d_1 \left(\frac{W_2}{W_1}\right)^{1/4}$.

For rectangular gate, $t_2 = t_1 \left(\frac{W_2}{W_1}\right)^{1/3}$, assuming gate width constant.

where, d_1 = the gate diameter of the first cavity (in or cm)

d_2 = the gate diameter of the second cavity (in or cm)

t_1 = depth of gate in first cavity (in or cm)

t_2 = depth of gate in second cavity (in or cm)

W_1 = weight of the first cavity component (gm or oz)

W_2 = weight of the second cavity component (gm or oz)

A certain degree of molecular orientation in the flow dimension of the melt takes place which in turn affects the

properties of the moulding. A proper location of the gate is important to ensure proper melt flow, which is governed largely by the shape and size of the gate.

If the gating is designed such that two melt flows comes face to face on a straight bar, which may be a case when flowing around a core, the flow comes to a stand still at such places. This may cause weak mould lines or weld lines. This can be removed by following ways,

1. good mould venting.
2. high injection speed and mould temperature.
3. proper polymer and mould temperature.
4. by using ring gating, or
5. the weld line can be shifted to a offset projection in the moulding which can be removed during finishing the product.

From the above discussion it is clear that for optimum conditions of manufacture of plastic radio cabinets, one has to make a compromise of all the relevant parameters discussed.

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CHAPTER - III

PROCESS OF MANUFACTURE

1. Product design:-

The plastic radio cabinet as mentioned earlier, is manufactured by injection moulding. The cabinet designed for this particular project report is that for two band radio of size 19 x 11.6 x 2.6 (cms).

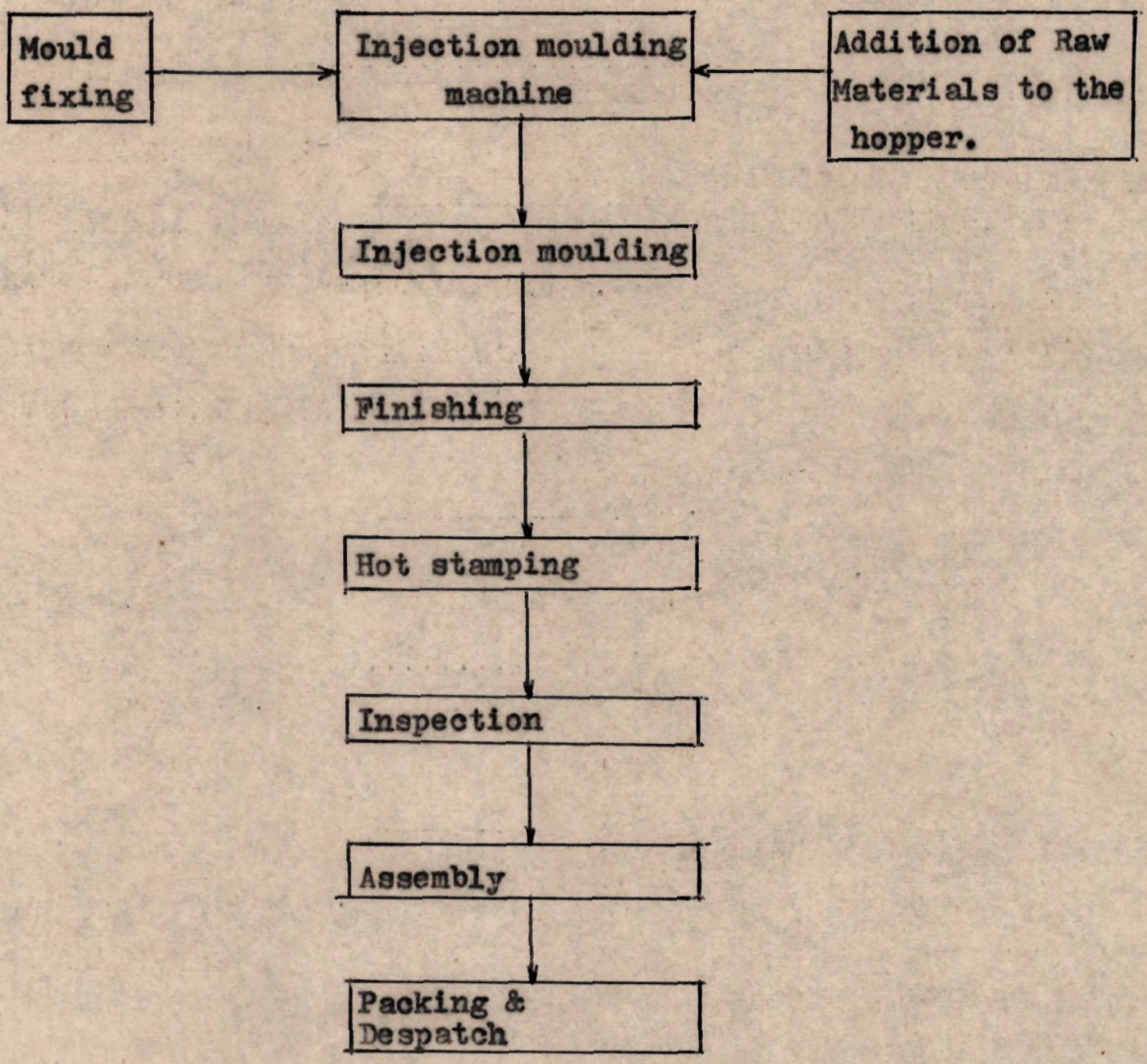
It consists of totally 7 parts. They are shown below with the respective material of manufacture used.

1.	Front cover	-	HIP.
2.	Back cover	-	"
3.	Grill	-	"
4.	Side grill (2)	-	"
5.	Battery case lid.	-	"
6.	Dial glass	-	SAN

The diagrams of the components are shown in Annexure XI.

2. Process:-

As stated in the literature, optimum conditions of the process must be chosen and correct adjustments of the machine must be done to obtain a good quality product. All the parts mentioned are manufactured in the same injection moulding machine by changing the moulds. The various steps for each of the process are shown below:-



The first step in the process is to fix the mould to the mould carrier provided in the machine. The fixing of mould is a time consuming work and since there are different moulds to tk be used for different products required for radio cabinet, the schedule of production must be well planned to get maximum production in minimum time possible. The mould must be well cleaned before fixing to the machine. The idle moulds must be kept oiled and in clean place to protect it from getting rusted.

The mould must be handled properly during fixing to avoid damage both to the machinery and mould. A crane can be used for carrying the mould.

The two parts of the mould must be fixed firmly to the carrier using the crame and release the mould from the crane. If the two parts of the mould must be mounted separately first mount the nozzle sided part to mould carrier and fix solidely. The mould part at the mould carrier on the ejector side is to be only slightly fixed. Then run the mould very carefully together until the guide pins get hold. By mean of slight screwing the second part of the mould, the latter centres itself. The mould parts having run together, also the second mould part is to be solidely clamped and fixed. After opening the mould, unscrew the ejector screws to such a extent until the desired ejector strike is obtained.

The next step in the process is to switch on the control valves provided for screw speed, heating and to adjust the desired shot volume. All the process conditions required for the production of any of the cabinet component can be fixed only by trial and error method. However for a rough idea of approximate valves of temperatures in different zones, injection and clamping pressures and cycle time are given below:-

Component	Material	Temp. °C 1	2	3	4	Injection pressure Kgf/cm^2	Clamping pressure Mt.	Cycle time Sec.
Front Cover	HIP	220	230	230	130	1000	90	50
Back cover	"	"	"	"	"	1100	100	55
Grill	"	"	"	"	"	600	45	35
Side Grill	"	"	"	"	"	350	30	30
Lid	"	"	"	"	"	350	30	25
Dial glass	SAN	220	230	230	160	350	30	40

Note:- Zone counting starts from nozzle.

After mould is mounted and preparation for injection can be accomplished, the injection can be started. The initial adjustment should be done only by hand operation method. Run some trial shots and thereby adjust injection speed, injection pressure and counter pressure as required. After the desired level of conditions are fixed and when the required quality product is achieved the process can be switched on to automization.

3. Finishing & Hot stamping:-

The article moulded will be having sprue and gate projections and side flashes which makes the product look awkward. The sprue and gate projections can be cut of with a knife and the product can be finally buffed to obtain a finished one.

The mould of each component is so designed to get letters whereever needed. These namings on the cabinet components shows the brand name, manufacturer's name and other indication for the operation of the radio, which are provided at specific spaces as directed by the customer. These letters are made to look brilliant by a process called hot stamping. A silver paper is placed over the letters over which a metal plate of required dimensions is kept. The full assembly is then placed under the hot platen of the hot stamping machine and pressed by which well shining silvered letters are obtained. The finished and hot stamped components are then transferred to the inspection section for final inspection.

4. Inspection:-

For a radio cabinet the main features required are impact strength and attractive look. Since we have chosen HIP, we can assume the product to have good impact strength. The outer appearance can be inspected visually. Eventhough this final inspection is done, the actual inspection is carried out at the machine itself. As the product is ejected from the machine, it is checked by the operator and if the product is satisfactory it is collected as a good quality one. If the product is not satisfactory the reason for the defect is to be found out and rectified. The defected articles are collected separately and recycled after grinding in a scrap grinder. After final inspection the components are transferred to the assembly section.

4. Assembly Packing and Despatch:-

The finished components are assembled in the assembly section. The assembled cabinets are either despatched or stored in the store room. Plastic radio cabinets can be included in the industrial products and the main market is the radio receiver manufacturing industry. The distribution inside the state can be done directly. For outer states extension counters can be opened for getting better orders and quick delivery of products. For reliable parties credits upto one month can be given. The pricing system selected for this particular product is a competitive pricing. The price is fixed as Rs.20/= per set.

5. Planning:-

The schedule of production of different components of the radio cabinet is given below:-

Component	Wt. (gms)	Cycle time (Sec.)	Per shift production (no.)	2 shift production (no.)
Front Cover	55	50	425	850
Back cover	110	55	380	760
Grill	30	35	600	1200
Side grill	14	30	700	1400
Lid	15	25	850	1700
Dial glass	13	40	525	1050

The production figures are rounded off to a minimum. From the figures it can be realised that by effective manipulation

of the production schedule, round about 48000 sets of radio cabinets can be produced per year. The scheduling must also be planned such as to deliver the finished product according to the customer's demand. If 2 or more impression mould is used for smaller components, the production figures can be increased to about 25%.

6. Recycling:-

During finishing operation sprues gates and side flashes are obtained as a waste. This together with other detected articles the waste of production may be around 5% of the total material weight. The waste is ground in a scrap grinder and recycled for production. The excess waste materials are stored in the raw material store room separately.

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CHAPTER - IV

PRODUCTION REQUIREMENTS

1. Land & Building:-

To start any unit the first step to be taken is procurement of land and building. The land can be either procured or taken on rent basis. Forseeing the future expansion programme and other advantages, for this project own land & building are used.

The most important factor in determining a proper location for the plant should be according to the market of the product. If it is nearer to the product market the acquitance with the market will be more which helps to obtain continuous orders for production. The sources of raw materials also must be nearer which helps to have quick availability of raw materials. The nearness of both the market and sources of raw materials makes transportation cheap. For better transportation facilities and cheapness the location must be nearer to a high-way road or at a place from where the access to different parts is easier. The prices of land and other utility facilities also must be takeninto account. If the location is in some backward area government subsidy and other allowances are available which reduces the own capital investment. Moreover the location should be at a place where cheap labour and skill are easily obtained.

The area of land required for a unit must be 4 times the area of working floor space. For this project the area of

working place required is estimated to be 1200 sq.ft. and hence the land requirement is about 5000 sq.ft. The details of land and building are given in Annexure I-A.

For a process like injection moulding, the layout is not so much important because the full process is carried out in a single machine. Other secondary operations like finishing, stamping, inspection etc. requires very small area. A simple lay-out selected for this unit is given in Annexure IX.

2. Machinery & Equipment:-

The main machinery and equipments required are described below:-

The selection of the injection moulding machine must be such that its capacity should be 40% more than the volume of the product. The maximum shot volume of the radio cabinet component for this project is about 116 cm^3. Therefore a machine with a shot capacity of atleast 160 cm^3 will suffice the needs.

The machine must be bought only from reputed firms, who are manufacturing the machines, which provide recent techniques for a efficient process. For present requirement Engel India 100-200 Machine is selected. The details of the machine is given in Annexure - X.

A list of injection moulding machine manufacturer's is given in Appendix - I.

The selection of machine is done in such a way that products with shot capacity upto 150 cm^3 and with slightly bigger size can be produced.

A radio cabinet can be of different parts. The design selected is a radio cabinet having 7 parts which are to be manufactured individually. For this 7 moulds are required. The cost of moulds comes to around 40000. The mould cost can be reduced by designing 2 or more impressions in a single mould. This will also help in increasing the production. Moulds must be designed according to the customer's need and get them manufactured from mould manufacturers. A list of mould manufacturers is given in Appendix - II. Other secondary equipments like stamping machine, buffing machine, scrap grinder etc. must also be provided.

3. Raw Material Requirement:-

The raw materials required for the production of radio cabinets are High impact polystyrene and styrene acrylonitrile. The components like Front cover, back cover, grill, side grills and lid are manufactured using HIP and the dial glass is made in SAN. Raw materials are easily available in the market. A list of suppliers of raw materials is given in Appendix - III.

The raw materials can be purchased directly from the open market or through banks at concessional rate of 4% sales tax. The price of HIP is Rs.32/Kg and that for SAN is Rs.45/kg. The purchase system must be such that there should be always a half month inventory of raw materials as a part of safety in case

scarcity arises. The details regarding requirements/year and costs of raw materials is given in Annexure II-A.

4. Man Power requirements:-

A proper selection of skill and labour is a must for an unit. A correct selection of skill and labour results in high productivity and reduced labour charges. The details of posts and respective salaries with other benefits are given in Annexure II B-2. It is decided to appoint one electrician and one mechanic who may also suprevise the operation in shift basis. The selection, posting and salaries of labour must be according to the rules and regulation given in the Factory Act.

5. Utilities:-

Utilities like power and water requirements must also be provided. The details regarding utilities are given in Annexure II B-1. As stated before the location of the unit must be at a place where these facilities are available. The factory must be well illuminated and ventilated for better working. If water is not available in plenty a well can be digged at a corner of the factory and water can be stored in a overhead tank using a motor.

6. Erection and Commissioning:-

To establish the unit a well planning is necessary. It will take about 2-3 months for the machinery to reach the factory. So first the purchase order for machinery and equipment must be forwarded. During the period the procurement of land and building

for factory floor and site developments works are to be done. On reaching the machinery and equipment the erection works may take about a month. Then the purchase of raw materials and other requirements must be done. So that by around 6th month the unit can be commissioned and trial production can be started.

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CHAPTER - V

FINANCE PLANNING, CAPITAL REQUIREMENTS AND PROFITABILITY

A major factor to be encounted when starting a manufacturing unit is finance. A better financial planning is a must for reducing the investment to a minimum. The enterpremure must have a clear cut knowledge about the various financial facilities available in the country. As it is difficult to invest the whole capital from own money, the financial planning must be done sufficiently earlier to raise the required capital. The capital requirement for the project can be divided into the following items:

I. Fixed Assets:-

a. Land and Building	-	75,500.00
b. Plant & Machinery	-	3,90,530.00
c. Preoperative expenses	-	46,603.00
d. Contigency 10% of(a+b)	-	30,022.00
Total fixed assets	-	5,42,655.00

The details regarding fixed assets are given in Annexure I (A,B,C,D.)

II. Working Capital:-

The margin money required for carrying out the production of cabinets includes in the working capital. It is the working expenses for a definiteperiod which is usually taken as 3 months. The details of various heads coming under working capital and the respective costs are given in Annexure II (A,B,C).

The estimated working capital requirements comes to around Rs.1,99,648.00.

Resources for finance can be classified into four groups:

(1) Own Capital.

(2) Loan amount from financial institutions.

(3) Government subsidy.

(4) Borrowings.

Financial institution usually provide upto 85% of fixed capital requirements. Certain institutes give it as cash loan and others as machinery on hire purchase.

It is suppossed to take 85% of fixed capital from Kerala Financial Corporation as loan and 75% of working capital from The Industrial Development Bank of India. The different terms and conditions of interest and loan repayment are given below.

State financial Corporation provide 85% of land, building, machinery, miscellaneous assets and contigency upto 10 lakhs. Repayment starts by the end of second year and should be completed within 10 years in 17 half yearly instalments. The interest in the case of specified backward area is 10.25% and for other areas 11.85%.

The assistance given by The Industrial Development Bank of India is 3/4th of the capital investment, so that promotor's contribution should not be less than 25%. Convession available in promotor's contribution is upto 17½% in case of specified

backward areas. The interest and terms of repayment are the same as that of State Financial Corporation.

The details of the borrowing and own capital investment are given below:-

	(Rs.)
Own Capital	- 1,31,310.25
Borrowing from KFC for fixed assets (85%)	- 4,61,256.75
Loan from IDBI for working capital (75%)	1,49,736.00
Total investment	7,42,303.00

The details of total investment is given in Annexure III.

ANNUAL PROFITABILITY:-

(1) Sales income & Profit:-

	(Rs.)
Return on sales of 48000 sets @ Rs.20/=	960000.00
Less:- Distribution Cost (5%)	48000.00
	912000.00
Less:- Cost of production	733244.00
Profit before tax	178756.00
Less:- Tax incidence	99383.00
Net Profit	79373.00

It is supposed that there will be only 70% production in the 1st year, 85% in the second year and 100% from 3rd year onwards. The production can be increased from the existing capacity by adding one more shift production. The details of sales income and profit are given in Annexure VI. The details of other fixed costs and interests on loan and total cost of production are given in annexure IV & V respectively.

(2) Break even point:-

This is calculated to get an idea of how much production must be carried out to have no loss, no profit point. It can be calculated as

$$B/E = \frac{F}{P-V}$$

where,

F = fixed costs = cost of production + distribution cost-variable cost.

= Rs.226838/=

Variable cost/unit = $\frac{554406}{48000}$ = Rs.11.55

Selling price / unit = Rs.20/=

B/E = $\frac{226838}{20-11.5}$ = 26845 Sets.

3) Rate of return on own capital investment:-

Own capital	=	Rs.131310.00
Net profit	=	Rs. 79373.00
Rate of return on own capital.	=	Rs. 60.45%

4) Rate of return on total capital investment

Total capital investment = Rs.742303.00

Net profit = Rs. 79373.00

Rate of return on total capital investment. $\% = \frac{79373}{742303} \times 100 = 10.7\%$

5) Rate of return on sales turnover:

Total sales turnover = Rs.960000.00

Net profit = Rs. 79373.00

Rate of return on sales turnover $\% = \frac{79373}{960000} \times 100 = 8.27\%$

6) Pay back period (Rs. in lakhs)

Year	Net profit	Depreciation	Total	Cumulative
1	0.446	0.610	1.056	[illegible]
2.	0.655	0.610	1.265	2.321
3	0.793	0.610	1.403	3.724
4	0.793	0.610	1.403	5.127
5	0.793	0.610	1.403	6.530
6	0.793	0.610	1.403	7.933

Therefore the pay back period is around 6 years.

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ANNEXURE - I

Total Fixed Assets:-

Items		Cost (Rs.)
A. Land & Building	-	75,500.00
B. Plant & Machinery	-	3,90,530.00
C. Preoperative cost	-	30,022.00
D. Contigency 10% of (A+B)	-	46,603.00
Total	-	5,42,655.00

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ANNEXURE - I-A

Land & Building:-

	Items	Cost (Rs.)
1.	Cost of 5000 sq.ft. of land @ Rs.5/=	- 25,000.00
2.	Cost of 1200 sq.ft. of built up area @ Rs.40/=	- 48,000.00
3.	Site improvement @ 10% of (1)	- 2,500.00
	Total	- 75,500.00

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ANNEXURE I - B

Plant & Machinery

	Items		Cost (Rs.)
1.	a. Injection moulding machine of shot capacity 200 cm^3	-	2,65,000.00
	b. Central excise duty @ 8%	-	26,200.00
	c. Central sales tax @ 4%	-	11,448.00
	d. Installation, electrical wiring, water connections and others @ 5% of (a+b+c)	-	14,882.00
2.	Moulds (7)	-	40,000.00
3.	Scrap grinder, Crane, over buffing machine, stamping M/C etc.	-	30,000.00
4.	Office equipment & Furniture	-	8,000.00
	Total	-	3,90,530.00

ANNEXURE - I - C

Preoperative Cost:

Items		Cost (Rs.)
1. Interest on loan @ 12% for 6 months.	-	23,767.50
2. Establishment	-	1,000.00
3. Travelling expenses	-	1,000.00
4. Property taxes.	-	1,500.00
5. Postage, telephone, telegram advertisement etc.	-	2,000.00
6. Building Insurance (1%)	-	755.00
Total	-	30,022.50
Rounded off	=	30,022.00

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ANNEXURE - II

Working Capital for 3 months:-

Items		Cost (Rs.)
A. Total raw material cost	-	4,34,526.00
B. Manufacturing cost	-	1,28,760.00
C. Other overheads	-	35,659.00
Total annual working capital	-	5,98,945.00
Working capital / 3 months	-	1,99,648.33

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ANNEXURE - II-A

Annual Raw Material Cost:-

Component	material	Wt. (gms)	Annual production	Total Wt. (kgs)	Cost/Kg (Rs.)	Total cost
Front Cover	HIP	60	48000	2880	32/=	92,160.00
Back cover	HIP	120	48000	5760	32/=	1,84,320.00
Grill	HIP	33	48000	1584	32/=	50,688.00
Side Grill	HIP	15	96000	1440	32/=	46,080.00
Lid	HIP	16	48000	768	32/=	24,576.00
Dial glass	SAN	15	48000	720	45/=	32,400.00
						4,30,224.00
			Other materials			4,302.00
			Total			4,34,526.00
			Rounded off		-	4,35,000.00

ANNEXURE - II-B

Manufacturing Cost:-

1. **Utilities:-**

   a. **Power:-**

Total connected load	=	30 KW.
Daily consumption (16 hrs) assuming 80% consumption	=	384 KWh.
Cost of power/annuam @ Rs.0.17/Unit.	=	17,280.00

   b. **Water:-**

Consumption of water by machine/annum at the rate of 1lit./6 Sec.	=	2880 Kilo lit.
For other uses	=	120 Kilo lit.
Total	=	3000 Kilo lit.
Make up water requirement (50%)	=	1500 Kilo lit.
Cost of water/annum @ 40 ps./ 1000 lit.	=	600.00
Total utility cost	=	17,880.00

contd.....

2. Salaries and Wages:-

Salaries of administrative & Technical Staff:-

Post	No./ shift	No. of shift	Salary (Rs.)	Total salary (Rs.)
Plant Manager	1	1	1200/=	1200.00
Plastic Technologist	1	1	800/=	800.00
Engineer cum shift supervisor	1	2	600/=	1200.00
Clerk cum Typist	1	1	500/=	500.00
Accountant	1	1	500/=	500.00
Peon	1	1	200/=	200.00
			Total	4400.00
Labour Charges				
Skilled	1	2	300/=	600.00
Semiskilled	6	2	200/=	2400.00
Unskilled	1	2	150/=	300.00
			Total	3300.00
			Total salaries & wages	7700.00
			Total salaries & wages/annum	92400.00
			Benefits and allowances @ 20%	18480.00
			Total	110880.00
			Manufacturing cost/annum (1 + 2) =	128760.00

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ANNEXURE - II-C

Other overheads:-

	Items		Cost (Rs.)
1.	Repair and maintenance of building @ 1% of I A-2	-	480.00
2.	Repair & Maintenance of Machine @ 5% of I B	-	19,526.00
3.	Travelling & advertising expenses	-	1,000.00
4.	Insurance 2% on fixed capital	-	10,853.00
5.	Property taxes	-	1,500.00
6.	Stationary, postage & telephone	-	1,200.00
7.	Miscellaneous	-	1,000.00
	Total	-	35,659.00

.....

ANNEXURE - III

Gross Capital Investment:-

Item		(Rs.)
1. Total fixed Capital	-	5,42,655.00
2. Working capital/3 months	-	1,99,648.00
Total	-	7,42,303.00

.....

ANNEXURE - IV

Other fixed cost and interest on Loan:-

a. Depreciation:

1. Depreciation on machine @ 15%	=	58,579.50
2. Depreciation on building @ 5%	=	2,400.00
Total	=	60,979.50

b. Interest on loan:

1. Interest on working capital loan @ 12%	-	17,968.32
2. Interest on fixed assets loan @ 12%	-	55,350.80
Total	-	73,319.12

Other fixed cost and interest on loan = 1,34,298.62

.....

ANNEXURE - V

Total cost of production (annual)

1. Raw material cost	-	4,34,526.24
2. Utilities	-	17,880.00
3. Personnel cost	-	1,10,880.00
4. Overheads	-	35,659.00
5. Other fixed cost and interest on loan.	-	1,34,298.62
Total	-	7,33,243.86

ANNEXURE - VI

Cost of production and Profitability (Rs. in lakhs.)

	Year	1	2	3
	Capacity Utilisation	70%	85%	100%
A.	Sales income	6.720	8.160	9.600
B.	Cost of production:			
	Raw material cost	3.042	3.694	4.345
	Utility	0.125	0.152	0.179
	Salaries & Wages	0.947	1.028	1.109
	Other overheads	0.250	0.303	0.357
	Depreciation	0.610	0.610	0.610
	Interest charges	0.513	0.623	0.733
	Total B	5.487	6.410	7.333
C.	Gross operating profit (A-B)	1.233	1.750	2.267
D.	Selling & distribution	0.336	0.408	0.480
E.	Profit before tax	0.897	1.342	1.787
F.	Income tax	0.451	0.687	0.994
G.	Net profit	0.446	0.655	0.793
H.	Profit before tax with interest added back	1.410	1.965	2.520
I.	Profit + depreciation	1.056	1,265	1.403

ANNEXURE - VII

List of radio receivers manufacturers:-

1. Philips (Pieco electronics)
2. Murphy (Micotronics)
3. Bush.
4. Nelco.
5. Televista
6. Weston electronics.
7. Bigstern electronics.
8. UMS Radio factory.
9. Polestar electronics.
10. Keltron.

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ANNEXURE - VIII

Production figures of radio receivers from 72 - 78

Year	Nos. in Million
1972	3.02 (1.04)
1973	2.62 (1.00)
1974	3.46 (1.40)
1975	2.52 (1.00)
1976	2.98 (1.30)
1977	3.76 (2.00)
1978	4.42 (2.50)

The figures in brackets shows the production in Small Scale Sector.

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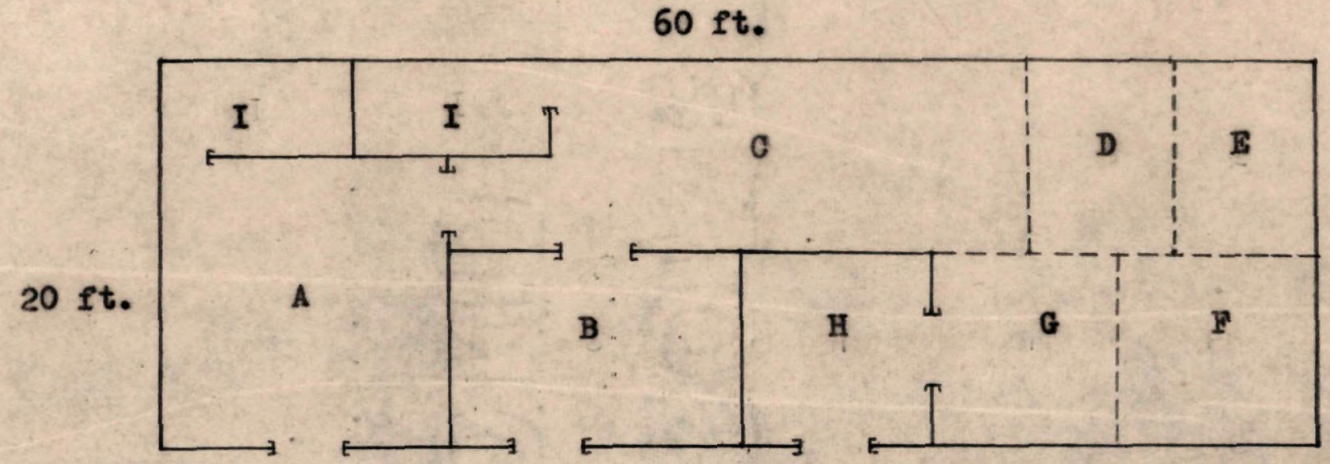
ANNEXURE - IX



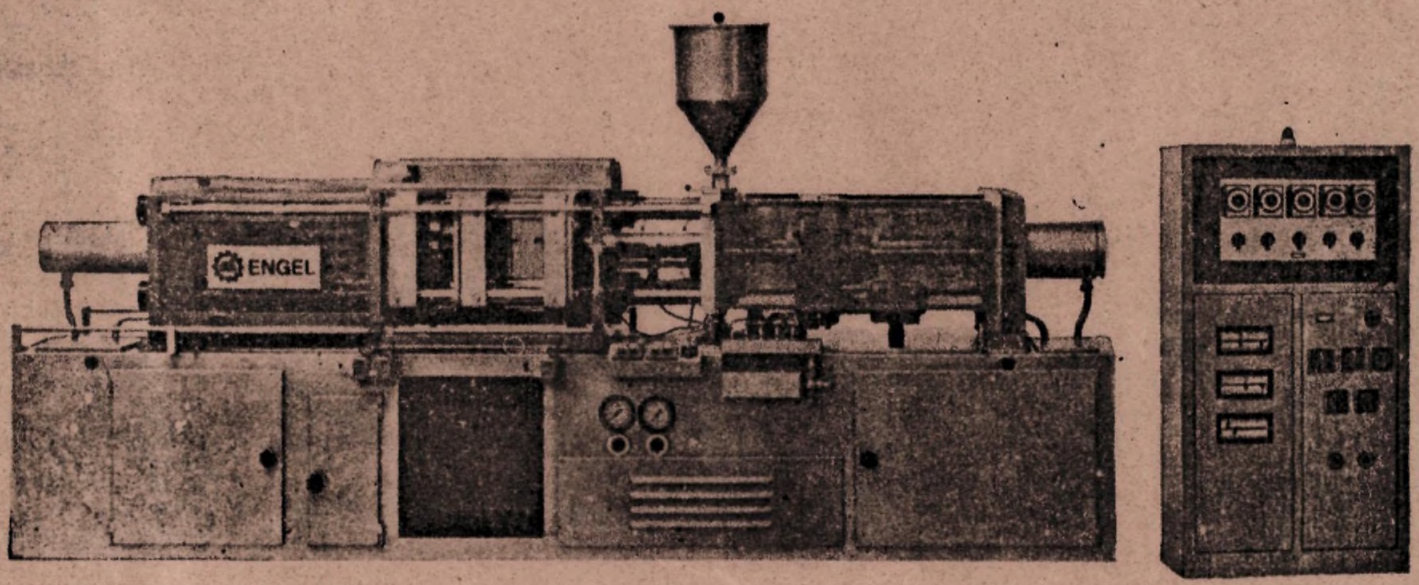
LAYOUT

A.	Office	-	225 sq.ft.
B.	Raw Material Store	-	150 sq.ft.
C.	Injection moulding	-	275 sq.ft.
D.	Stamping Machine	-	75 sq.ft.
E.	Scrap Grinder	-	75 sq.ft.
F.	Finishing & Inspection	-	100 sq.ft.
G.	Assembly section	-	100 sq.ft
H.	Finished goods store	-	100 sq.ft.
I.	Toilet	-	100 sq.ft.
	Total	-	1200 sq.ft.

ANNEXURE - X

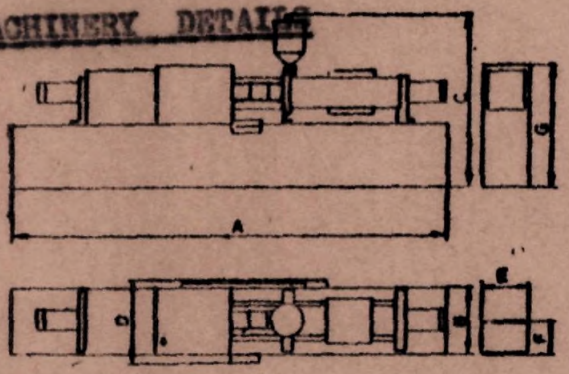
EI 100-200

Automatic Injection Moulding Machine with Screw Plasticizing for Shotvolume up to 200 cm³



ANNEXURE - X

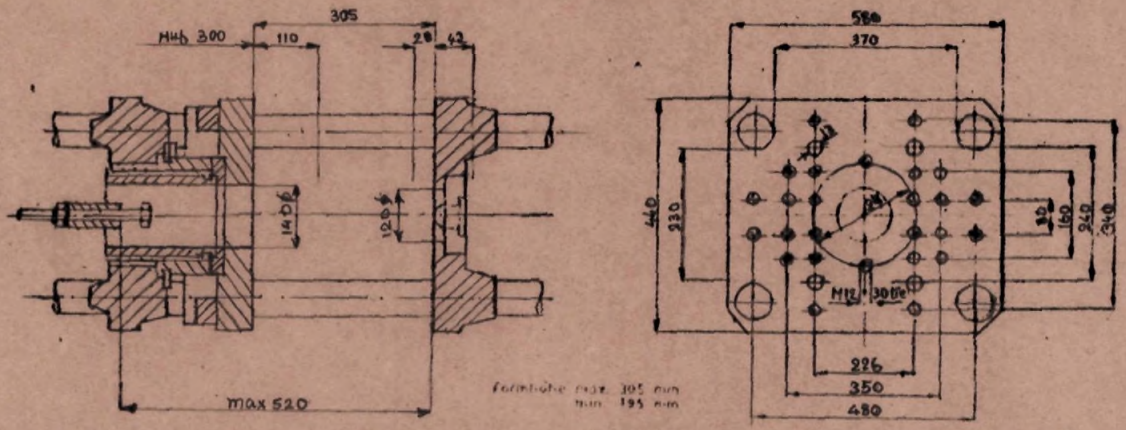
MACHINERY DETAILS



A	4125 mm
B	750 mm
C	1900 mm
D	1055 mm
E	700 mm
F	420 mm
G	1500 mm

Cases outside : 5·4/1·3/ 2

Weight :
gross : 4100 kg
net : 3500 kg



TECHNICAL DATA**
MODEL EI 100-200

1. INJECTION SIDE		SCREW UNIT I	SCREW UNIT II	SCREW UNIT III
Diameter of Screw	mm.	35	40	45
Maximum volume per injection*	cm³	135	180	220
Cross-section of Screw	cm²	9.6	12.6	15.9
Specific injection pressure (infinitely variable)	kg./cm²	1650	1270	1000
Plasticizing capacity*	kg./h.	35	40	45
Stroke of Screw	mm.	150	150	150
Number of Screw-rotations	r.p.m.	50-130	50-130	50-130
Absolute injection pressure	m/t.	15.9	15.9	15.9
Number of tie-bars (injection side)		2	2	2
Diameter of tie-bars	mm.	60	60	60
Number of injections (during idle run)	per hour	840	840	840

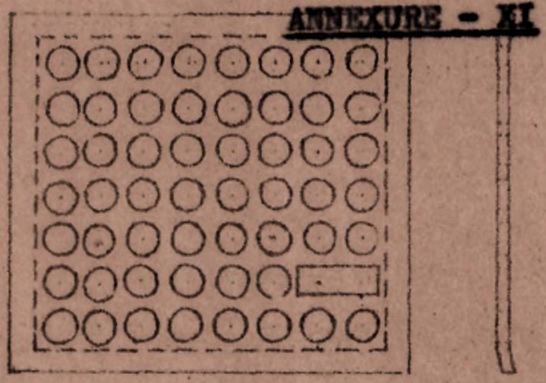
2. CLAMPING SIDE (SAME FOR ALL SCREW UNITS)		
Clamping Pressure	m/t.	140
Stroke	mm.	300
Number of tie-bars (clamping side)		4
Diameter of tie-bars	mm.	70
Distance between tie-bars	mm.	370 x 230
Size of mould fixing plate	mm.	580 x 440
Height of mould (maximum)	mm.	305
Height of mould (minimum)	mm.	195
Maximum mould opening	mm.	605
Maximum injection surface*	cm²	480

3. ELECTRICAL EQUIPMENT (SAME FOR ALL SCREW UNITS)		
Motor for drive of oil pump	kw	15
Heating capacity	kw	5.1
Heating controls	Pcs.	3
Timing relays	Pcs.	5

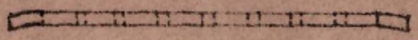
**Subject to modifications due to continuous research and development

*Depending on material, conditions of working and type of mould.

ANNEXURE - II

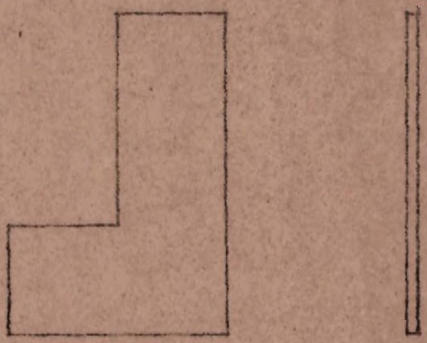


FRONT VIEW SIDE VIEW

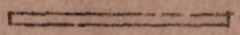


SIDE VIEW

GRILL

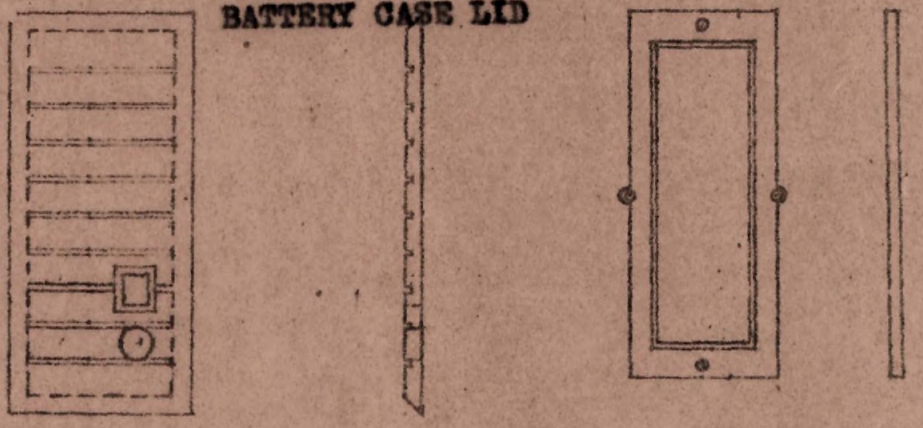


FRONT VIEW SIDE VIEW

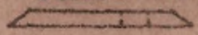


SIDE VIEW

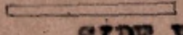
BATTERY CASE LID



FRONT VIEW SIDE VIEW FRONT VIEW SIDE VIEW



SIDE VIEW



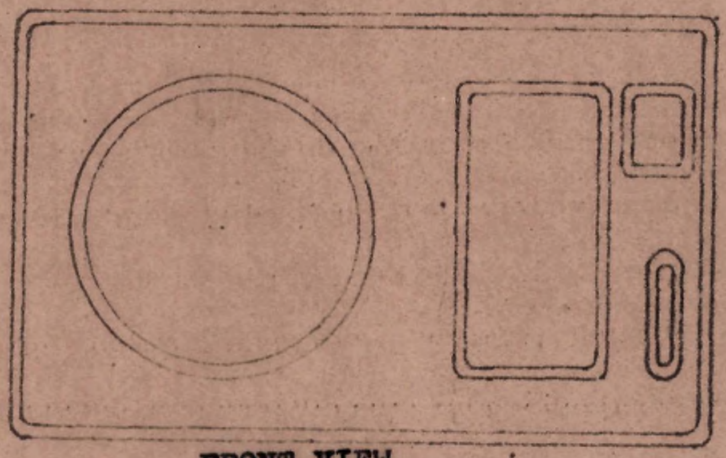
SIDE VIEW

SIDE GRILL

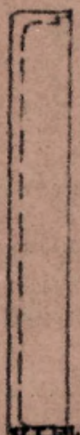
DIAL GLASS

ANNEXURE-XI

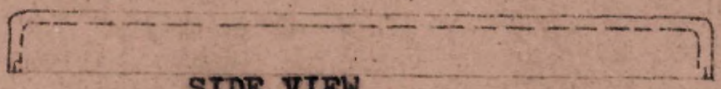
COMPONENTS OF RADIO CABINET



FRONT VIEW

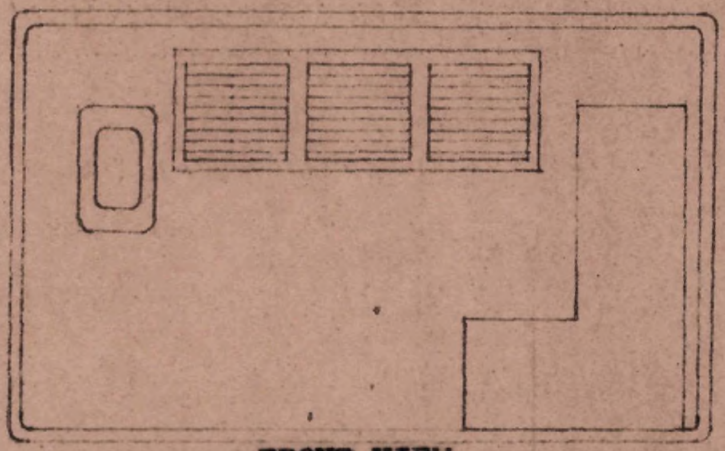


SIDE VIEW

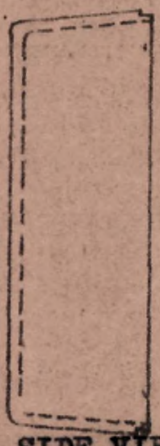


SIDE VIEW

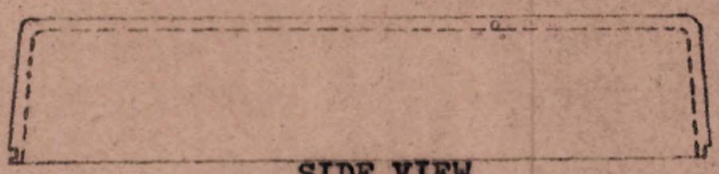
FRONT COVER



FRONT VIEW



SIDE VIEW



SIDE VIEW

BACK COVER

APPENDIX - I

List of injection moulding machine manufacturers:

1. Engel India,
   Machine & Tools Limited,
   1, Taratala Road,
   Calcutta - 700053.

2. M/s R.H. Windsor India Ltd.,
   6 U Road, Thana Industrial Estate,
   Maharashtra - 400 604.

3. M/s Nerangan Plastics,
   Std. Metal estate,
   Old Nagardas Road,
   Andheri (East),
   Bombay - 400069.

4. M/s Juneja Engg. Works.,
   A/36 M/DC Industrial Area,
   Central Road, St. No.2,
   Andheri (E),
   Bombay - 400093.

5. Hindustan Machines & Tools,
   Bangalore,
   Karnataka.

6. M/s Plasmac Machine Manufacturing Corporation Pvt.Ltd.,
   35, Interlink Industrial Estate,
   Caves Road,
   Jogeswari East,
   Bombay - 400060.

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APPENDIX - II

List of Mould Manufacturers:-

1. Trencos Ltd.,
   Veli Industrial Estate,
   Trivandrum, Kerala.

2. Accurate Moulds & Dies,
   United Industrial Estate,
   Shanti Nagar,
   Vakola Pipeline,
   Santacruz (East),
   Bombay - 55.

3. Calcutta die Works,
   Prabhadevi Industrial Estate,
   Veer Savarkar Road,
   Bombay - 25.

4. Ferrodle Ltd.,
   C-43, Road No.22,
   Thana Industrial Estate,
   Bombay.

5. Kalyan Engineering Corporation,
   Plot A-160,
   Wagle Industrial Estate,
   Thana, Bombay.

6. Mould craft,
   78, Government Industrial Estate,
   Kandiveli (W),
   Bombay - 67.

7. Kaycee Scientists tool manufacturing co.,
   Bombay Talkies Compound,
   S.V. Road, Malad,
   Bombay - 64.

8. Keming tools Mfg., Co. (P) Ltd.,
   16, Bank Street,
   Fort, Bombay - 1.

9. Universal Machine & Service,
   Tarun Plastics Industrial estate,
   Mogra Road,
   Bombay - 59.

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APPENDIX - III

Raw Materials Suppliers:

1. Polychem Limited.,
   Jamshedji Tata Road,
   Church gate Reclamation,
   Bombay - 1.

2. Hindustan Polymers Ltd.,
   Brown Boveri Houses,
   264 A. Besant Road.,
   Worli,
   Bombay - 18.

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