

CLOTH MEASURING DEVICE FOR
RETAIL SHOPS

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1973

**cloth measuring device for
retail shops**

diploma project 72-73

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Cloth measuring device for retail

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Cloth Measuring Device for Retail Shops

Diploma Project

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

by

Manoranjan R. Gandhi

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Industrial Design Centre
Indian Institute of Technology
Bombay

1973

Guide

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Approval Sheet

Diploma Project entitled

"Cloth Measuring Device for Retail Shops"

by Manoranjan R. Gandhi is approved for
the postgraduate diploma in Industrial
Design.

Guide

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and

Retail Shops in Bombay

Workshop staff

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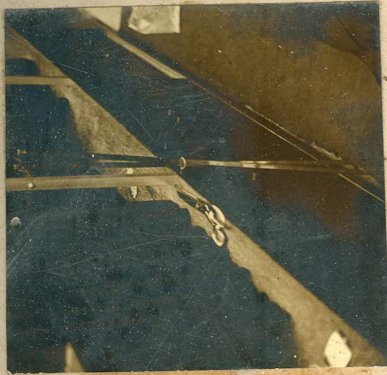
My friends.

Contents .

1. Problem Statement
2. Introduction
3. History
4. Information
5. Analysis
6. Hypothesis
7. Synthesis
8. Communication
9. Bibliography

1. PROBLEM STATEMENT

To design cloth measuring device
for retail shops.



2. INTRODUCTION



Importance of the cloth is connoted by the fact that it satisfies the second but not the secondary economic want of man after food. Textile industry is world's second largest industry to which 10% of world's energies are devoted, which plays a major role in world economy.



Millions of metres of cloth produced by world industry is measured out manually with measuring stick or tape at retail level. The process of cloth measurement at retail level is the most habitual, oldest and universal.



The idea behind taking up the project is to design intermediate link between customer and salesman which will make retail cloth measuring more convenient and faster. Such a design can become a boon for the salesman at the time of stock checking particularly for mill's retail shops.

Considering present case of industrial and technological development, fashions and competitive market, it is found that the major factor governing the production of cloth in industry is the feed back which sales department obtains from the sales of the cloth at retail level. Bearing all these factors in mind, I feel that my attempt in designing such a device will be justified.

3. HISTORY

3.1 Development of textile industry in India.

The origin of textile mill industry in India dates back to 1818, when the first cotton mill was set up in Bengal by an English enterprise, but it was only in 1854 that the first cotton mill was established in Bombay by Mr. Cowasjee Bhabar. The progress of the industry during last one and half a century has been so remarkable that it certainly constitutes one of the most interesting chapters in the economic history of India.

India was under British rule, which was not allowing growth of the industry, but the 1st World War gave an impetus to the industry in India, but the post-war depressions hampered the progress of the industry for certain period.

Undivided India before the outbreak of II World War used to export cotton to the tune of about two million bales a year. The II World War stopped this export. So Government devised ways and means to diversify acreage from cotton to the other commodities. Thereafter Indian cotton was feeding entirely Indian industries. After partition in 1947 the supply of cotton from Pakistan disappeared

GROWTH OF COTTON MILL INDUSTRY

As at commencement of the year

NUMBER OF MILLS

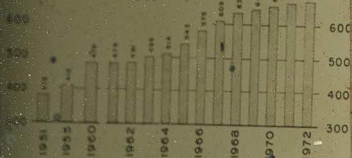
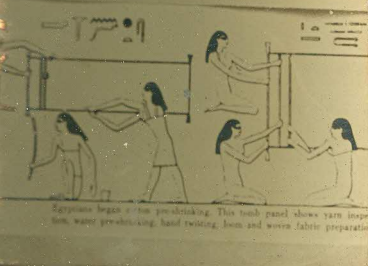


TABLE 2: GROWTH OF INDIAN COTTON MILL INDUSTRY

Year	Spinning Mills		Composite Mills		Total	
	Number of Mills	Spinning Spindles (in 1000)	Number of Mills	Spinning Spindles (in 1000)	Number of Mills	Spinning Spindles (in 1000)
1951	100	1,000	215	9,150	315	10,150
1952	107	1,070	226	9,260	333	10,330
1953	113	1,130	232	9,320	345	10,450
1954	116	1,160	236	9,360	352	10,520
1955	121	1,210	242	9,420	363	10,630
1956	124	1,240	245	9,450	369	10,690
1957	127	1,270	248	9,480	375	10,750
1958	129	1,290	251	9,510	380	10,800
1959	131	1,310	254	9,540	385	10,850
1960	133	1,330	257	9,570	390	10,900
1961	135	1,350	260	9,600	395	10,950
1962	137	1,370	263	9,630	400	11,000
1963	139	1,390	266	9,660	405	11,050
1964	141	1,410	269	9,690	410	11,100
1965	143	1,430	272	9,720	415	11,150
1966	145	1,450	275	9,750	420	11,200
1967	147	1,470	278	9,780	425	11,250
1968	149	1,490	281	9,810	430	11,300
1969	151	1,510	284	9,840	435	11,350
1970	153	1,530	287	9,870	440	11,400
1971	155	1,550	290	9,900	445	11,450
1972	157	1,570	293	9,930	450	11,500



HISTORICAL DEVELOPMENT OF TEXTILE FIBERS

10,000 Flax used in Swiss lake dwellings
3,000 Wool in industry in Mesopotamia
2,000 Silk originated in China
1,500 Cotton in India in India

1861 Robert Hooke (Sw) suggested man-made fibres
1865 George Audemans (Swiss) made cellulose nitrate
1867 Schwaner (German) made rayon from wood
1889 de Chazelles (French) produced rayon commercially
1892 Viscose rayon process, England
1910 Viscose rayon produced, United States
1913 Cuprammonium rayon produced in United States
1921 Acetate rayon produced in United States
1935 Lanthan rayon (fibers) produced in Italy
1936 Lanthan rayon (fibers) produced in United States
1937 Viscose rayon (fibers) produced in United States
1938 Terylene (nylon) produced in England
1944 Viscose rayon (fibers) produced in United States
1949 Dacron produced in United States
1950 Orlon produced in United States
1951 Acrilan produced in United States
1952 Nylol produced in United States (pilot plant)
1954 Terylene produced in United States

and in order to keep up cotton industries running, India had to start import of cotton from other countries. Cotton industry is a big industry which not only supports large number of people, but also supports number of ancillaries. Initially, import of textile machinery was considerable, but now it has dropped considerably as the indigeneous manufacturers are now able to supply requirements of present textile mills.

It was in the year 1912-1913 that India was importing 3000 million yards of cloth for clothing its population. But now the position has been completely changed. It is not only producing full quota for the requirement of its large population of 550.51 million people, but it also exports substantial quantity of cloth ranging from 100 to 400 million metres.

The future of textile industry in our country is bright as the mills are adopting and installing processes and machinery which are capable to give larger output at the reduced cost together with good quality which compares favourably with those produced in other textile centres in the world. Also industries are trying to become self-reliant in case of man-made fabrics. The industries have become research conscious and many textile research centres have been organised in our country.

which will assist this industry by developing new processes and automation to reduce waste, produce superior quality of cloth at reduced cost.

There are five countries in world cotton market viz. U.K., U.S.A., Japan, Continental Europe and India, out of which only U.S.A. and India produces cotton. Rate of Indian cotton is less than United States. Hence there is tremendous advantage for our country to modernise industries so that it can work at lower cost, more efficiently to produce cloth, in good quality at low cost so as to achieve top rank in the world market.

Today, natural fibres finds great difficulty to compete with man-made fibres, but still considering the initial cost and specific properties of the fibre, natural fibres has its own standing in the consumer market. The future is of research and development in blended fabrics, in order to have two fold benefits of the natural and synthetic fibres for the consumers.

3.2 Development of unit of measurement.

Units of measurement were derived by men from the nature. In the great civilisation of ancient Egypt, Greece and Rome, philosophers pondered over natural events, then by s

speculating the facts known to them, they tried to fit their observations into a logical scheme to derive units of measurement, Aristotle was one of such Greek philosopher. One of the reasons of the lack of scientific advancement by the Romans was their cumbersome number system. Roman system was replaced by the present Arabic system in thirteenth century. Leonardo da Vinci and Galileo performed quantitative and qualitative experiments using measurements as an important part of their experiments in sixteenth century. History also reveals that people of ancient civilisation were using palm, hand widths and foot steps as standards for measuring length.

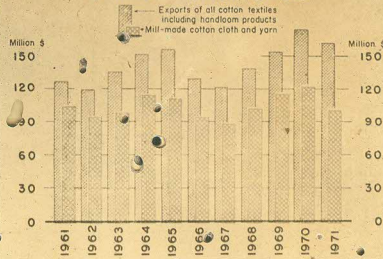
Unit of length:

British unit of length is foot, which is commercially used by Britain, Japan and U.S.A. The metric system of measurement was developed in France near the end of eighteenth century. Today it is used everywhere in the scientific world. In the unit of metric system is one metre which was hoped to be exactly 10^{-7} of the distance from the earth's equator to the either pole. For many years standard metre was defined as the distance measured at 0°C between two parallel lines scratched on a platinum irridium bar kept at the International Bureau of Weights and Measures at Se'vres, near Paris, France.

From this many standard copies were made. In 1960 International Conference on Weights and Measures defined a non-destructible standard meter which any properly equipped laboratory can reproduce as a standard meter. By this new definition meter is described in terms of orange-red spectral lines of light emitted from excited atoms of Krypton-86. The meter is 1,650763 times the wavelength of this light. Standard yard was fixed by the relation $3600 \text{ meters} = 3937 \text{ yards}$ or $1 \text{ meter} = 39.37 \text{ inches}$.

CONSUMPTION OF CLOTH

EXPORTS OF COTTON TEXTILES



PACKED PRODUCTION OF CLOTH FOR CIVIL EXPORT AND OTHER PURPOSES
(In Million Metres)

Year	Coarse		Lower Medium		Higher Medium		Fine		Superfine		Pima		Total		For Government purposes	Total
	Civil	Export	Civil	Export	Civil	Export	Civil	Export	Civil	Export	Civil	Export	Civil	Export		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
1961	589	178	1,397	270	1,814	84	170	1	174	34	247	—	4,181	270	23	4,264
1962	543	165	1,332	243	1,782	63	169	4	173	39	220	—	4,069	216	28	4,033
1963	563	170	1,403	244	1,851	72	175	8	189	48	283	—	4,274	242	88	4,366
1964	600	172	1,456	252	1,935	91	188	14	200	52	306	—	4,423	261	84	4,462
1965	574	159	1,385	239	1,843	84	179	12	209	62	349	—	4,205	241	76	4,222
1966	523	134	1,205	179	1,641	84	179	12	209	62	349	—	4,205	241	76	4,222
1967	512	112	1,188	190	1,573	80	154	13	214	44	364	—	4,005	241	42	4,000
1968	537	121	1,205	193	1,612	78	167	18	223	60	343	—	4,005	241	42	4,000
1969	403	707	1,060	179	1,609	83	147	11	216	42	319	—	3,800	276	41	4,017
1970	457	85	964	137	1,530	66	171	9	234	63	357	—	3,800	276	34	4,019
1971	546	88	1,072	150	1,523	69	173	13	239	52	346	—	4,005	274	34	3,963

Neg—Negligible

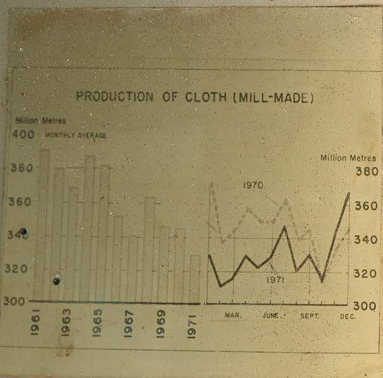
ALL-INDIA EXPORTS OF RAYON AND SYNTHETIC FABRICS

Year	Mis.	Rs.
1952	54,03,531	66,66,873
1953	25,50,162	41,67,320
1954	33,67,497	61,17,145
1955	26,72,594	51,70,636
1956	29,02,194	59,73,513
1957	25,68,894	49,97,513
1958	3,01,24,479	9,12,92,061
1959	1,78,95,767	4,18,96,064
1960	3,61,17,717	4,56,84,695
1961	6,73,49,899	6,32,60,881
1962	8,37,62,723	9,11,31,878
1963	9,04,88,782	10,35,31,500
1964	7,12,70,305	8,26,32,787
1965	3,04,55,866	4,36,63,173
January-May 1966	2,63,22,106	2,55,72,832
June-December 1966*	1,45,89,658	1,91,32,315*
1967	38,65,690	94,83,484
1968	1,54,22,903	3,03,54,797
1969	1,55,00,000	3,56,00,000

PER CAPITA AVAILABILITY OF CLOTH

Period	Estimated mid-year population (in millions)	Availability for home consumption (Million metres)		Per capita availability	
		Cotton cloth	Man-made fibre fabrics	Cotton cloth	Man-made fibre fabrics
				Metres	Metres
1	2	3	4	5	6
1951	363.30	3,992	—	10.99	—
1952	369.45	3,972	—	13.46	—
1953	375.94	5,273	—	14.03	—
1954	382.78	5,293	—	13.83	—
1955	390.00	5,595	n.a.	14.35	—
1956	397.62	5,847	n.a.	14.71	—
1957	405.67	5,882	n.a.	14.50	—
1958	414.16	5,913	382.16	14.28	0.92
1959	423.12	5,806	485.38	13.72	1.15
1960	432.56	5,971	520.52	13.80	1.20
1961	442.74	6,527	508.93	14.74	1.15
1962	453.41	6,482	526.71	14.30	1.16
1963	464.34	6,780	573.59	14.60	1.24
1964	470.53	7,179	766.88	15.10	1.61
1965	486.99	7,097	833.47	14.57	1.71
1966	498.86	6,874	812.06	13.78	1.63
1967	511.30	6,832	879.17	13.37	1.72
1968	524.05	7,400	975.70	14.12	1.86
1969	537.12	7,259	942.72	13.51	1.76
1970	547.00	7,480 (f)	921.39	13.67 (f)	1.68

PRODUCTION OF CLOTH



PRODUCTION OF MAN-MADE FIBRE TEXTILES

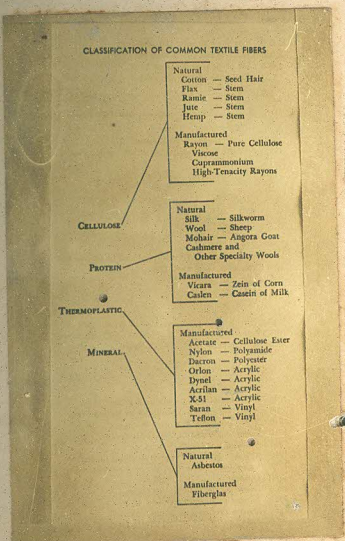
(figures in thousands)

Year	MAN-MADE FIBRE TEXTILES		
	Dissolved rayon	Wool	Total (1)+(2)
(1)	(2)	(3)	(4)
1951	28,312	12,973	299,487
1952	42,991	6,201	436,192
1953	58,820	2,739	589,379
1954	57,000	2,870	572,160
1955	57,517	2,125	602,283
1956	67,555	3,151	651,687
1957	82,467	2,701	835,168
1958	86,672	3,812	870,284
1959	84,000	12,646	852,646
1960	87,000	5,800	881,600
1961	98,600	4,100	892,500
1962	102,800	1,600	894,000
1963	111,820	1,400	933,380
1971	146,620*	1,420*	1,460,000*

TOTAL PRODUCTION OF CLOTH

Calendar Year	1951 Cloth (million metres)	Percentage to Total Cloth Production	Handloom and Powerloom Cloth (million metres)	Percentage to Total Cloth Production	Total Cloth Production
(1)	(2)	(3)	(4)	(5)	(6)
1951	3,737	78.4	1,013	21.6	4,750
1952	4,381	76.2	1,313	23.8	5,694
1953	4,461	76.0	1,409	24.0	5,870
1954	4,170	71.1	1,312	20.9	5,482
1955	4,618	74.2	1,624*	25.8	6,242
1956	4,932	74.3	1,683	25.7	6,615
1957	4,662	72.9	1,811	27.1	6,473
1958	4,381	69.4	1,980	30.6	6,361
1959	4,104	69.2	1,772	31.2	6,376
1960	4,816	69.6	2,083	30.4	6,899
1961	4,261	66.4	2,372	33.6	7,633
1962	4,106	62.4	2,462	37.6	8,568
1963	4,623	61.6	2,876	38.4	9,499
1964	4,674	60.3	3,081	40.8	10,755
1965	4,301	60.6	3,001	40.4	11,302
1966	4,229	57.0	3,301	43.0	12,530
1967	4,001	56.3	3,179	43.7	13,180
1968	4,366	55.3	3,330	44.7	14,696
1969	4,381	56.1	3,338	43.9	15,719

	Fibers	Sources or Classification
Natural fibers	Cotton	Cotton plant (cellulose)
	Flax	Flax plant (cellulose)
	Wool	Sheep (protein)
	Silk	Silkworm (protein)
Man-made fibers	Viscose rayon	Cotton plant (cellulose)
	Cuprammonium rayon	Cotton plant (cellulose)
	Acetate	Tree (cellulose)
	Amel	Tree (cellulose)
	Vicars	Corn (protein)
Synthetic fibers	Nylon	Polyamide
	Dacron	Polyester
	Orlon	Acrylic
	Acrilan	Acrylic
	Dynel	Acrylic
	Creslan	Acrylic
	Varel	Acrylic
	Zelran	Nitrile-acrylic alloy
	Darvan	Dinitrile
	Saran	Vinylidene chloride
	Fiberglas	Glass



CLOTH¹

(Million square yards)

Country	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
U.K. ²	1,047	1,014	1,035	1,015	915	745	731	723	686	611
Belgium	793	823	860	754	740	684	707	708	703	717
Holland	657	636	648	589	536	492	496	469	464	424
France	1,983	1,985	1,988	1,716	1,795	1,723	1,607	1,624	1,562	1,563
W. Germany	N.A.	2,015	1,998	1,986	1,900	1,674	1,747	1,777	1,698	1,657
Italy	1,368	1,361	1,267	970	1,203	1,181	1,111	1,088	1,090	1,033
Austria	...	...	...	...	116	103	99	104	93	92
Portugal	350	400	423	445	437	436	446	466	464	N.A.
Pakistan ²	725	731	758	719	741	771	761	795	805	N.A.
Spain ³	635	593	558	765	998	1,069	756	810	819	759
Japan ⁴	3,687	3,515	3,547	3,603	3,484	3,379	3,282	3,324	3,129	2,965
Canada ⁵	...	...	...	...	353	369	304	305	266	267
*U.S.A. ²	9,256	8,771	8,966	9,238	8,840	8,278	7,477	6,968	6,246	6,157
U.S.S.R.	5,884	6,056	6,430	6,588	6,817	7,075	7,310	7,424	7,353	N.A.
Hongkong	509	560	579	650	674	733	789	765	772	774
India ²	7,624	7,982	8,342	8,358	8,022	7,957	8,635	8,527	8,584	8,045

4.1.3

The details regarding number of cloth shops in Bombay were not available. But it is observed that the ratio of number of small cloth shops to big cloth shops (like Mill's retail shop) is very large.

4.2 Information from retail shops and salesmen.

4.2.1

In all retail cloth shops the following measuring device is used.

- Half and or full meter stick. This is used almost everywhere at present. Half meter stick is found particularly in some saree and blouse-piece shops.
- Measuring tape, particularly found in small shops, like tailors and cloth merchants and mattress maker's shops.
- Marking of meter length on sales table for measuring cloth was not found in any cloth shop in Bombay. This is old and out-dated method of measuring cloth, but it is still used in some small shops in towns and villages.

4.2.1.1

The cost of meter stick is about Rs.5/- and it bears standard mark and inspected by the Officers of Inspectorate of Weights and Measures.

The following is the cycle of operation in the cloth shops.

- Customer comes in the shop, selects the cloth which he want to see.
- Salesman fix up the wraps which the customer requires and unfolds it by 1 - 2 meters in front of the customer.

Customer selects the cloth after seeing it, feeling it with hand and many times wearing it around or keeping it on the body. Then he tells the salesman to meter it according to his requirement.

On selection of the cloth by customer, the salesman by experience unfolds the cloth from the wrap little more than the customer requirement. He measures the cloth by meter rod, to the required length and then takes the scissor and cuts it.

- After cutting comes the packing operation which varies from shop to shop, but in general, it is done in the following ways.

- a. In small shops salesman himself folds the cut cloth, packs up in a paper or pvc bag and gives it to the customer.
- b. In some shops salesman folds the cloth and passes on to the peon at the gate. The peon packs it up and keeps it ready for the customer. On seeing the bill and putting delivery stamp he delivers



the cloth to the customer.

c. In some retail shops at the time of folding, the peon does remeasuring before packing the cloth.

Cloth wrapping and placing it to the original place.

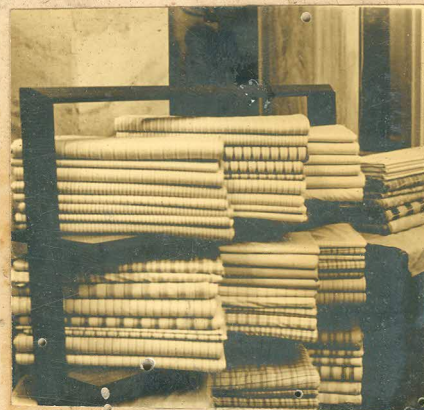
The operation is done by the salesman when the customer leaves. In many shops because of heavy rush, a peon is employed to do the wrapping work. In many cases part of the wrapping work is done after the business hours.

4.2.2.1

It is found that in many western countries 80% of cloth is sold in readymade form, and retail level measuring procedure is the same.

4.2.3

Layout of the cloth in shops varies considerably from shop to shop depending upon the type of shop and space in it.



4.2.4

There are two types of shops in our country.

- . One in which the salesman is sitting on a mattress, customer also sits on the mattress and selects the cloth. This is old and traditional method.
- . In second type of shops the salesman and the customer are separated by a table partition, both of them stand at the time of business. Most modern cloth shops cloth is well displayed and it is very easily accessible by the customers and salesmen. The height of sales table is upto the salesman's waist i.e. about 100 cm.



4.2.5

Types of cloth wraps.

- . Rectangular cardboard pieces.
- . Cloth wrapped in roll form on paper tube or wooden stick.
- . Cloth folded in meter fold.

Cardboard wraps are mostly found for cotton, Khadi and other rough cloths, while roll wraps are found for fine and superfine cloths, satin, synthetic cloth, silk and other man made fibres. Khadi and handloom do not have roll wraps.

4.2.6

The following are the different width in which the cloth is available. The cloth having with greater than 36" (90 cm.) are available



in double fold.

Single fold	-	27" (68 cms.)
		30" (76 cms.)
		36" (90 cms.)
Double fold	-	40" (100 cms.)
		44" (110 cms.)
		52" (130 cms.)
		54" (135 cms.)
		60" (150 cms.)
		72" (180 cms.)

This widths are not strictly fixed, few centimeters variations in width is always there from one mill's cloth to another, e.g. terywool, allwool suiting width varies from 54" - 58" or 137 - 146 cms. It is found that only cardboard folds and not roll folds are used for double folding.

4.2.7

The number of meters contain in each wrap is not fixed, but generally varies from 4 m. to 50 m.

4.2.8

The following table gives approximate information regarding the total sales of cloth in meters per day. This information is collected randomly from the different cloth shops situated at various places in Bombay.

Shop	Non-seasonal sales of cloth per day	Seasonal sales per day	Cloth measured by a salesman		
			Average per day	Max.at one time	Min.at one time
1. Mill's retail shop	50 m	100 m	25 m	42 m	10 cm and multiples
2. -do-	50 m	100 m	35 m	22 m	5,10 cm and multiples
3. -do-	1000 m	1.5 times of N.S.S.*	80 m	40 m	-do-
4. -do-	500 m	1.5-2 times of N.S.S.	60-80 m	35 m	-do-
5. Khadi	75-80 m	1.5 times of N.S.S.	30-40 m	30 m	10 cm and multiples
6. Private having Mill agency	300 m	500 m	30-50 m	24-28 m	-do-
7. Private	300-500 m	2 times of N.S.S.	60 m	Mostly 60 70 80 cms.	5 cm and multiples
8. Small	20-30 m	1.5-2 times of N.S.S.	20-30 m	10 m	5,10 cm and multiples

* N.S.S. - Non-seasonal sales per day.

4.2.9

Costly cloths like woollen, synthetic and blended fabrics required very precise measurement.

4.2.10

The following are the average figures found by observation in cloth shops.

Average sales per customer	-	4 - 6 m
Average length for pant piece	-	1.10 - 1.20 m double width
Average length for shirt piece	-	1.10 - 1.25 m single width
Average length for suiting	-	80% 2.70 m 20% 3.00 m people
Saree lengths	-	4.5, 4.6, 5 m
Dhoti lengths	-	3.7; 7.3; 8.2; 9.7 m

4.2.11

Sales of sarees and dhotis does not require any measurement as it comes in measured form from the cloth industries. Also it's found that cut-piece shops very rarely requires measuring although they keep the meter stick to satisfy the customers, but hawkers selling cut-pieces do not keep measuring tape or stick.

4.2.12

The top ranking sales are of poplin and other shirting cloth, long cloth, dhotis, sarees, sheetings and suitings.

4.2.13

It is found that new salesman requires 2 to 3 days and atleast 100 meter of measurement



of cloth in order to get accustomed to measure the cloth efficiently and accurately.

4.2.14

The following observations were made while measuring average time required for an average salesman.

Length	Unfolding and measuring	Cutting & folding	Packaging
1 meter	10 sec.	10 sec.	30 sec.
2 m	30 sec.	30 sec.	30 sec.
5 m	45 sec.	45 sec.	45 sec.
10 m	60 sec.	90 sec.	60 sec.



Bag packing takes minimum time of about 15 sec. but it is costlier than paper packaging. It is found that thicker and very thin cloth takes double time for measurement than the normal cloth. It was also observed that total average time taken by the salesman to give 5 meter packed cloth is 2 minutes, sales talks adds up some more time in this process.

4.2.15

It is found from the salesman that at one time cloth measurement upto 5 meters is okay, 5 to 10 meters is little inconvenient and greater than 10 meters, it is tiresome.



4.2.16

Many private shops do stock checking once a year while mill's retail shops keeps the shop closed for minimum three days to carry out stock checking twice a year. At this time salesman measures every wrap by meter stick and makes the account.

4.2.17

Many cloth shops and mill's retail shops sells 'unit packaging' or 'ready pack form' of cloth for shirting, suiting and blouse pieces in certain standard lengths.

4.2.18

Salesman also prepares bills for the customer. In small shops only single copy of the bill is given to the customer while in most of the mill's retail shops two or three bill system is used. The bills are in different colours. Salesman prepares three bills, out of which two is given to the customer and one is passed to the packaging peon with the cloth. Customer shows bills to the cashier, pays the amount. The cashier on receiving payment stamps 'paid' on the bills and gives one bill to the customer, customer on giving this bill to the packing peon gets his packet delivered with the original bill marked 'delivered'.

4.2.19

It was found that 80 to 90% of the total retail sales of the cloth takes place in the evening hours between 4 p.m. to 8 p.m.

4.2.20

The following observations were made during evening hours in a busy retail shop.

- . Limited place both for the salesman and the customer.
- . There is no time to fold the unwrapped cloth for the salesman. Cloth wraps were lying scattered on the sales table.
- . Due to lack of space every corner of the shop was utilised for storing and displaying the cloth.
- . Many a times the salesman has to search for meter stick and scissor covered under the wraps.
- . Many times the salesman has to climb the sales table to fetch the cloth required by the customer. Bigger shops and mill's retail shops do not have this problem.

4.2.20.1

Shops were found tidy, neat and clean.

4.3 Information from customers

4.3.1

Cloth is selected by adult persons only.

4.3.2

Some of the customers stated that by present system of measurement they don't feel that they had to wait long to get the cloth in required length in packed form because they are at

leisure when they come to buy the cloth.

Also sales talks psychological tendency to see other cloths and social environment are the other factors which affects them a lot.

4.3.3

Customers shows greater tendency to buy cut-pieces if it is good in quality and available at discount, but they show lesser tendency to buy 'unit packaging' or 'ready packed cloth' available at the same cost as that of the cloth from the wrap, as they psychologically doubt about the quality and the size of the cloth. They like to take slightly more cloth for the stitching rather than taking second visit to the shop.

4.3.4

Some customers do not mind to buy good quality of cloth having washable stains on it if it is offered to them at a discount rate.

4.3.5

While buying the cloth, customer wants to feel the cloth, possibly they want to wrap around the cloth and see in the mirror how it suits to them. They also want confirmation on quality of the cloth by feeling it, consulting with the salesman and their colleagues. They also take long time in deciding what print or which cloth is to be taken and also sees the different cloths even though they don't want to buy. Many customers says that they don't



plan to buy the cloth. Many suggested that they are making use of shareholder's coupon for buying the cloth.

4.

4.4 Information from cloth industries

4.4.1

The following are the major cloth industries.

- . Different mills - cotton, woollen, silk, rayon, etc.
- . Dyeing, printing and process houses.
- . Power looms
- . Wrap knitting industries

4.4.2

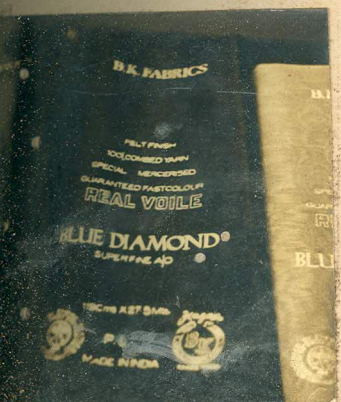
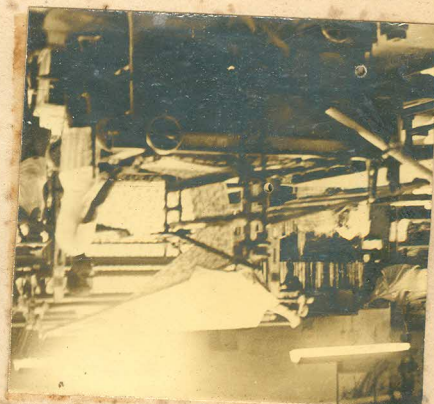
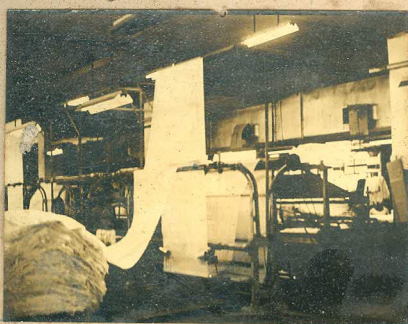
The production in the cloth industry is at present entirely governed by the feedback obtained by sales department from the whole sellers who in turn are governed by the retailers.

4.4.3

Finished cloth from the finishing department of the industry is passed on to the folding department. In the folding department the following cycle of operation was observed.

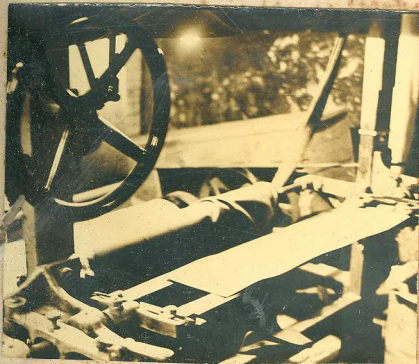
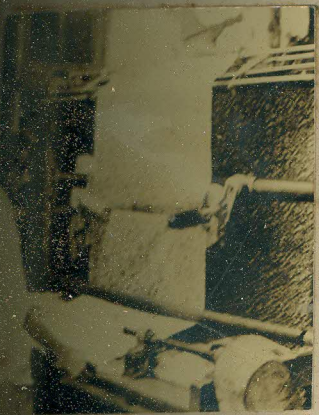
- . Finished cloth was folded in meter length by single and double folding machines.

In some cloth industries, measuring kantas are used to fold the cloth in meter length. This measures upto 100 meters at a time and use to measure particularly saree and dhoti lengths in industries.



- After meter folding the cloth is passed on to the cut-lookers, who check the quality of the cloth, look for stains and defects on the cloth and then cut the cloth in lengths to wrap it on the roll or cardboard according to the whole sellers' requirement. They write numbers of meters and quality number by pencil on the wrap.
- The cloth wraps are made manually or by roll and cardboard wrap folding machines.
- The printing on the wrap is done by block or screen-printing according to the standard and as per whole sellers' requirement.
- Individual wrap and bale packing is done according to the whole sellers' requirement. Finally, the bales are marked with

order number, and weighed before sending to the respective parties.



- . In many industries selvedge stamping machines are used as an attachment to the folding machine in order to print continuously at a fixed distance on the cloth border, at the time of folding.
- . Counting the number of meters of cloth is done manually by the worker. It was found that counter attachment to record number of folded meters was not found efficient and practical and hence it was not used.
- . One meter and 1.5 m. steel rods are used by the cut-lookers just to check the length folded by the meter folding machine.

- It was found that efficient worker takes five minutes to measure out 100 meters on measuring kantas.
- It was noted that counter mechanisms were used on number of processing machines to measure total number of meters.

4.4.4

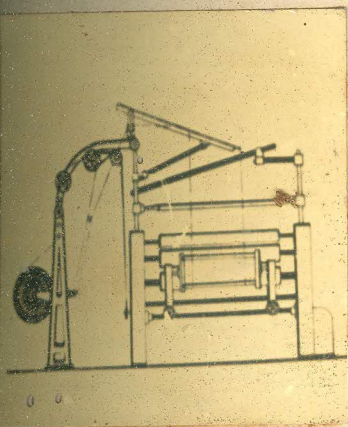
The following are the information about 'Swastik' folding machines.

a. Double folding and platting machines.

- Table width - 1200-1500-1650 mms.
- Max. width for double folding - 1800 mms.
- Single folding speed - 60 mts./min.
- Double folding speed - 45 mts./min.
- Power consumption - 1.5 h.p.
- Space - 2900x2350x2350

b. Double folding and rolling.

- Paper tube diameter - 50 mm.
- Flat cardboard size - 200 mm.
- Working speed - 45 mts/min.
- Max. width for rolling single cloth - 1000 mm.
- Max. width for double folding and rolling - 100 mm.
- Power required - 1.5 h.p.
- Speed range - 15-45 mts/min.



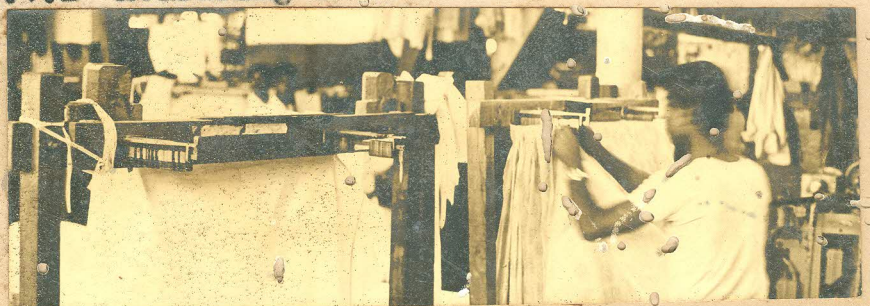
5. ANALYSIS

5.1 Structural Analysis

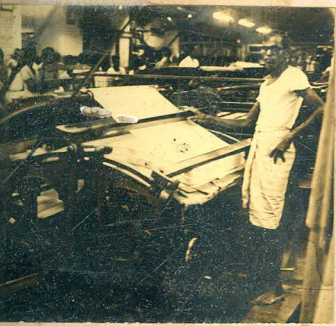
5.1.1 Meter Stick

- It is made up of chrome plated steel.
- Distance between its two ends is exactly one meter. The first ten cms. are calibrated in one cm. There are cross marks at distance of quarter meter, and the two edges have arrow marks. The markings are made at a distance of five cms. by cutting grooves on the face.
- The back face has marking 'Meter 1' in Hindi and English.
- The sectional area of meter is 15 mm x 5 mm and is about 425 gms. in weight.
- The marking can be made visually much more prominent and better.
- Half and one and half meter sticks are similar to the one meter stick in construction.
- Chrome plating on meter sticks does not last long.

5.1.2 Measuring Kanta

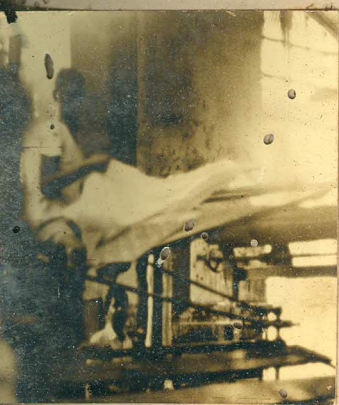


- Measuring kantas are used in many industries to measure the cloth in required length. It has a wooden frame of about 5'-0" high which supports the brass rods.
- The two brass rods are square in section and has 100 brass hooks cut from sheet metal which are slinged in it. This facilitates the measurement of cloth upto 100 meters.



5.1.3 Folding machines

- The folding machines operates individually by electric motors or on a single line shaft, depending upon the layout of the folding shop. In this machine, rotary motion of the motor or shaft is converted into oscillatory or to and fro motion of the arm, which carries the cloth and makes folds of one meter length. Cloth gripping plates are placed one meter apart, the operation of it is governed by cams; which is synchronised with moving arm carrying the cloth. Many single and double folding machine can be fitted with selvedge printing attachment which operates simultaneously with the folding machine to print on the cloth border. The placing of the selvedge printing machine and adjustments in the folding length is done manually.



5.2 Ergonomical Analysis

- Two persons are employed per folding machine. To set the machine for folding, one has to climb on the machine. This is inconvenient and unsafe.
- Particularly in small shops, during rush hours the salesman has to be careful while utilising full meter stick for longer measurements so that it may not hurt the customer or himself.
- Measurement of cloth length greater than 10 meter and stock checking is a tiresome job for the salesman.
- Height of the sales table (100 cm) is convenient for salesman, and customers.
- In many small retail shops and saree shops, the salesman sits on the covered floor. It is found that measuring by meter stick while sitting on the floor is inconvenient. Also it is found that salesman has to sit down and stand up number of times from the floor at the time of sales. Hence ergonomically layout of such shops is inefficient.
- In many shops cloth layout is not well. Heavy wraps are kept on the top shelves which cannot be reached normally. Thus the salesman has to climb on the sales table or shelf to fetch it at the time of sales.



- The weight of the cloth wraps varies considerably according to the quality of cloth and number of meters in it. The wrap weight varies from 5 kg. to 25 kg. or even more sometimes. These wraps are handled by salesman number of times to fold and unfold the cloth at the time of sales, which is a tiresome job to the salesman.

5.3 Functional Analysis

5.3.1

It is found that upto one meter measurement the meter rod is not lifted up from the table by the salesman. But for longer lengths he lifts the meter stick and measures. He coinsides the cloth and with the beginning of the meter stick kept on the table, puts the finger mark upto the required length folds the cloth to coinsides the edge; keeps the cloth on the table and cuts it with the scissor.

5.3.2

For longer measurements greater than two meters the salesman wraps the cloth around the meter stick upto 2 meters by coinsiding the cloth end, then he relieves the edge and measures further length, by revolving the meter stick in hand to measure required length.

5.3.3

Cutting the cloth is not done in a single cut, but by number of cuts with scissor by taking care for straight cut. The measuring and cutting operations are found to be habitual.

5.3.4

It is found that both the hands of the salesman are occupied at the time of cloth measuring. Measuring by keeping the meter rod fixed on the table is more convenient for the salesman, rather than measuring the cloth by lifting the meter stick. But, considering the accuracy of measurement, flexibility of its use in any corner of the shop, and its inspection meter stick is normally not fixed on the table.

5.4 General Analysis

5.4.1

It is found that cloth length in each wrap and width of the cloth is not possible to standardise.

5.4.2

Roll wraps are convenient to handle than cardboard wraps and it gives better display of cloth and is more compact. Paper tubes and wood sticks are used to make roll fold. It is found that paper tube gets damaged or bended, but it is cheaper and lighter. It was found that wraps cannot be standardised to one form i.e. only roll form or wrap form,

because quality, quantity, and size of the cloth varies; as well as internal layout of the cloth shops.

5.4.3

It was found from the salesman that sales talks is one of the most important factor for sales of cloth. Customers wants the cloth measured and cut in front of them as a matter of satisfaction. Also they want to touch and see the cloth that they purchase. Social atmosphere, cleanliness and decoration are required in the cloth shop to attract customers.

5.4.4.

Stock checking in the mill's shops takes 3-5 days twice a year and affects the sales of the cloth. Measuring device can be thought of to reduce this time.

5.4.5

Some of the shop-keepers showed positiveness to change the layout of the shop if a new measuring device requires, provided the device is more convenient to them, and reduces number of salesmen employed. While many declined to change the layout in the shop, they want a new device which will be more convenient than the present one and fits in the present state.

5.4.6

In mill's retail shops sales to the shareholder is maximum. Customers shows less interest

in 'ready packed' or 'unit packed' cloths.

Also salesman suggested that it is not possible to have ready packs in all shades and varieties of the cloth.

5.4.7

Shop owners needs space for customers, storing and displaying the cloth. They require most compact and accurate device for cloth measurement which need no maintenance and can be easily stored.

5.4.8

Hawkers don't keep the meter rod, it was found that often they cheat the customers by giving cloth, sarees and dhotis of short lengths.

5.4.9

Industry requires continuous production with minimum wastage of time or stoppage of the machines. As far as possible they want to have minimum number of operations, in the folding shop.



6. HYPOTHESIS

6.1

The device should be simple, compact, sturdy and durable. It should be cheap and can be economically mass produced and should have no maintenance cost.

6.2

It should fit the present state of retail shops in our country i.e. it can be applicable to the smallest retail shop.

6.3

It should simplify and hasten the cloth measurement procedure by the salesman without giving up accuracy and flexibility in measurement.

6.4

It should hasten and simplify the process of stock checking.

6.5

Device should also be aesthetically good so as to fit tidy, decorative and clean interior of the shop; it should not spoil the cloth or damage it at the time of measurement and should ergonomically fit the salesman.

6.6

Possibly attempt should be made to simplify cloth cutting operation.

7. SYNTHESIS

Solution to the design problem was attempted by analysing retail cloth selling procedures. Studies were also critically made right from the factory's folding shop to the retail sales shops to arrive at a solution to the problem. Device is required to be fitted in the smallest cloth retail shop as well as fairly big retail shops in its present state.

It was found that it is not at all advisable to design fully automatic system which can take care of cloth measuring, cutting, folding, packing and delivering it to the right customer. This involves very high initial investment, more space, maintenance cost, and may require change in the layout of the cloth shops.

Although it may save considerable time, reduce number of sales man to be employed and be most accurate, it is not a practical solution at the moment for retail cloth shops, particularly in our country where there is problem of unemployment.

7.1 Solution - 1

Printing length marks on the cloth edge at factory level by employing specially designed printing machine.

7.1.1

Before packing the cloth, length marks can be made very accurately on one edge of the cloth by a printing machine designed for the purpose for cloth industry's folding shop.

7.1.2

Different marks are used indicating cloth lengths of 5, 10, 25, 50 and 100 cms in a length of 1 meter of the cloth.

7.1.3

Suitable inks can be used for printing the marks so that marks are prominent on the cloth of different colours and prints.

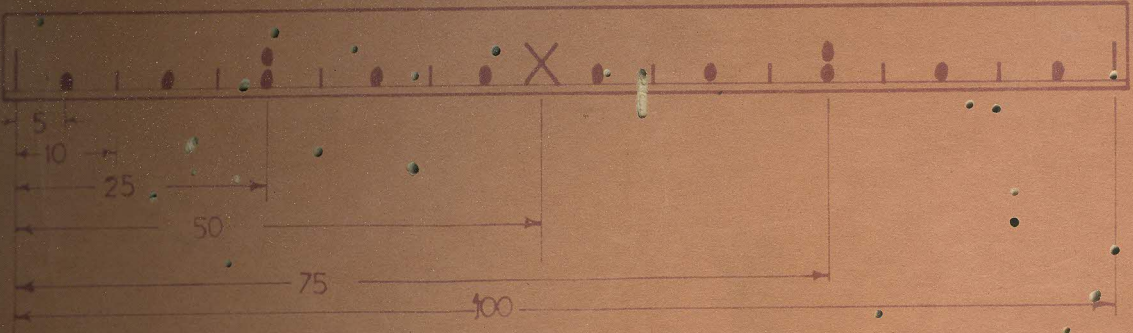
7.1.4

Marks are of maximum 5 mm in length on one of the cloth edge and are washable.

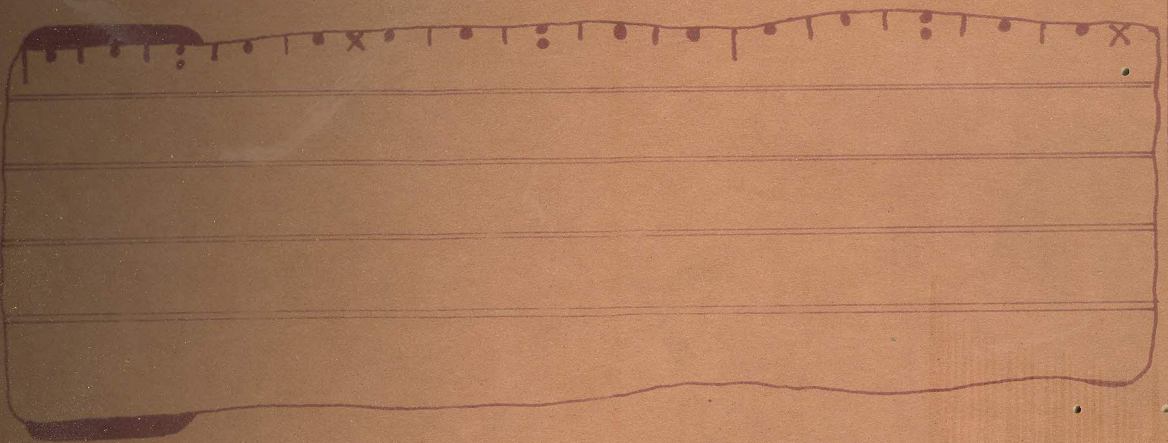
7.1.5

Printing machine can be adjusted to prints marks only for 10 cms, 25 cms, 50 cms or 100 cms length. This is useful for printing marks for sarees, dhotis, bed covers, etc. which usually goes in the retail market in multiples of above length in cut form at the factory stage.

SOLUTION 1

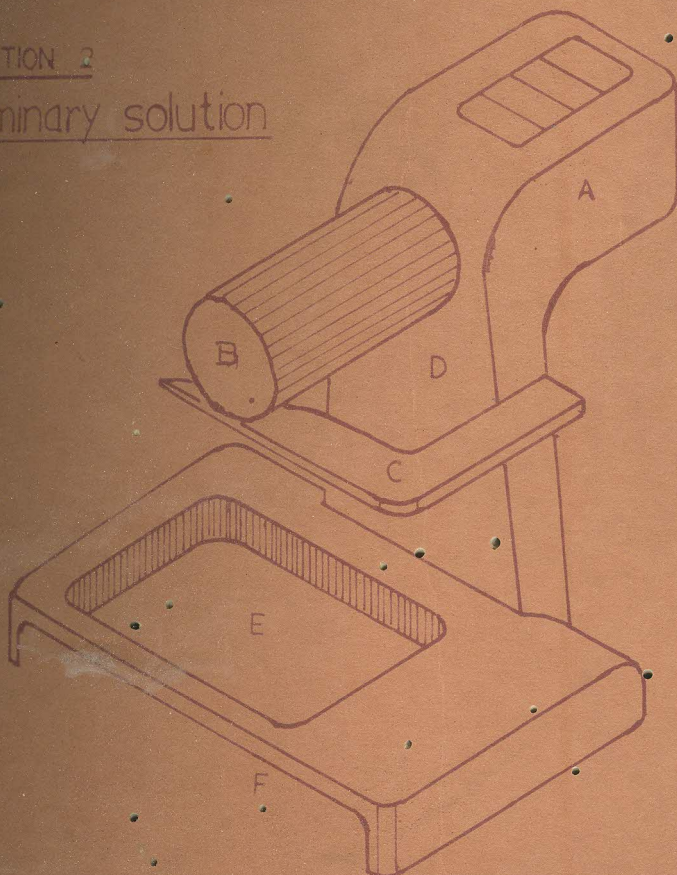


Print in visu 1 marks at 5, 10, 25, 50, 75, 100 ms on on edge of cloth.



SOLUTION 2

preliminary solution



A- Mechanical counter with reset

B- Roller

C- Knife edge

D- Body

E- Place for bill book

F- Place for packing box

7.1.6 . . .

This method of marking accurately the length marks on the cloth at the factory level eliminates use of the meter-rod for measuring the cloth at retail stage. But the following disadvantages makes it impracticable.

- . Although most of the retail sales takes place in multiples of 5 cm length, customer may ask length in multiples 1, 2, 3 or 4 cms for costly cloth.
- . The process of mental calculation is involved for the salesman in order to give correct length of cloth to customers. This is not at all convenient for the salesman.
- . Every cloth industry has to have the printing device and should inspect and be responsible for printing correct length mark on the cloth in order to have consistency at the retail level.

7.2 Solution - 2

Preliminary solution:

7.2.1 . . .

As shown in the sketch, a device to be mass produced was thought of which can serve two main purpose.

• Cloth measurement of any length correctly,
• conveniently and quickly.

• Cutting the measured cloth length in straight
path.

For measurement small mechanical counter with a knurled roller was decided; the cloth edge can be passed over the knurled roller which in turn displays the length in cms and meters visually in the mechanical counter which can be reset to zero by operating reset device.

It was found that cutting the cloth can be made faster than scissors and in straight path by providing a single knife edge fixed as shown in the figure to the body of the device. In this case exactly reverse as in the case of cutting with scissors, the cutting device is fixed while the cloth of required length is folded in the same present way for cutting with the scissors and then by holding its two edges it is dragged through the knife edge to get a straight cut.

The device can be fixed on the sales table rigidly and the base portion can be utilised to keep bill book, stapler and packing bags.

7.2.2

After deciding preliminary solution, a rough model of the preliminary solution was made to try out cloth measuring and cutting operations. From the trials, required changes in the preliminary solution were made. To arrive at the final solution to the problem decisions were made regarding overall size and placement of different elements, shape of the entire product, choice of the materials and processes in order to get economical solution; to suit the product ergonomically, functionally and visually.

7.3 Design decision

Considering all the aspects, the solution 2 has been chosen for final development. The following are the salient features of the design.

7.3.1

The base of the device is eliminated as there are number of shops where salesman does not do the packing work, also sizes of the packing bags for the cloth are not standard but are available in various sizes. There is no consistency in the size and thickness of the bill books. All these factors indicates that for compact, economical design, base is not required for the device, to be mass produced.

But individual shopkeeper can be supplied with such an arrangement as per his requirement which can easily fix with the device. This arrangement will definitely improve tidiness of the shop.

7.3.2

Mechanical counter with reset arrangement indicates visually the cloth length passed through the rollers. Indications are prominent in cms and meters. The mechanical counter is a sturdy, accurate and reliable instrument. It can measure upto 30 m without reset. This arrangement helps for stock checking. The digits indicating cm and meter lengths are in two different colours. The visual display of measured length remains in front of salesman and customer till it is reset to zero. This is a matter of satisfaction for the customer to see that correct cloth length has been measured, cut and given to them.

Counters can be obtained from the counter manufacturing firm by placing order to them, by giving specifications regarding shape, size, material and technical requirements. This counter can be directly fit in to the place provided on the body of the device.

7.3.3

Two rollers with rough surfaces are provided one above the another. One is connected with the shaft of the mechanical counter. Rotation of the roller is shown in length in cms and meters by the counter. By rough surface of the rollers and pressing of the other dummy roller there is no possibility of the slipping of the cloth over the roller at the time of dragging the cloth in between two rollers. Also cloth does not slip out of the roller because of the pressing grip between two rollers.

7.3.4

Knife edge for cutting the cloth is rigidly but temporarily fixed with the body so that it can be easily taken out for reshaping. Cutting the cloth with knife edge is faster, and more convenient than that with scissor. It also assures straight cut unlike scissors where many a times straight cut is not obtained. The slight inclination and concave cutting edge of the knife is selected for efficient cut. Certain thin cloth which cannot be cut with scissors can be easily cut with the knife edge by a single stroke.

7.3.5

A small cutting edge is provided just above the rollers, which acts as a pointer mark to

indicate the point of cutting the measured length and also a small cut is made at that point by this sharp edge. This cut indicates measured length, then the cloth is folded and passed through the knife edge for cutting it. This assures exactness in length of the cloth to be cut.

7.3.6

The device makes the measuring process compact as the salesman doesn't have to lift the device and spread his arms for measuring the length. He doesn't have to carry the weight of the cloth and meter stick on his arms while measuring long lengths.

7.3.7

The device which combines measuring and cutting operation of the cloth is a compact product and has prestige value for the shopkeeper.

7.3.8

All the parts like main body, rollers, counter, knife edge, protective cover can be easily separated out. This facilitates its packing.

7.3.9

The device can be fixed on the edge of the sales table facing customer's side. Proper fixing and clamping arrangements are made for the entire device and individual parts like

knife edge so that it can withstand the forces at the time of cloth measurement and cutting.

7.3.10

The overall dimensions of the product are 100x 145 x 190 mms and decided by considerations of average height and width of the sales table so that cloth measuring and cutting operations are convenient for the salesman.

7.3.11

Counter housing and knife holder is made integrated with the body; counter obtained from manufacturer is to be inserted into the housing at the time of assembling the device.

7.3.12

Body of the device is made of polypropylene and it can be available in various colours. Final form was selected after achieving functional requirements so as to make the product an attractive piece to suit interior decor of the shop.

7.3.13

Counter is connected to the main roller by plastic bevel gears, one rotation of the main roller measures 10 cm length.

7.3.14

Apart from convenience in cloth measuring and cutting, it was found by experiments that total

time for measuring and cutting the cloth length is lesser than that of present method of measuring and cutting the cloth.

Thick double folded cloth was taken for experiment, the following are average experimental results.

Cutting required length with scissors 25-30 secs

Cutting required length with sharp edge 10-15 secs

Unfolding & measuring cloth length of	Time with meter stick	Time required with designed device
1 m	10 secs	10 secs
3 m	40 "	30 "
5 m	55 "	45 "
7 m	75 "	60 "
10 m	90 "	75 "

It was found that saving in total time (measuring and cutting) increases for longer lengths.

7.3.15 Materials and processes.

The following materials are suitable for various parts:

<u>Part</u>	<u>Material</u>	<u>Process</u>
. Main body (with counter housing and knife edge holder)	Steel	Casting
	Aluminium	Die casting
	Polypropylene	Injection moulding.
	H.D.P.E.	-do-
	C.A.B.	-do-
	A.B.S.	-do-
. Rollers	U.F.	Compression moulding.
	Aluminium)	Turning, knurling extruded bars.
	Steel)	
	Natural rubber	Extrusion
	P.V.C.	-do-
	P.F.	Compression moulding.
	U.F.	-do-
. Knife edge	High speed steel	Hardened and ground.
. Counter parts (gears, reset knob)	High impact polystyren	Injection moulding.
	H.D.P.E.	-do-
	Polypropylene	-do-
	Nylon	-do-
	P.V.C.	-do-
	U.F., P.F.	Compression moulding.

• Counter window	Perspex	Extrusion
• Roller shafts	M.S.)	Extrusion
	AL)	and
	P.V.C.)	turning.

Weighing advantages and disadvantages of the materials for mass production, functional requirement and considering economy, polypropylene has been selected as a main material for body counter parts and gears. It is light, cheap and easily available thermoplastic suitable for mass production by injection moulding and has properties better than that of H.D.P.E. It has good flexural rigidity and hence it can withstand bending stresses at the time of cutting the cloth. Plastic does not require finishing treatment like metals, and production processes has no wastage.

Aluminium and natural rubber have been selected for bottom and top rollers and M.S. for shafts of the rollers.

8. Approximate cost considerations :

Material cost for the product was worked out roughly and from that other costs like material overhead, process cost, sales expenses, taxes, etc. were approximately estimated as percentage of the material cost to derive approximate overall cost of the product.

8.1 Material cost

Amount of plastic material (polypropylene) required is 0.30 kg., taking wastage and other considerations into account.

Therefore, cost of plastic = $0.3 \times 10 \text{ Rs} = 3 \text{ Rs}$

Approximate cost of plastic counter - 10 Rs

Cost of aluminium roller, rubber roller, knife edge and M.S. stand - 5 Rs

Total material cost - 18 Rs

8.2 Other costs

Material overhead = 15% of material cost

$$= 18 \times 0.15$$

$$= 2.70 \text{ Rs}$$

Process cost = 10% of material cost

$$= 1.8 \text{ Rs}$$

Inventory charges

and sales expenses = 25% of material cost

$$= 4.5 \text{ Rs}$$

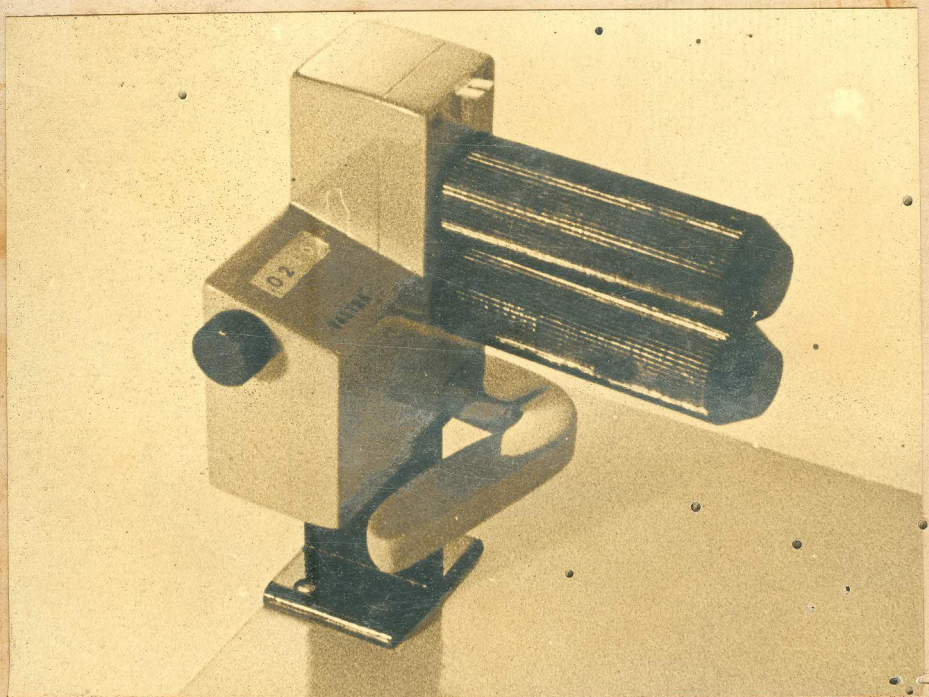
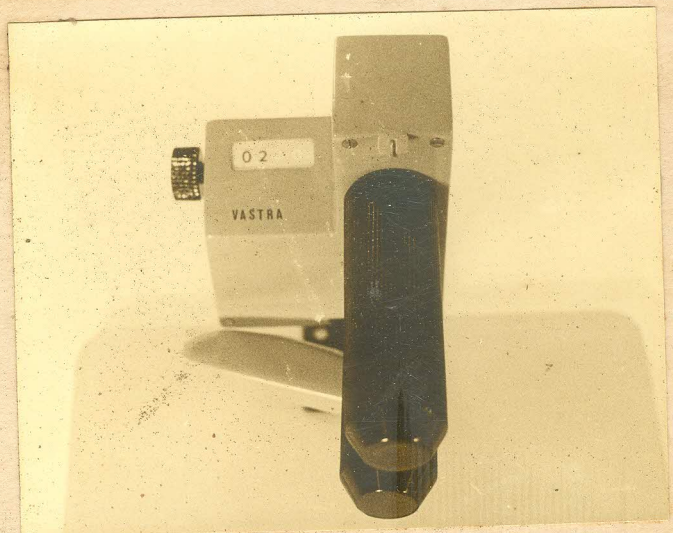
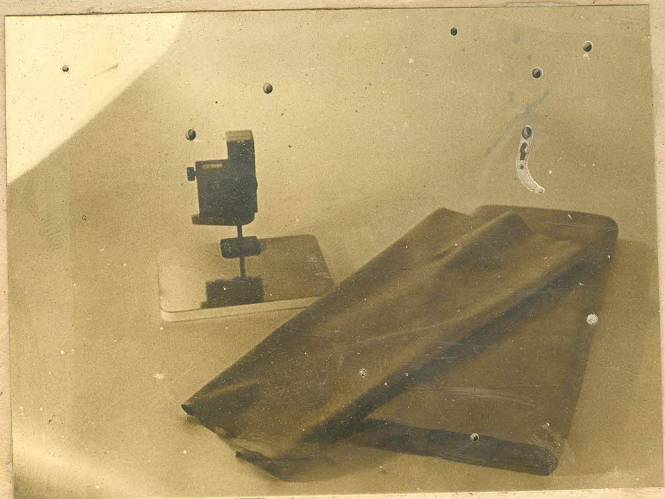
Taxes and other expenses = 10% of material cost
= 1.80 Rs

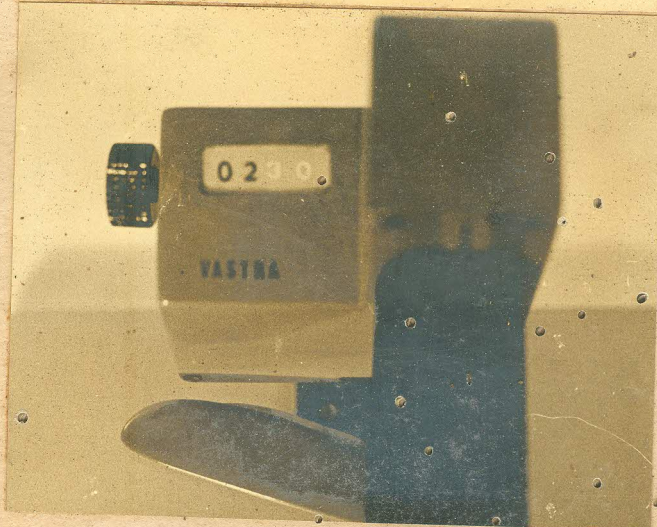
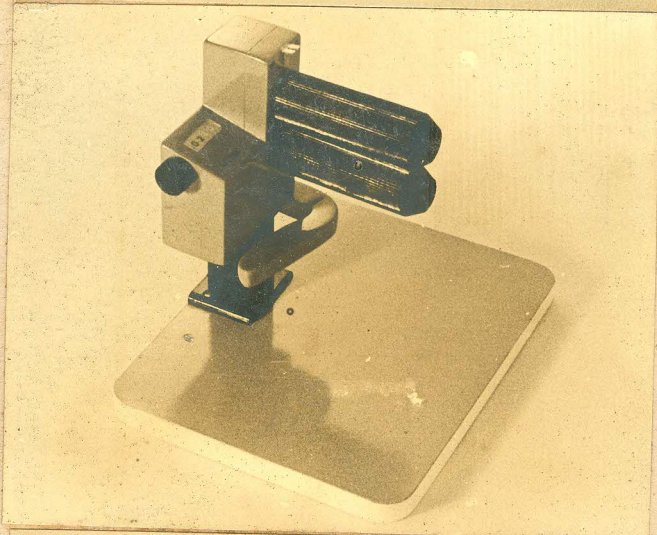
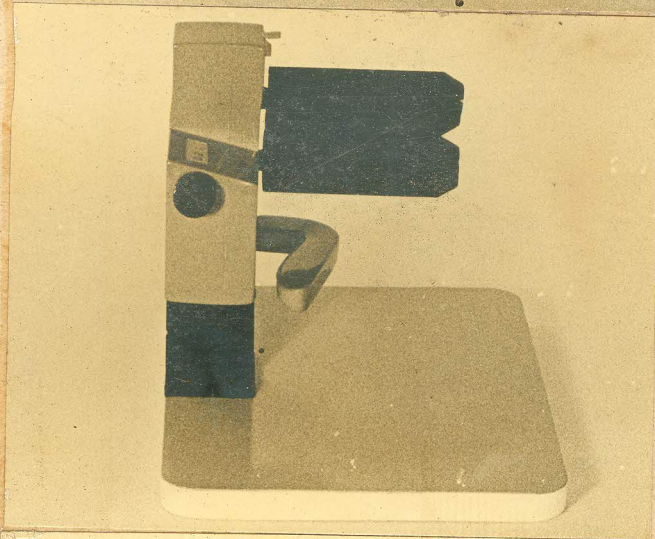
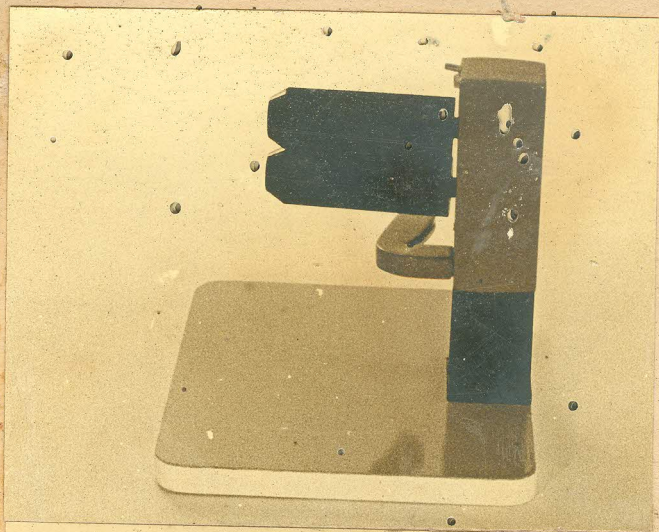
For safety against
unknown expenses = 10% of material cost
= 1.8 Rs

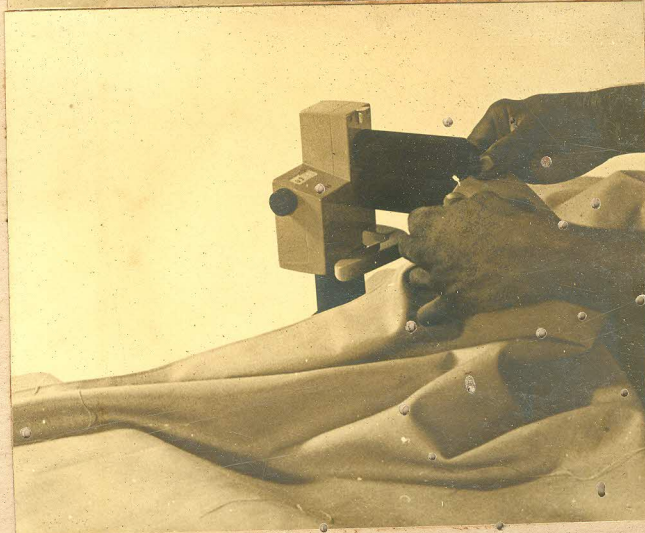
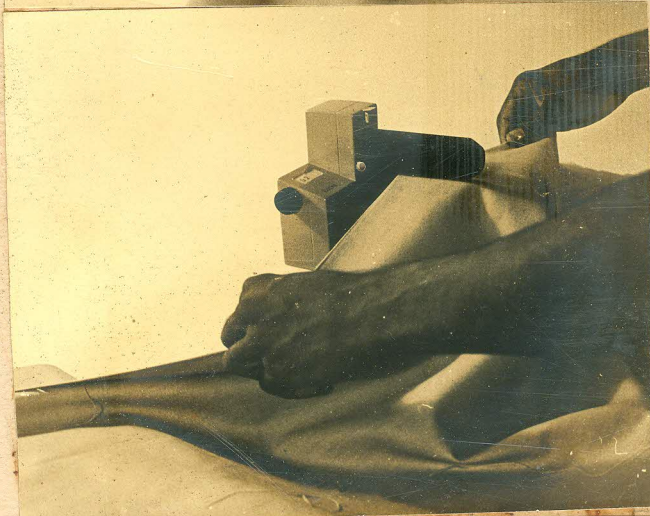
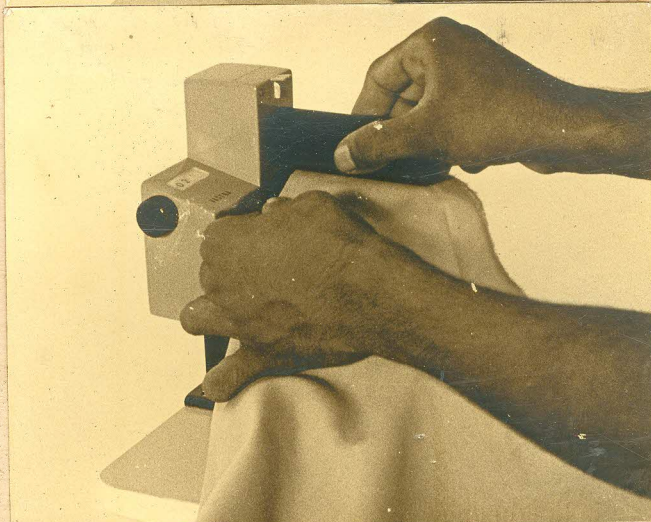
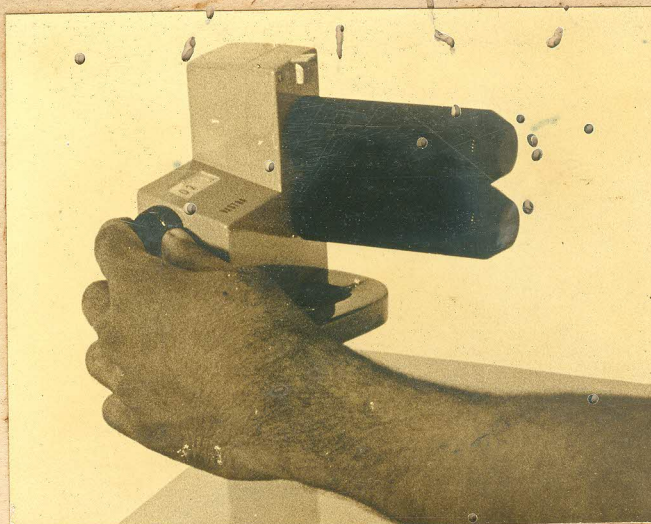
Profit = 25% of material cost
= 4.5 Rs

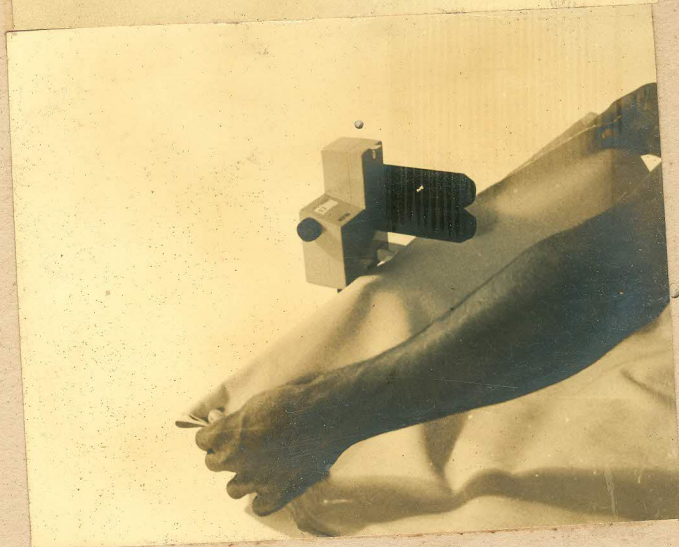
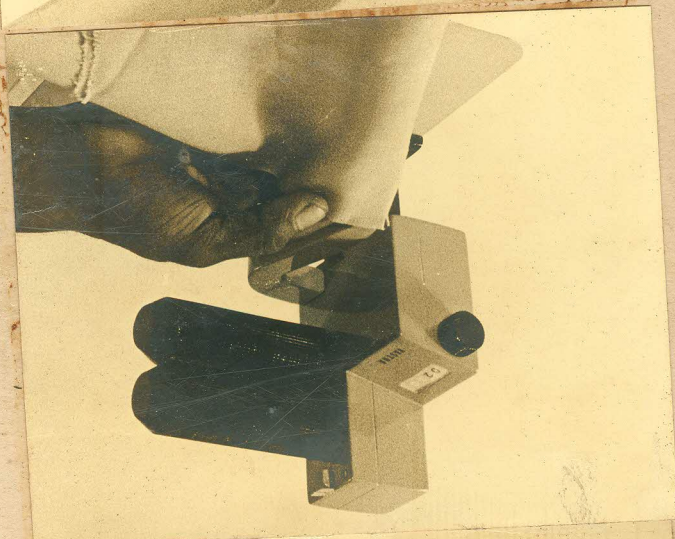
Overall cost = Material cost + other expenses
= 18 + 17.1
= 35.10 Rupees

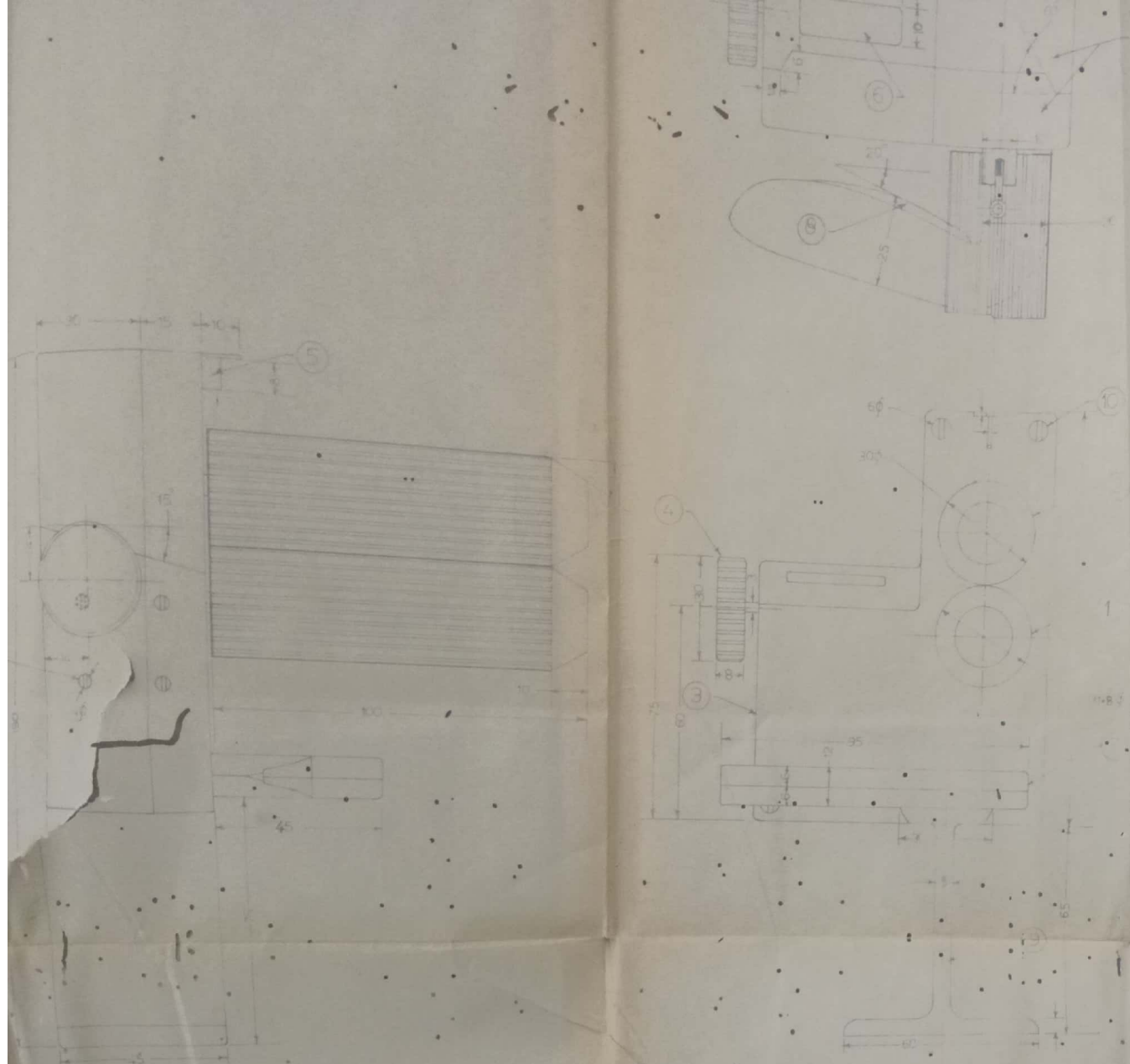
Say 35/- Rupees per piece.





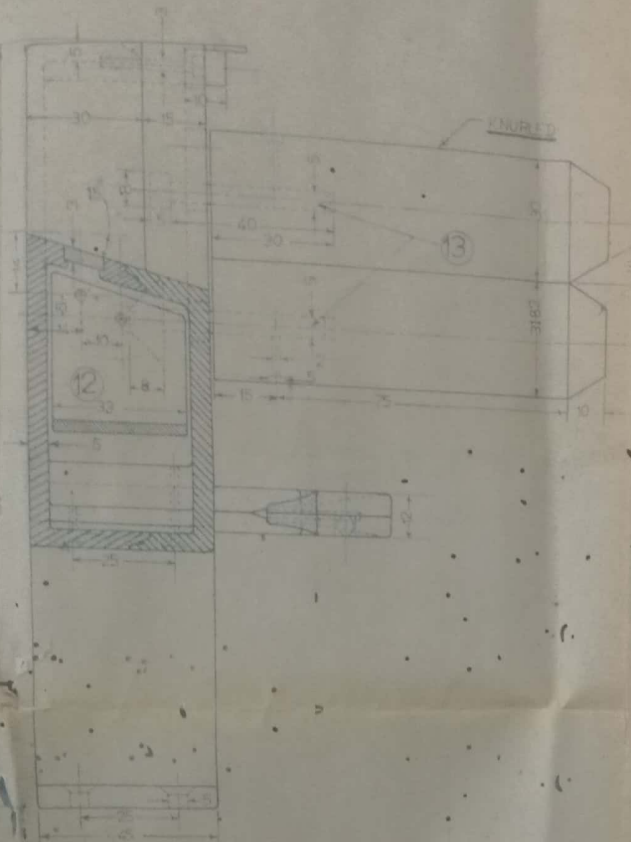
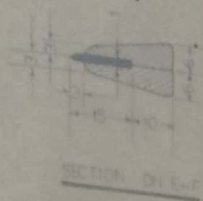




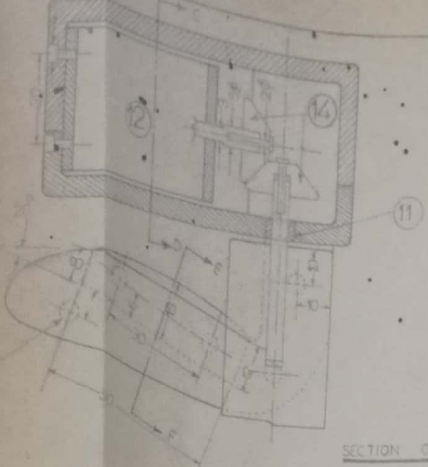


10	SCREWS M2 - M3	BRASS - 100
9	BODY STAND	M.S. [100 x 100]
8	CLOTH CUTTING KNIFE	P.P.
7	KNIFE HOLDER [IN TWO PARTS]	P.P.
6	COUNTER WINDOW	ACRYLIC
5	SMALL KNIFE EDGE	H.S.S. STEEL
4	COUNTER RESET KNOB	P.P.
3	BODY [IN TWO PARTS]	POLYPROPYLENE [P.P.]
2	DUMMY ROLLER	NATURAL RUBBER
1	MAIN ROLLER	ALUMINUM KNUBBLES
NO.	DESCRIPTION	MATERIAL

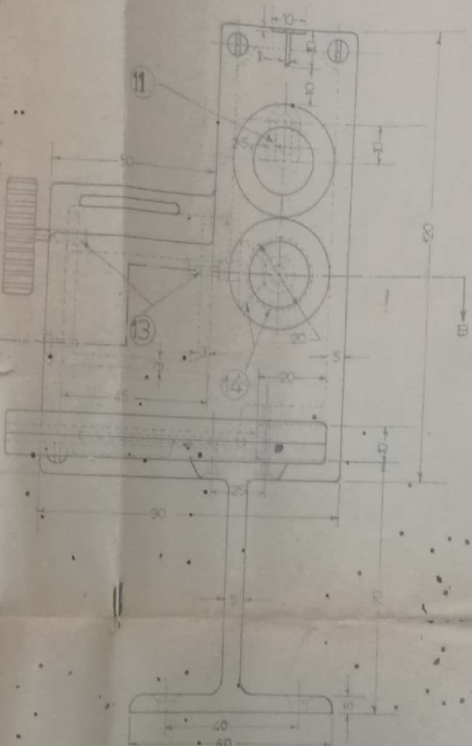
DIPLOMA PROJECT		CLOTH MEASURING DEVICE FOR SHOPS	
ASSEMBLY DRAWING - 1		M.R. [Signature]	
SCALE 1:1		ROLL NO. [Blank]	DATE [Blank]
DIMENSIONS IN MM.			
INDUSTRIAL DESIGN CENTRE		117	B. BAY



SECTION ON G-H



SECTION ON A-B



11	BEVEL GEARS [TWO]	P. R. (POLYPROPYLENE)
13	ROLLER SHAFTS GEAR SHAFTS	M.S.
12	COUNTER HOUSING	H.I. POLYSTYRENE
14	GUSKETS	P. R.
NO.	DESCRIPTION	MATERIAL

DIPLOMA PROJECT • CLOTH MEASURING DEVICE FOR SHOP

ASSEMBLY DRAWING - 2

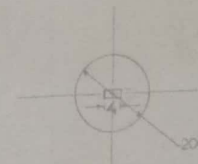
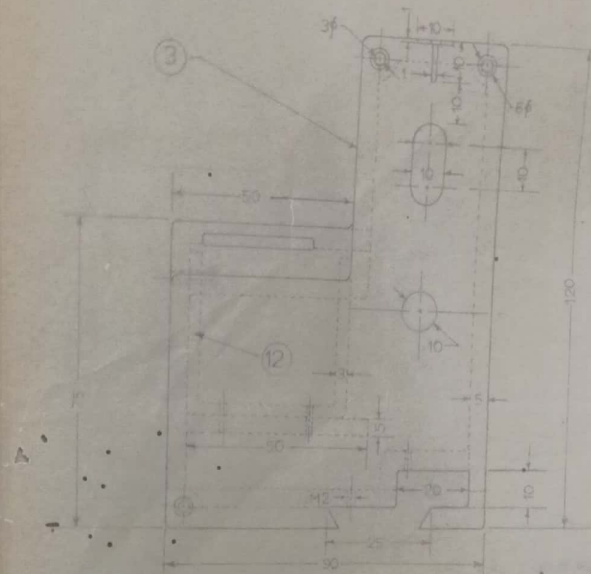
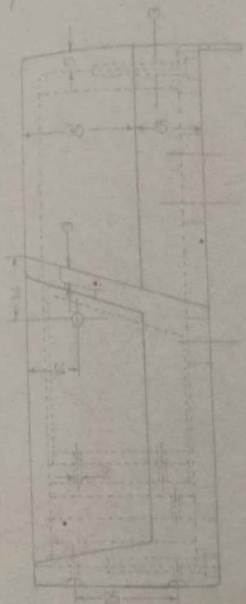
SCALE 1:1

INDUSTRIAL DESIGN CENTRE • 11T BOMBAY

M. R. GANDHI

ROLL NO. E-154

DATE: 1973



DIPLOMA PROJECT		CLOTH MEASURING DEVICE FOR SH	
DRAWING - 2		DESIGN DEVELOPMENT	
SCALE 1:1		M. R. GANDHI	
DIMENSIONS IN MM		ROLL NO. P-954	
INDUSTRIAL DESIGN CENTRE		WIT BOMBA	

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