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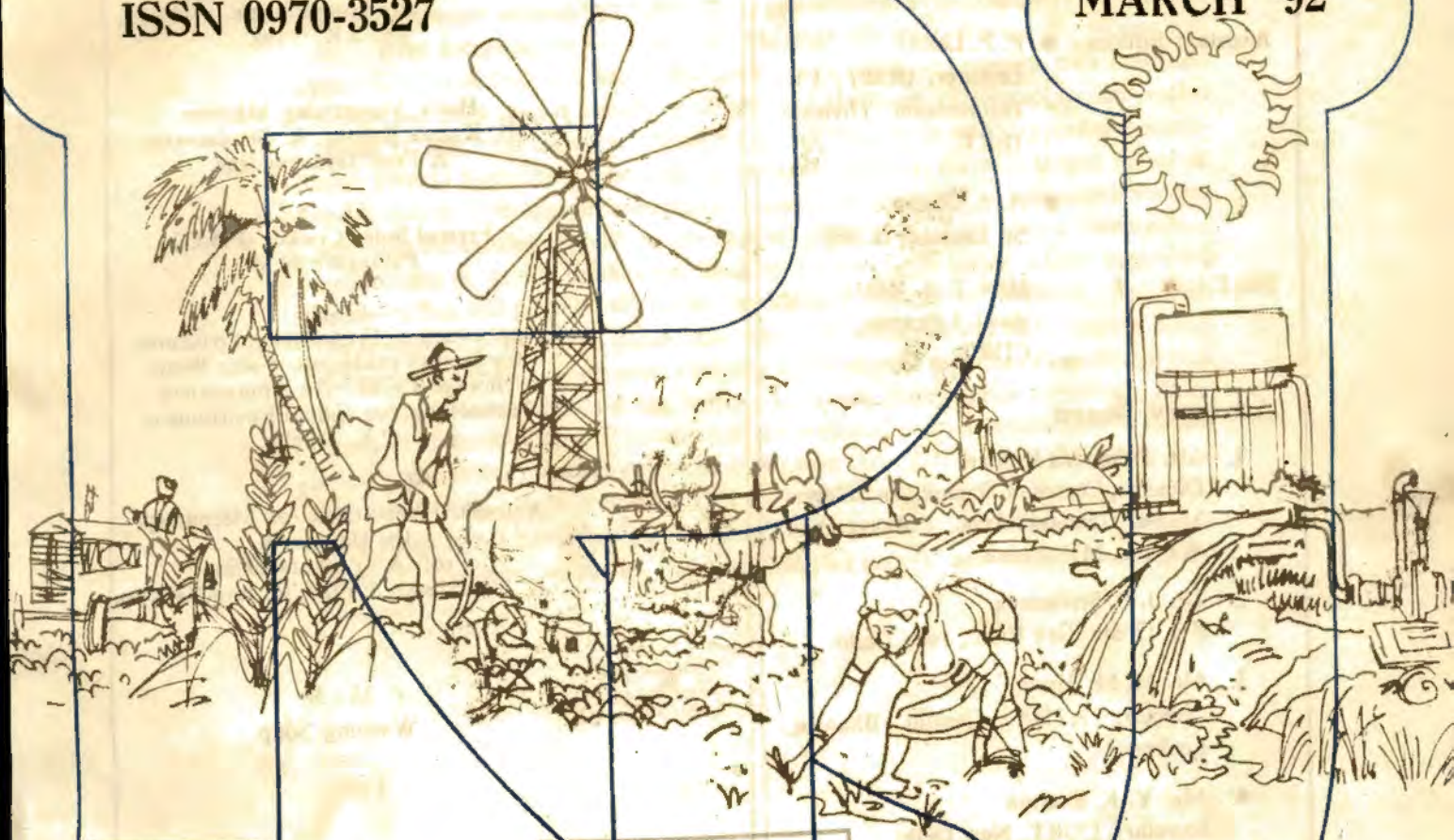
RURAL TECHNOLOGY

ISSN 0970-3527

MARCH '92



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Article/Paper

ECONOMIC ANALYSIS OF A LARGE SIZE BIOGAS PLANT

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Community Biogas Plants are being increasingly adopted in the rural India as a source of energy to meet with the requirements for cooking, lighting, irrigation and other agro processing operations. Not enough literature is available on economic analysis of such plants. In this paper economic analysis of a 140 Cubic meter plant using the conventional technology and high rate digester technology has been made. The analysis reveals that large community biogas plants are economically viable.

INTRODUCTION :

Due to energy crisis in early seventies, ever increasing prices of petroleum and limited sources of fossi fuels, greater emphasis is being laid on non-conventional energy sources all over the world. Since the meagre foreign exchange at the disposal of the developing countries is getting quickly drained through the purchases of petroleum, concerted efforts are made in these countries to install alternative sources of energy besides comprehensive research programme related to energy. These alternative energy sources are decentralised and therefore does not involve large sums of money on distribution of the energy. Out of these popular non-conventional energy sources viz. solar wind and biomass the last one is getting very popular being a consistent source of energy. Biogas produced from the biomass consisting of cattle dung and crop residues is getting very popular in rural areas of China, India and many other Asian countries. Again for the production of biogas from cattle dung, two types of digester plants are being constructed. These two are : Family size biogas plants and comunity/large scale biogas plants. From the statistics, it is known that if all the family size biogas plants are made in India, it will cater the need of only 2 percent population of higher strata of society and the poorer masses will be left out. There are many poor families which are maintaining milch animals for their sustenance but they do not have surplus land and money to install family size biogas plants. Community size biogas plants, if installed and operated by a village co-operative society, may help in balanced energy distribution amongst different strata of rural population Although energy problem is very acute, yet the Government does not have unlimited funds to install many community plants if these are not economically viable. Therefore, economic analysis of community plants are essentially required.

REVIEW OF LITERATURE :

Prasad, Prasad and Reddy (1974) considered the cost benefit analysis of biogas plants versus rural electrification to meet rural energy demands for

cooking, lighting, irrigation and agro industries. They observed that the adoption of biogas is a suitable alternative source of energy. Parikh (1978-1963) studied the economics of a biogas plant of 2 Cu. m size in the private sector and found that sueh an investment yields a gross return of 14% to 18% Moulik and Srivastava (1976) presented an economic analysis of the data obtained from Khadi Village Industries Commission (KVIC) and the sample survey carried out by the Indian Institute of Management, Ahmedabad. They observed that 2 Cu. m. plant is economically viable. Bhavani (1976) made detailed social benefit cost analysis for a 2 cu. m. plant and observed that benefit cost ratio varies from 1.234 to 1.898 depending on the assumption made in the analysis, at the 10 percent discount rate. However, Bhatia (1977) made a benefit cost analysis of a 2 Cu. m. plant and observed that such an investment is not economically viable.

METHODOLOGY :

The authors in this study have analysed thc data of a 140 cu. m. plant. They have also incorporated the new high rate digester technology meant for community biogas plant being developed by the Civil Engineering Department, College of Agricultural Engineering, Punjab Agricultural University, Ludhiana. It is anticipated that a high rate digester technology is likely to yield additional gas upto 50 percent over the conventional KVIC plant. For the present analysis data were obtained from the technical report of operational research project on integrated energy and nutrient supply, Hambran Community Project. Department of Civil Engineering, College of Agricultural Engineering, PAU, Ludhiana. In the project report the life of the community biogas plant was assumed to be 25 years. While describing the biogas plants six possible combinations were considered which are :

(i) Biogas plant without high rate digester technology with one gas holder being used in the whole life span of the plant.

(ii) Biogas plant without high rate digester/technology with two gas holders being used in the life span of 25 years.

(iii) Biogas plant using high rate digester technology with one gas holder being used for 25 years of plant life without considering the increase in the gas yield due to adoption of high rate digester technology.

(iv) Biogas plant using high rate digester technology with two gas holders being used in the span of 25 years of the plant life without considering the increase in the gas yield due to adoption of high rate digester technology.

(v) Biogas plant using high rate digester technology with two gas holder being used in the span of 25 years of the plant life and considering the increase in the yield of gas by 50 percent.

(vi) Biogas plant using high rate digester technology with two gas holders being used in the span of 25 years of the plant life considering the increase in the yield of gas by 50 percent.

The analysis was further elaborated by considering various shadow prices or opportunity cost on items like steel gas holder and distribution gas lines at fifteen percent and thirty percent. The following investment criterion for evaluation and comparing the efficiency of the biogas plants were used.

The first criterion involves the use of various formulae of discounted cash flow :

1. Discounted receipt =

$$= \sum_{t=1}^{n} \frac{B_t}{(1+r)^t} \qquad (1)$$

2. Discounted Expenditure :

$$= \sum_{t\ 1}^{n} \frac{C_t}{(1+r)^t} \qquad (2)$$

B_t = Benefit from biogas plant in time 't'

C_t = Cost incurred in biogas plant in time 't'

t = 1,2.....n in years

r = rate of interest generally applying the standard rate of interest.

3. BENEFIT COST ANALYSIS (B—C) :

The benefit cost ratio is the ratio of discounted receipts to discounted expenditure. The criterion of measure of profitability is benefit cost ratio (B – C ratio). For a project to be viable, the ratio should be more than one and for a non viable project the ratio is less than one.

B—C ratio has been worked out by using the formula :

$$\text{B—C ratio} = \sum_{t=1}^{n} \frac{B_t}{(1+r)^t} \Big/ \sum_{t=1}^{n} \frac{C_t}{(1+r)^t} \qquad (3)$$

where B_t, C_t, and t are same as in (1,2).

4. NET PRESENT WORTH ANALYSIS (NPW) :

Net present worth worked out by substracting the discounted expenditure from discounted receipts :

$$NPW = \sum_{t=1}^{n} \frac{B_t}{(1+r)^t} - \sum_{t}^{n} \frac{C_t}{(1+r)^t} \qquad (4)$$

5. INTERNAL RATE OF RETURN (IRR) :

Another measure of profitability is internal rate of return (IRR). This is defined as the discounted rate o return at which the net present worth is equal to zero. It is expected that IRR should be greater than the prevailing market interest rate for the viability of a project. Thus, for IRR the following should hold.

$$\frac{B_t - C_t}{(1+r)^t} \quad 0 \qquad (5)$$

Where * is the internal rate of return.

SENSITIVITY OF ANALYSIS :

Sensitivity analysis shows how the values of the above mentioned criteria change with the changes in the values of any variable like cost, revenue etc. It may be expressed either as the absolute change in the net present worth or IRR divided by a given percentage or a given absolute change in the variable whichever seems to be more appropriate. Usually, a percentage change in a variable is chosen and correspondingly IRR is calculated. Therefore, an analysis has been made by changing the cost and revenue by 5.00 and 10.00 percent and corresponding values of IRR were calculated for the following combinations :

1. Between increased cost and original revenue.
2. Between increased revenue and original cost.
3. Between increased revenue and increased cost.

RESULTS AND DISCUSSIONS

The basic data of cost and revenue on annual basis were analysed to measure the profitability and the results were set out in table 1. A perusal of data of discounted cost of four combinations of biogas plants with use of high rate digester technology were 4.62, 4.80, 4.62 and 4.80 rupees in lacs and corresponding discounted receipts were 6.11, 6.11, 7.77 and 7.77 rupees in lacs respectively. These discounted costs and receipts were calculated at 12 percent rate of interest. Similarly, the total discounted cost and the receipts at 12 percent rate of interest for two combinations of biogas plants without the use of high rate digester technology were 3.99, 4.18, 6.11 and 6.11 rupees in lacs respectively.

The benefit cost ratio, net percent worth and internal rate of return of biogas plant without using high rate digester technology were calculated and the same are set out in table 2. From table 2, it is revealed that the biogas plant having one drum without high rate digester has higher B—C ratio, NPW and IRR in comparison to biogas plant having two drums without using high rate digester technology in all the three types of cost analysis i.e. without opportunity cost of 15 and 30 percent. The B—C ratio NPW and IRR in case of high rate digester biogas plants were calculated and the same are set out in table 5. It is revealed that B—C ratio NPW and IRR were highest in plant having only one drum with increased yield of gas by 50 percent followed by plant having two drums with increased yield of gas by 50 percent, one drum without increased yield of gas and two drums with-

out increased yield of gas respectively when opportunity cost was not considered. Interesting, the pattern of B—C ratio, NPW and IRR for all the four combinations of high rate digester biogas plants were repeated in similar way when opportunity cost of 15 percent and 30 percent were considered.

Sensitivity analysis was done for increased cost and revenue both by 5.00 and 10.00 percent for biogas plants with and without high rate digester technology and the results are set out in table 4 and table 5. From table 4, it is revealed that IRR was higher for one drum plant than a plant with two drums of non high rate digester type, while considering the different combination of variations in cost and revenue alongwith different opportunity cost. From table 5, it is pointed out that in all types of variations, i.e. increase either in cost or in revenue or in both alongwith different opportunity cost, higher IRR was observed in case of biogas plant with high rate digester technology having one drum with gas yield increased by 50 percent followed by plant having two drums with gas yield increased by 50 percent, one drum with high rate digester technology and two drums with high rate digester technology respectively.

CONCLUSIONS :

From the above discussions of different combinations of community biogas plants, it is revealed that all the combinations are economically viable. However, plants using high rate digester technology with increased gas yield by 50 percent has shown relatively higher B– C ratio, NPW and IRR. This has further been supported by the sensitivity analysis.

Table 1 : Cost and Return of Biogas plants with and without High rate Appliances

Year	With High Rate Digester Technology			Without High Rate Digester Techn logy		
	One Drum	One drum with increased yield 1.5 times	Two drums	Two Drums with increased yield by 1.5 times	One Drum	Two Drums
COST STRUCTURES						
1.	3.85	3.85	4.65	4.65	3.15	3.96
2.	0.17	0.17	0.17	0.17	0.17	0.17
3.	0.17	0.17	0.17	0.17	0.17	0.17
4 to 12	0.17	0.17	0.17	0.17	0.17	0.17
13.	0.17	0.17	0.98	0.98	0.17	0.98
14.	0.17	0.17	0.17	0.17	0.17	0.17
15.	0.17	0.17	0.17	0.17	0.17	0.17
16 to 25	0.17	0.17	0.17	0.17	0.17	0.17
Total	7.93	7.93	9.54	9.54	7.23	8.85
Total discounted cost 12%	4.62	4.32	4.80	4.80	3.99	4.18
REVENUE STRUCTURE						
1 to 25 yrs.	0,84	1.11	0.84	1.11	0.84	0.84
Total	21.00	27.75	21.00	27.75	21.00	21.00
Total discounted revenue at 12%	6.11	7.77	6.11	7.77	6.11	6.11

Table 2 : Benefit cost ratio, Net present worth and Internal Rate of Return of without use of High Rate Digester Technology.

Particulars	Benefit cost Ratio	Net present worth	Internal Rate of Return
I. ONE DRUM			
Without OC	1.528	211.124	21.071
with 15% OC	1.499	203.426	19.796
with 30% OC	1.426	182.401	18.637
II. TWO DRUMS			
Without OC	1.461	192.575	20.471
with15% OC	1.397	173.550	19.138
with 30% OC	1.334	152.942	17 818

Table 3 : Benefit cost ratio, Net present worth and Internal Rate of Return with use of High Rate Digester Technology.

Particulars	Benefit cost Ratio	Net present worth	Internal Rate of Return
1. One drum without increase in gas yield.			
Without OC	1.322	148.614	17.014
with15% OC	1.291	137.751	16.098
with 30% OC	1.231	114.477	15.507
2. One drum with increased gas yield by 50 percent.			
Without OC	1.681	314.777	24.625
with 15% OC	1.643	303.914	23.169
with 30% OC	1.566	280.640	21.962
3. Two drums without increased in gas yield.			
Without OC	1.272	130.755	16.386
with 15% OC	1.222	111.040	15.779
with 30% OC	1.174	90.432	14.932
4. Two drums with increased gas yield by 50 percent			
Without OC	1.619	296.918	23.933
with 5% OC	1.555	277.203	22.416
with 30% OC	1.493	256.595	21.247

Table 4 : Sensitivity Analysis of without use of High Rate Digester Technology.

Particulars	INTERNAL RATE OF RETURN BY					
	Increasing cost by 5%	Increasing Revenue by 5%	Increasing cost Revenue by 5%	Increasing cost by 10%	Increasing Revenue by 10%	Increasing cost & Revenue by 10%
I. ONE DRUM						
Without OC	19.966	22.421	21.313	18.517	23.794	21.070
with 15% OC	18.791	21.322	20.010	17.417	21.192	19.796
with 30% OC	17.630	19.847	18.849	16.316	20.612	18.637
II. TWO DRUMS						
Without OC	19.376	31.263	20.110	18.422	23.181	20.481
with 15% OC	18.017	29.410	19.367	16.609	21.764	18.428
with 30% OC	16.821	27.629	18.030	15.391	20.362	17.818

Table 5 : Sensitivity Analysis of Plant with use of High Rate Digester Technology.

Particulars	INTERNAL RATE OF RETURN BY					
	Increasing cost by 5%	Increasing Revenue by 5%	Increasing cost & Revenue by 5%	Increasing cost by 10%	Increasing Revenue by 10%	Increasingcost & Revenue by 10%
1	2	3	4	5	6	7
I. ONE DRUM						
Without OC	16.098	18.070	17.267	14.826	1.320	17.014
with 15% OC	13.256	17.270	16.341	14.571	1.275	16.084
with 30% OC	13.896	16.426	15.474	13.589	1.274	15.254
II. One Drum, Gas yield increased by 50 percent						
Without OC	23.168	26.510	24.541	23.084	23.684	24.313
with 15% OC	21.980	24.300	23.383	20.853	24.601	23.193
with 30% OC	20.957	23.160	22.211	19.611	23.766	21.981

1	2	3	4	5	6	7
III. TWO DRUMS						
Without OC	15.466	17.599	16.640	14.155	18.756	16.386
with 15% OC	14.512	16.433	15.614	13.559	17.683	15.390
with 30% OC	13.770	15.566	14.677	12.993	15.932	14.466
IV. Two Drums, gas yield increased by 50 percent.						
Without OC	22.732	24.404	24.144	21.459	26.318	23.934
with 15% OC	21.520	23.991	22.918	20.007	25.687	22.694
with 30% OC	20.384	23.061	21.700	19.046	24.224	21.488

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HANK MERCERISING MACHINE

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Mercerisation is an important finishing process for cotton that improves lusture, hygroscopicity, strength and dyeability. This paper deals with the design and fabricatien of a low cost hand operated hank mercerising machine suitable for Handloom weaving industry. It also deals with the economics of the machine and gives the machine fabrication details.

INTRODUCTION

Mercerisation is an important finishing process for cotton that improves lusture, hygroscopicity, strength and dyeability, The process consists of treating the cellulosic material with 18% concentrated caustic soda solution and stretching it. The effect of mercerisation is governed by various parameters such as alkali concentration, nature of alkali, temperature of mercerisation, total amount of stretch given etc., Generally yarn mercrisation is carried out in batch form and it is very important to avoid batch to batch variation. The design and fabrication of hank mercerising machines demand complicated mechaninsms, the machine cost is very high and small scale manufacturers cannot make use of hank mercerising machine. So a hank mercerising machine at a cheaper cost is fabricated. It is designed to give all possible features and functions of the costly hank mercerising machine.
The economic analysis is also carriedout and the machine fabrication details are also given.

DESIGN OF THE HANK MERCERISING MACHINE :

In hank mercerising machine the entire sequence of mercerising process is as follows—

1. Loading of the hank in the machine.
2. Alkali impregnation
3. Application of tension
4. Removal of excess of alkali
5. Washing
6. Neutralising
7. Removing the hank

The ultimate effect of mercerisation can be varied by varying the parameters like concentration of alkali, time of contact of yarn with alkali, stretch applied after impregnation.

The machine designed for hank mercerising should be capable of performing the above said works in sequence.

In addition it should have provision to change the percentange of stretch given and alkali contact time.

Other features which need consideration taking in view of the small scale industries or deculturalised sections are—

1. The machine cost should considerably be low.
2. Manual driving is preferred.

Basic Design Features—

1. Impregnation
2. Stretching
3, Drive to the rollers

1. Impregnation :

The contact time of yarn with alkali during mercerisation depends on the count of yarn, absorbing capacity etc. In hank mercerising manchine for the commercial varieties of yarn normally the contact time is 2 minutes.

As like the original hank mercerising machines the hank is carried by two rollers and the caustic liquor is brought to it. The caustic soda is stored in a trough sprayed over the hank, which is collected in a trough at the bottom and the hank in the working position contacts i. e. passes through the liquor collected in the bottom trough. The hank of yarn is thoroughly impregnated as the rollers are rotated.

When the trough at the bottom is filled upto the preset level the supply will be procrastinated.

After the designed duration of impregnation the liquor in the trough at the bottom is drained.

The bottom trough can be raised and lowered accordingly to assist impregnation.

2, Stretching :

The hank is mounted on thc two rollers, The required amount of tension is given by considering the hank length or circumference of the roller,

hank length = (2 × centre to centre distance between the rollers)
+ circumference of the roller

Hanks length = (2 × centre to centre distance between the rollers)
+ Rollers circumference

$$54'' = (2 \times 22.5) + 9''$$

To keep the hank under increased tension for the purpose of better mercerisation, the hank is stretched to a higher level than the above calculated length by about 0.5". This can be noted from the pointer which moves over the graduated scale.

The upward movement of the top roller is obtained by a high tensioned spring and for mounting the hank. Springs and the slackness of the chain being taken up by the Pulley.

The two roller driven by an endless chain which in turn is driven by a handle.

The sprocket wheels are mounted between the pair of top and bottom rollers and another sprocket wheel on the shaft to which the handle is fixed. The chain gears with this sprocket wheels through suitable guide rollers.

For smooth rotation of the rollers they are mounted in ball bearing which are housed in the main framing. The top roller is lowered by lifting the hand lever.

The mercerisation is carried out under tension and without releasing the tension, a hot and cold water wash is done. The hank is then neutralised and washed with water. The hank is removed from the machine and squeezed.

During the washing and neutralising processes the water or neutralising liquor is sprayed from the top and during washing the drain at the bottom is also kept open.

3. Drive to the roller :

To get a uniform mercerisation the hank is rotated during the process and the direction of rotation is changed periodically. This is acheived by positively driving both the rollers. Both the rollers are driven to prevent under slippage. The hank is rotated as well as in slack form and tensioned form

FABRICATION OF THE ELEMENTS

1. Rollers

The rollers are the main parts which comes in contact with alkali. Since alkali is highly corrosive in nature, materials, with suitable resistance should be chosen. The recommended grades are A/5/304

and A/5/306. Austenitic chromium nickel steels. Due to the high cost, higher weight, and non-availability we used synthetic sleeves in hank dyeing machines.

Synthetic sleeves are mounted on wooden rollers. Turned on a light duty lathe and fastened to the shaft by grub screws.

The dimensions are as follows :—

Length = 210 mm
Diameter = 70 mm
Thickness of sleeve = 5 mm

2. Trough :

Four troughs are used in this machine. Two troughs are placed at the top of the machine, and two at the bottom. The two trough at the top are plastic. The trough used in the bottom have a cylindrical bottom and was fabricated with mild steel plates of 16 gauge.

The dimensions of the trough are as follows :—

	Length	Width	Height
Plastic trough	256	150	125
M. S. trough	245	130	65

*All dimensions in mm.

3. Bearings :

Totally five bearings have been used to give a smooth rotation to the 2 pair of rollers. The bearings were selected according to the diameter of the shaft in consultation with the standard design data book.

Diameter of the shaft—15 mm
Outer dia —42 mm

4. Frame :

The main frame is made of mild steel channel welded to the base plate. And mild steel sheet bolted to its side encloses the chain sprockets.

Since caustic Soda is corrosive in nature and can cause injuries to human skin we enclosed the rollers in two separate enclosures. The frame for the enclosure is made of mild steel rods.

The main frame holds the housing for the bearings and the enclosure is also bolted to the main frame. Totally 8 hinges were used in the two enclosures which permits the doors of the enclosure to be opened freely.

Mica sheet was fastened to the welded frame work.

1. Main Frame :

Channel specification

(i) Material—mild steel
(ii) Size—50 × 100
(iii) Thickness—3
(iv) Enclosure 2 numbers

2. Frame wing rods :

(i) Material—mild steel
(ii) Diameter—5
(iii) Welding rod used—8

3. Frame Dimensions :

(i) Height—740
(ii) Width—180
(iii) Breadth—280

4. Sheet

(i) Material—MICA
(ii) Thickness—3
(iii) Total area—0.04 sq. metre

5. Miscellaneous :

(i) Height of the machine—1000
(ii) Breadth of the machine—670
(iii) Width of the machine—520
(iv) Height of the machine from the ground level—1600

*All dimensions in mm.

METHOD OF OPERATION

The machine is provided with 2 pairs of roller whose spacing can be varied as designed and can be rotated in either direction. The skeing of yarn are placed over the pair of roller and the spacing is adjusted in such a way that the skeins are moderately slack. Previously the hanks are wetted in cold

water and squeezed and impregnated with turkey red oil to assist impregnation with sodium hydroxide. Then the skeins are flooded with the mercerising liquor while the rollers are rotating to cause the skeins to travel around them and become saturated with the liquor. The liquor collected in the trough placed at the bottom assists the impregnation.

Immediately the mercerising liquor saturates the cotton skeins, the yarn commences to shrink and it is found beneficial to allow a small amount of contraction to take place. Then comes the stretching, The top pair of the roller are made to move away from other pair steadily thus extending the length of the skeins and stretching the yarn to about its original length, while at the same time the skeins are sprayed with hot and cold water to wash out the mercerising liquor.

It is also interesting to note that during the treatment of skeins with mercerising liquor and also during washing, the direction of rotation of the roller is changed or reversed and inturn the direction of the hanks is also reversed. The directional change ensures that the treatment of cotton is even.

Finally the skeins are stripped from the machine and neutralised (if necessary the neutralising can be done inside the machine itself) and washed in another apparatus. One most of the alkali in cotton has been removed it shows no tendency to shrink and so it is not necessary to maintain tension.

Some Recommendations :—

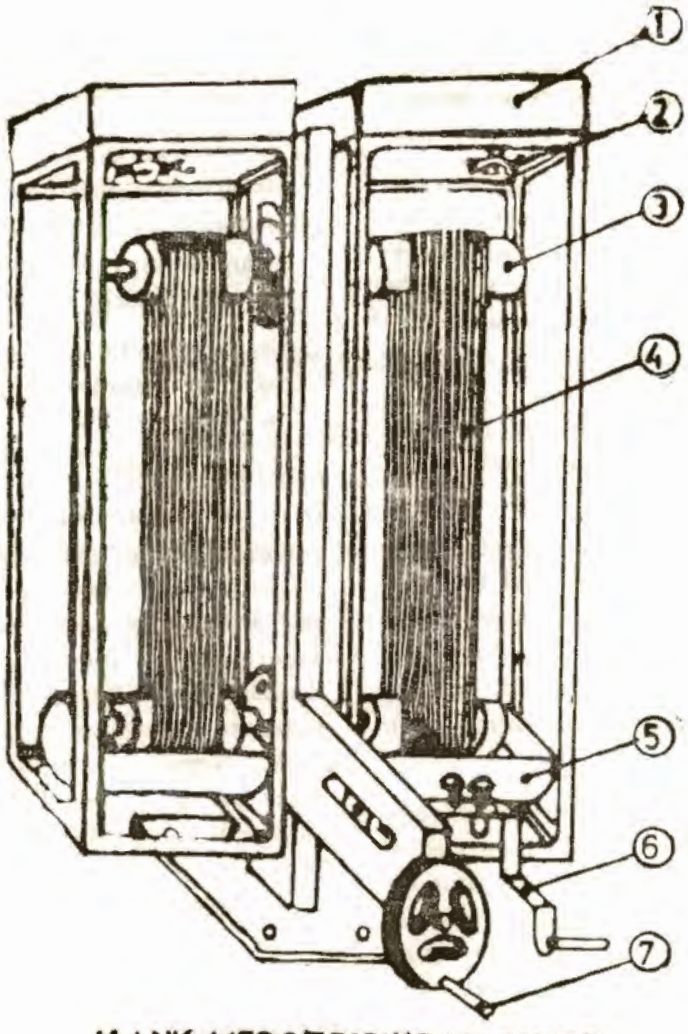
1. To assist wetting, the wetting agents like Leopen B, BM, (BASE). May be used in mercerisation.
2. After mercerisation the materials should be free from caustic soda by steeping the materials in a bath containing 2-3% acetic acid followed by soap washing.
3. Apply liquid lubricants, to the sliding top roller and grease to the ball bearing.
4. The enclosure is to be closed during the impregnation, stretching and washing.
5. Level the troughs at the bottom must be correct before impregnation with alkali is started.
6. After the mercerising process, if not proceeding with another run, clean the machine thoroughly to avoid rusting.
7. Storing of alkali or wash liquor after the process in throughs at the bottom should be avoided.

FURTHER SCOPE

In the hank mercerising machine there are provisions to change important parameters such as time of contact of yarn with alkali, tension applied etc. In the present design the contact of yarn with alkali poses no problem. The tension applied should be controlled by using a plate cut to a designed length, suspended from the top of the machine. When the required tension is attained a notch cut in the plate should be engaged to the shaft and this maintains the tension. During relaxing the yarn the shaft carrying the rollers must be disengaged from the notch. Different plates cut to the designed length can be used for different counts.

For thorough squeezing, the hank is to be removed from the machine and squeezed in mangle. This may be avoided by using a squeezing roller in corporated in the machine itself.

Further, heavier material can be used for the various components and weight of yarn loaded can be increased thereby increasing the productivity.



HANK MERCERISING MACHINE

1. TOP TROUGH
2. VALVE
3. ROLLER
4. HANK
5. BOTTOM TROUGH
6., 7. HANDLES

FRESNEL SOLAR COOKER (F. S. C.)

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Different types of solar cookers viz. Box type, Box type with single reflecting mirror, paraboloid concentrating type etc. are being used. Box type solar cookers are in wide use, which can give the temperature upto 140°C depending upto the solar insolation. This temperature is insufficient for cooking of some hard material like dal and consumes much more time for cooking.

The attempt has been made to fabricate a solar cooker using Fresnel lens to avoid above difficulties. This cooker gives comparatively high temperature up to 193°C and saves the cooking time. It requires tracking for every 15 minutes.

PRINCIPLE OF SOLAR COOKER :

The solar cooker is similar to what we use in our kitchen to cook food. But it does not require any cooking gas or kerosine, neither any coal nor any wood as a fuel. If works on the solar energy and does not give smoke and soot spoils. It keeps us free from nauseting smell and keeps environment clean. Thus, it conserves the precious energy sources of the country and saves the money.

THEORY OF F. S. C. :

Fresnel lens is nothing but an array of prismatic lenses situated in concentric manner as shown in fig. 1. It combines the advantage of multi lens system within a single unit as each concentric array is designed to concentrate the incident radiations on to a focal point. By changing the angle of prism, the deviation of the ray is so adjusted that the rays deviated from different prisms are brought to the focus at single point.

DESIGNING :

The Fresnel lens gives maximum temperature at the focal point. If the cooking vessel is kept at the focal point, one can get maximum temperature, but the height of the cooker will be so large that it will difficult to handle. In order to avoid this the height of cooker is chosen 30 cm. and the spot size from the lens at distance about 20 cm is measured which is 22 cm. in diameter. This spot size decides the diameter of cooking vessel.

The rays from the sides of the lens which are unable to reach at cooking vessel are reflected by inclined plane mirrors. The angle of these mirrors which is 143°, is calculated by optical method. This design is such that the cooker needs tracking after every 15 minutes. i. e. for this time interval, all the rays are reflected on the cooking vessel provided that the cooker is kept perpendicular to the sun rays initially.

Fig. 2 show the designing ray diagram with dismensions.

The Fresnel solar cooker consists of outer box, inner tray fixed with reflecting mirrors, glass covers and lens. The outer box is made up of galvanised-iron sheet of 18 gauge. (Wooden box can be used instead of metal box). The tray is made up of same metal on which the four reflecting mirrors are fixed

on inner side to reflect all diffused radiations on the cooking vessel. The sides of the tray are inclined at 143° and the arrangement at the base is made to keep cooking vessel. The region between the outer box and the tray is filledwith glass wool, which acts as insulating material and minimises conduction losses.

The lid of the cooker consists of Fresnel lens fixed in between two glass covers having thickness 3 mm and good transmitivity. The lens and glass covers are separated from each other by distance 2 mm by means of rubber packings to avoid damage of lens due to thermal expansion. The glass covers protect the lens and reduces the radiation and convection losses from the cooker.

PERFORMANCE AND EFFICIENCY OF FRESNEL SOLAR COOKER :

Energy balance equation for a solar cooker can be written as—

$$HR\,[(T\alpha)_b+(T\alpha)_d]\,A = Q_u+Q_s+Q_l$$

Where,

H : intensity of solar radiation,
R : geometric factor,
T : transmitance of glass cover,
α : absorptance of the absorber,
b : stands for beam radiations,
d : stands for diffused radiations,
A : area of cooker,
Q_u : useful heat gain,
Q_s : energy stored in the base,
Q_l : heat loss due to conduction, convection radiation.

Let $Q_u = Q_1 + Q_2$

Q_1 = heat gained by cooking material and
Q_2 = heat gained by cooking vessel.

$$Q_u = M_1\,Cp_1\,\Delta T_1 + M_2\,Cp_2\,\Delta T_2$$

Where,

$M_1, Cp_1\,\Delta T$, and $M_2, Cp_2\,\Delta T_2$ is mass, specific heat and rise in temperature of cooking material and cooking vessel respectively.

The instantaneous effiency of Fresnel Solar Cooker is the ratio of total heat gain to total incident energy and can be written as,

$$\eta_i = \frac{Qu}{IA\,dt}$$

$$\eta_i = \frac{M_1\,Cp_1\,\Delta\,T_1 + M_2\,Cp_2\,\Delta\,T_2}{IA\,dt}$$

or

$$\eta_i = \frac{M_1\,Cp_1\,\Delta\,T_1 + M_2\,Cp_2\,\Delta\,T_2}{I\,A\,d_t} \times 100\%$$

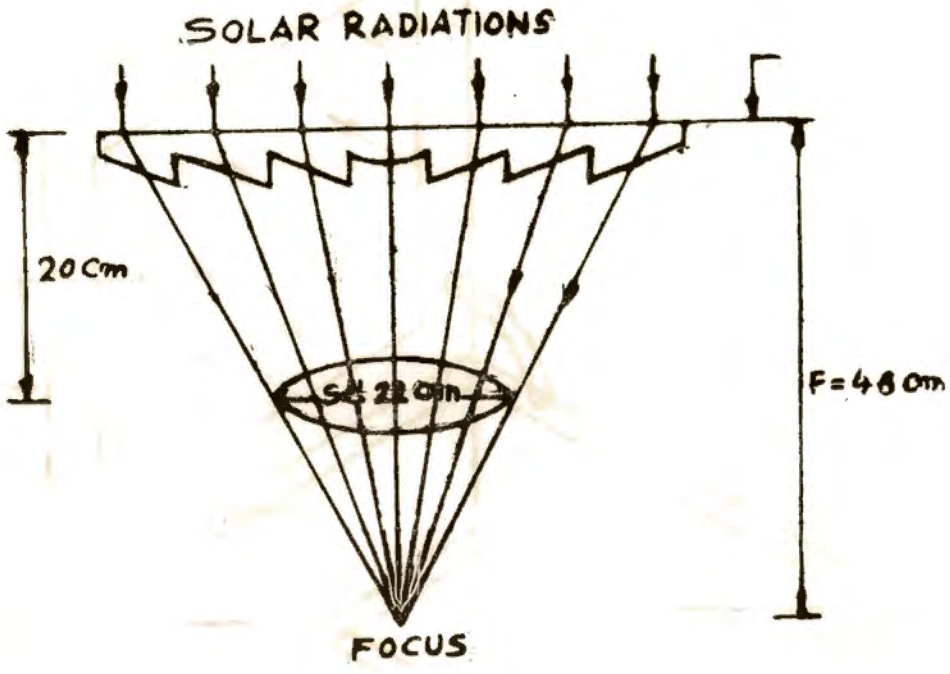
Where

I : average solar insolation for time interval dt.

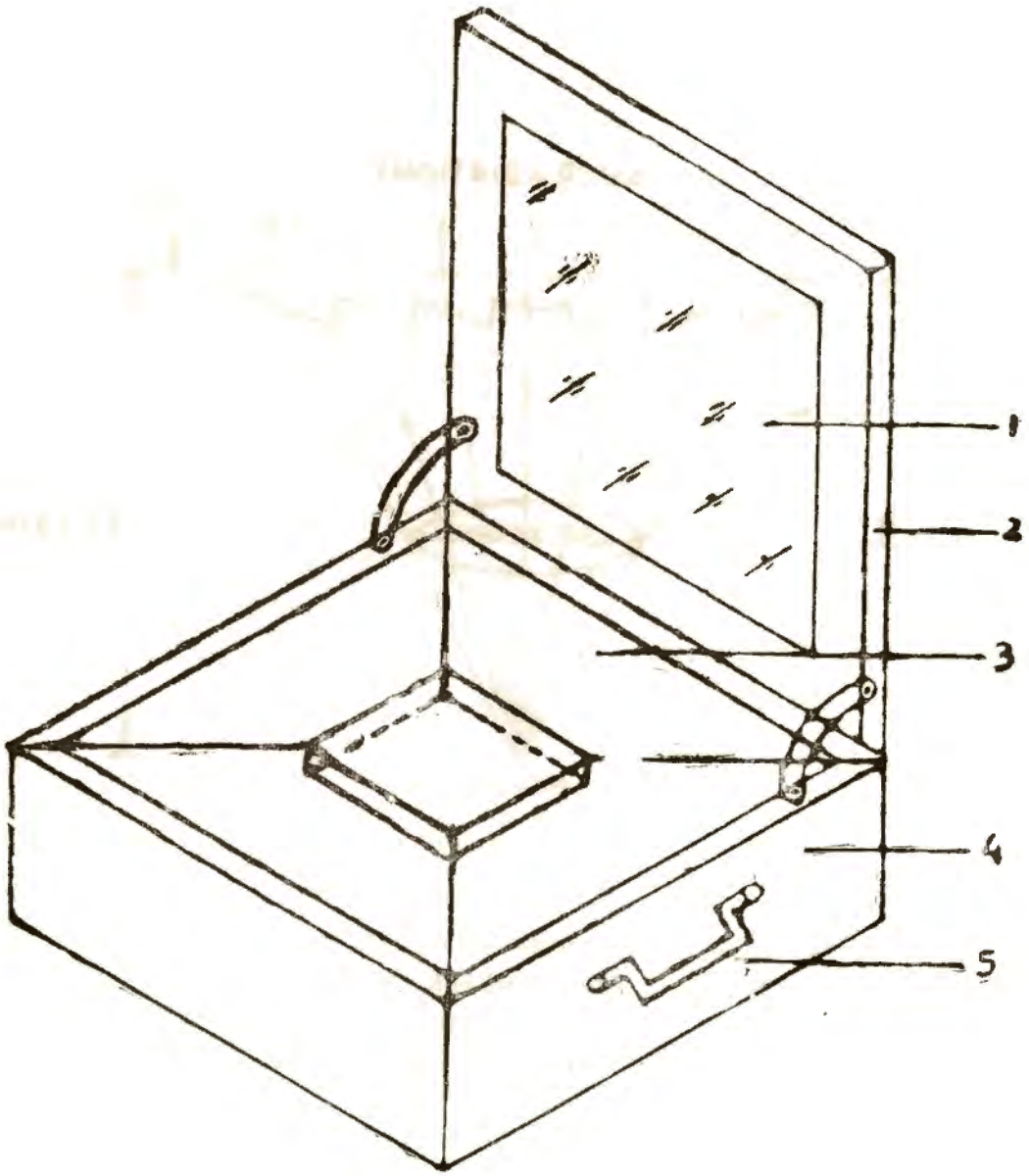
ΔT_1 & ΔT_2 : raise in temperature of cooking material and cooking vesoel for time interval dt. respectivly.

COMMENTS :

1. This cooker gives comparatively high temperature so is useful to cook hard material like dal.
2. It saves the cooking time.
3. Tracking is necessary, otherwise the focus will deflect and may cause damage.
4. The efficiency of this cooker is up to 15%.
5. Comparatively thermal losses are low.



L—FRESNEL LENS
F—FOCAL LENGTH (46 Cm)
Sd—DIAMETER OF SPOT AT
DISTANCE 20 Cm
FROM LENS



1. FRESNEL LENS FIXED IN BETWEEN TWO GLASS COVERS
2. WOODEN FRAME
3. MIRROR FIXED TRAY
4. OUTER INSULATING BOX
5. HANDLE

APPLICATION OF FERROCEMENT STRUCTURES FOR FACTORY MADE/CAST-IN-SITU WATER STORAGE TANKS - AN APPROPRIATE TECHNOLOGY FOR INDIAN ENVIRONMENT

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Recently various studies covering different aspects of water storage and supply system, both in Urban as well as rural areas of the Country, have been carried out but still a great deal of work is required to be carried out towards providing an adequate water storage and supply system. Adaptability to local surrounding, maximum use of local materials and manpower in construction and maintenance work, adoption of sound but relatively simple methods of design, involvement of law overall costs and social acceptability should be the guiding factor in such systems.

In this paper the work pertaining to the water storage system derived from ferrocement structures in New Zealand, Thailand, Rhodesia, Mali, Argentina and U. S. A. has been reported. The study provides the confirmation that the economy in this appropriate technology of ferrocement can provide a satisfactory basis for design of water storage and supply system in India, specially in the rural areas.

The paper deals with design of water storage tanks of 9m³ capacity and various other ranges of capacities with nominal reinforcement and labour intensive simple construction techniques for factory/cast-in-situ ferrocement structures which have been given field trial and are being used in Punjab.

1. INTRODUCTION

Ferrocement Water Storage Tanks may also be described in reality as Wire reinforced Cement-mortar water tanks. The main difference is that in ferrocement there is a very dense mesh of woven or welded reinforcing wire that has to have a minimum value of wire volume for each unit volume of material. Ferrocement tanks, under studies, have been made commercially in other countries and are being popularized in India as the quantity of straight wire reinforcement, weld mesh, labour and other materials fall far below the minimum value, although they provide ample strength for the purpose. They are used mainly to store water for domestic and dairy purposes, on the farm but they are also winning acceptance for industrial liquid storage. The cost of the smaller

tanks is comparable with that of tanks made of other conventional materials. The cost per unit volume decreases rapidly with increase in size of tank. This design is particularly suited for use in low income rural areas and its life is expected to exceed 50 years of continuous use.

2. QUALITY OF WATER :

The bacterialogical and chemical quality of the water stored in the tank will depend initially on the quality of the water put into the tank and if the tank is not open to further contamination the stored water will, in time, purify itself of most of the harmful bacteria by natural processes through self purification which is an essential step in most modern water treatment works. There have been very few measurements of the pollution load and the long history of the use of these tanks suggests that the water can be safely used for drinking and domestic purposes with few health risks which can be totally eliminated by boiling, sterlising, adding chlorine tablets before drinking or by having a sand filter off-take at the bottom of the tank.

3. SIZE :

The tanks are constructed in various sizes, with capacities from $1m^3$ to $30m^3$, diameters from 1m to 4m and heights from 1.3m to 3.0m. The sizes of various tanks and their weights are given in the table-1. With specially built form work and machine mortar mixures each tank takes from 2-5 man days to built. It takes 4-7 man days to built these tanks if the mortar is mixed manually. The present study gives the details of $9m^3$ capacity tank.

Table-1 : Sizes and weights of tanks

Capacity (M^3)	Diameter (m)	Height (m)	Weight (tonne)
1	2	3	4
0.9	1.20	1.30	0.25
1.8	1.55	1.30	0.30
2.7	1.85	1.30	0.45
3.6	2.0	1.45	0.80
4.5	2.0	1.95	1.25
9.0	2.9	1.95	2.1
13.5	2.9	2.6	3.0
18.00	3.65	2.6	4.0
22.5	3.65	2.9	5.0
29.00	4.0	3.0	6.61

4. DESIGN :

Unreinforced mortar and concrete are strong under compressive loads but very weak at resisting tensile or pulling loads. Conventional reinforced concrete is designed to overcome this characteristic by allowing the tensile loads to be taken completely on the reinforcing bars—the concrete in tension being assumed to have no strength. In reality, however, the reinforcing steel works to limit and control the tendency of the concrete to crack under tensile load according to the amount and distribution of the steel bars or wires and the degree of loading. The structural behaviour of wire-reinforced mortar shell is difficult to calculate with any exactness especially if the wires, in the case of cylindrical tanks, are fixed mainly in one plane around the tank. The calculations shown below suggests that the smaller tanks are not highly stressed and there would seem to be a large factor of safety in design which is demonstrated by the successful use of the tanks over many years :

Calculated Stresses in Thin Walled, Cylindrical Tank

Tank dia = 2.50 m., Wall thickness = 3.0 cm., Height = 2.0 m.

Position of Maximum hoop stress (h/H) = 0.20

(where h is the distance from base).

Maximum hoop stress = 0.73 N/mm^2

Maximum bending stress on inside face = 1.32 N/mm^2

Shear stress at base = 0.09 N/mm^2

In this case the minimum tensile stress occurs on the inside face at the junction of the wall and the base and is over double the maximum hoopstress.

These tanks have been designed to resist only hoop-stresses and a layer of woven netting is included as normal reinforcement. This netting in fact provides the only reinforcement at the base of the wall where it joins with the floor, the point of greatest stresses. This section is provided with 20 gauge double netting (wiremesh) and is thickened during construction and it has been seen that there is no evidence of cracks develop under normal loads and the plastic-hinge, on the inside face of the tank at the position of maximum stress, i. e. at the base which has tendency to deflect outward and throw a greater load into the hoopsteel, is avoided. The corrosion of reinforcing wire and leakage is avoided by applying a layer of black coal tar paint inside surface of the tank.

5. REINFORCEMENT DETAILS :

The details of reinforcements is clearly shown in fig. 2, 3 **&** 4. The main reinforcement consists of 6mm dia steel bars at different spacings of 3, 7, 12, 13, 14. 15, 16, 18, 19, 20..... c/c from bottom to top and wire mesh along the wall consists of 1" × 3" × 12" gauge welded mesh along the wall. The details of reinforcement in floor is given in the fig. 3 and 4 with 8 mm dia bars with 20 cm c/c from both sides and a double woven wire mesh consisting of 20 gauge is inserted in the foundation which is connected to the main reinforcement with an overlap of 6" as shown in fig. 3 & 4.

6. MATERIALS REQUIRED & COST :

The materials required for $9m^3$ and $6m^3$ capacity tanks is given in table—2.

Table—2 Materials :

Capacity m^3	Cement (bags)	Steel 8 mm (kg)	Steel 6 mm (feet/kg)	Wire Mesh (sq. ft) 20 gauge	Weld Mesh (sq. ft) 1" × 3" × 12"g
9	7	50	360/40	65	180
6	5	42	335/37	60	170

Cost of $9m^3$ capacity tank = Rs. 1800/- approximately (including labour)

Cost of $6m^3$ capacity tank = Rs. 1500/- approximately (including labour)

These rates are calculated according to prevailing market rate in India for the item of materials and are inclusive of labour charges (cost-in-situ). These rates can be brought down further by control conditions of factory. The tanks described are stronger than the self-help tanks to withstand the extra stresses produced during transportation.

7. ERRECTION OF FORM WORK AND CONSTRUCTION :

The tanks are constructed on special fabricated steel form-work which is quickly errected or on to tem porary timber form-work which provides the tank shape and usually consists of series of vertical planks, supported (removable type) by steel frame and sheathed in steel of steel before applyingthe reinforcement and mortar (plaster) as shown in figure-1. Usually the floor of the tank is cast first with R.C.C. as shown in fig. 4 and 5. Loops of 8 mm steel are allowed to project from the sides of the base to allow for easy handling; this also reduces the stresses that will be set up in the tanks as they are being lifted or winched. A strip of chicken wire of double layer 20 gauge is also cast into the sides of the floor and is bent up into the walls as shown in figure 4.

When the floor slab has been cast the form work is errected and the chicken wire or welded mesh of 1" × 3" × 20 gauge is wrapped around the tank to cover the shuttering. The main reinforcement, 6 mm dia, straight wire (steel) is wrapped tightly around the tank in a spiral with gaps from bottom to top as shown in figure 3. For economic and simple design the 4 mm dia straight wire can also be used instead of 6 mm dia with a 5 cm gap between the wires to prevent the mistakes of gaps. The same spacing is oftenly used on all the tanks, both small and large.

The first layer of Mortar (1 : 3 cement : sand by volume) is trowelled on to the tank 1 cm thick and given 24 hours to harden. A second layer of mortar is then trowelled on after making the surface of first layer rough with wire brush to ensure proper adhesion. This is finished smooth with a float : this is also given 24 hours to harden.

The form work is now carefully stripped and removed from inside the tank and third layer of mortar is trowelled on the inside to completely cover up the reinforcement. A thick unreinforced covering is added to strengthen the joint between the wall and the floor of the tank. The tank is painted with a layer of coat of cement and water slurry before applying paint from inside.

Finally, the roof is built onto the tank by laying mortar onto shaped form-work or on the ground. A prefabricated angle iron frame is set into the roof wire mesh to provide form work for an access hatch into the finished tank. The tank is allowed to cure for three days and a small volume of water is allowed to stand in the bottom of the tank is covered and cured for atleast 7 days for mortar to harden properly.

8. TRANSPORTING THE TANK :

The factory made tanks of less than 30 m^3 are light enough to be carried by lorry. They are taken to the prepared site and joined directly to the necessary pipe connections.

9. CONCLUSION :

Ferrocement tank is a viable technology both technological and economically. In India these are being popularised due to their cheap, simple and appropriate adaptability to the environment of the country. The tanks can be used with the same design universally with little bit of modification as per local needs.

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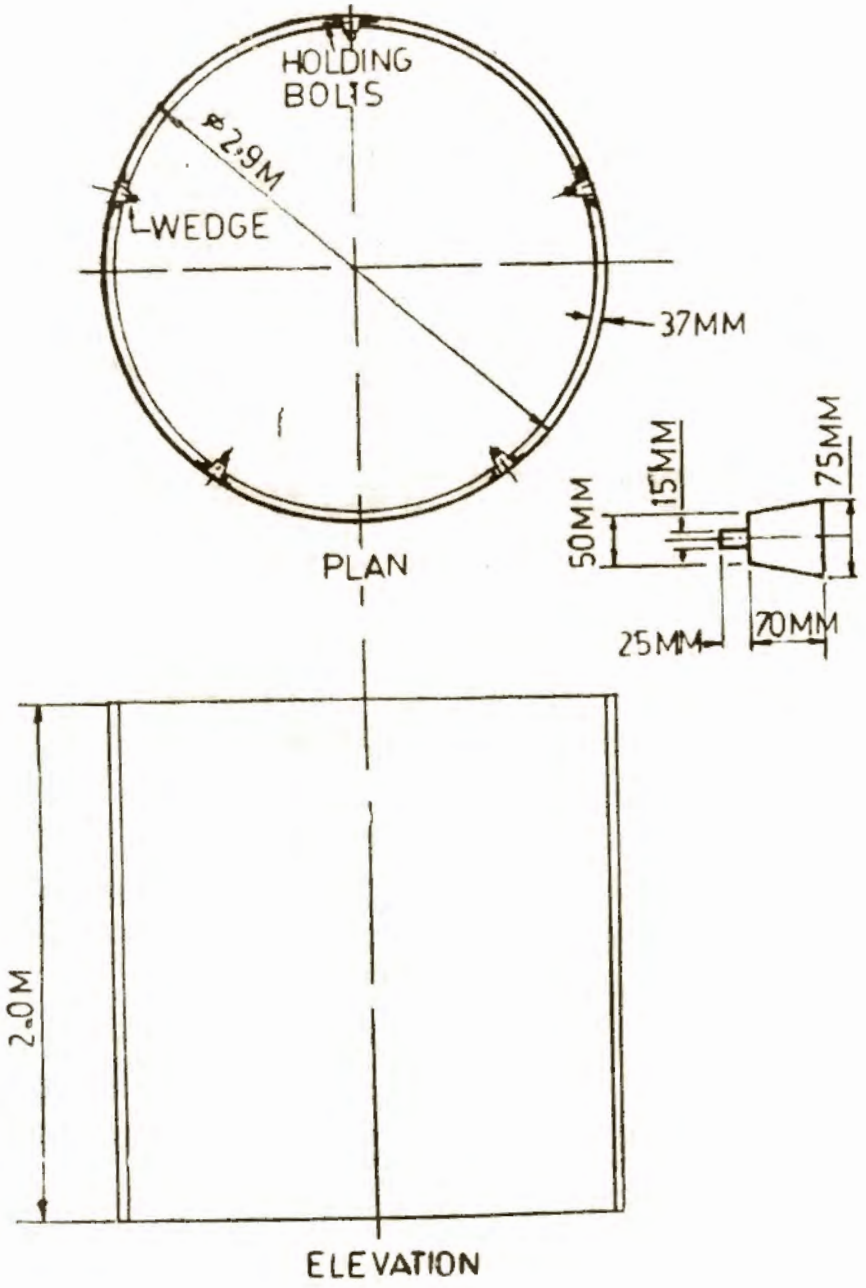

HOLDING BOLTS
ø 2.9M
L-WEDGE
37MM
PLAN
50MM
15MM
75MM
25MM
70MM
2.0M
ELEVATION

Fig. No. 1

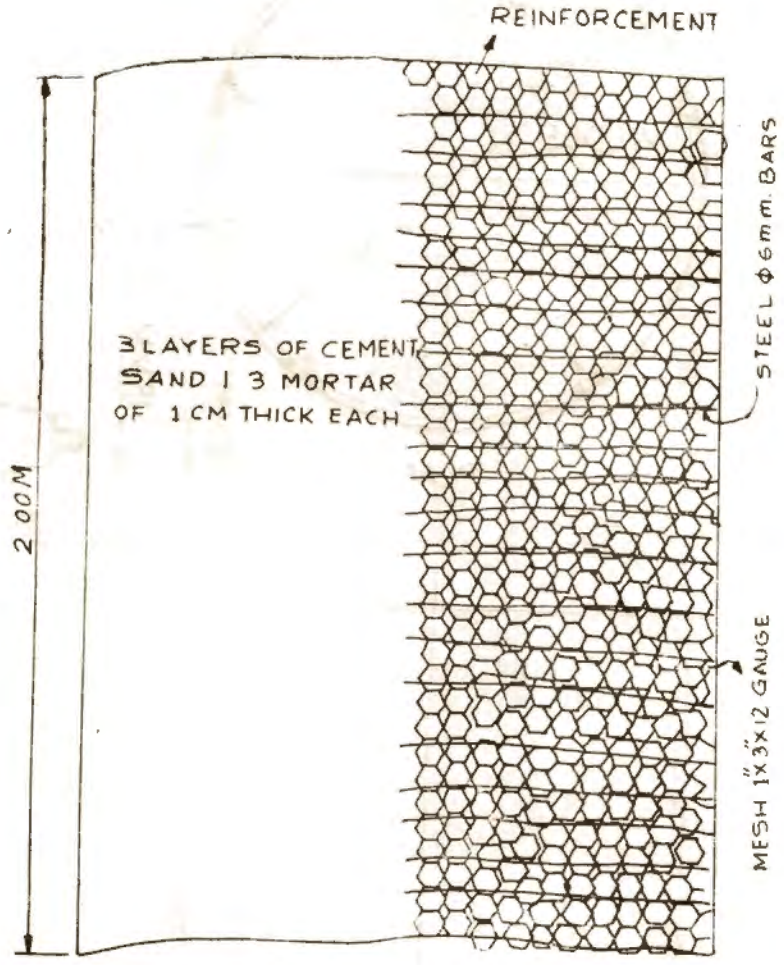
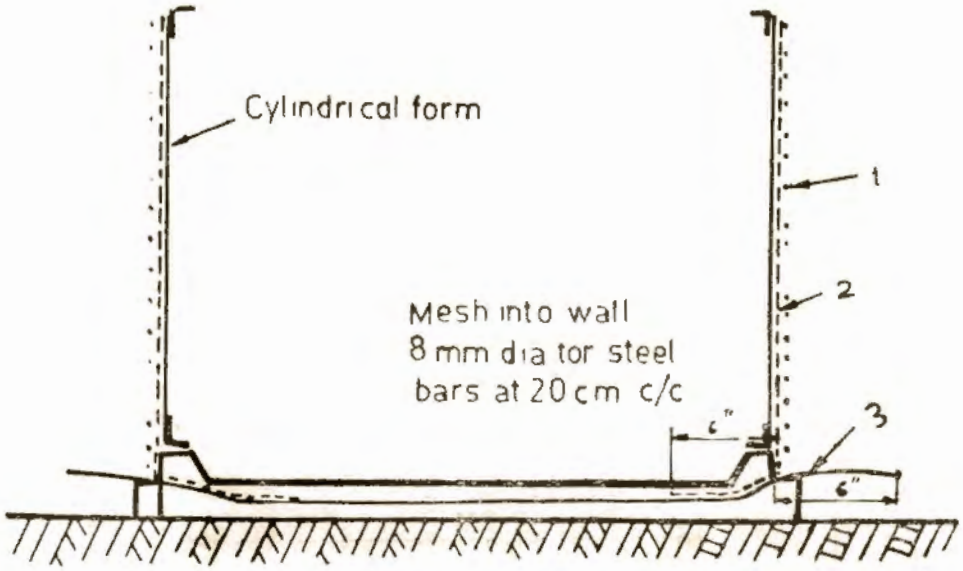
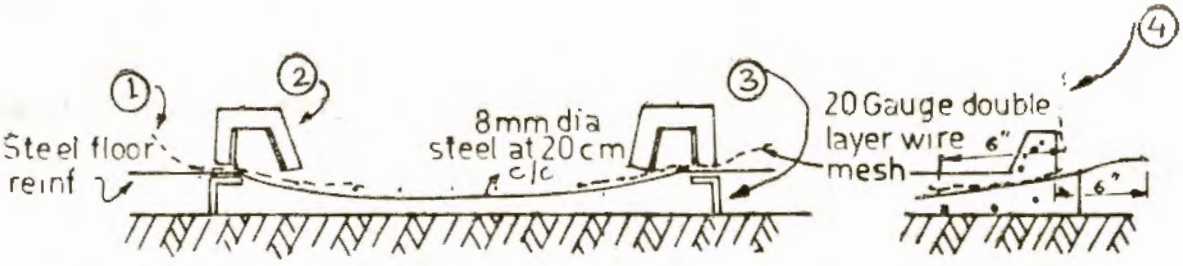


FIG. 2—THE REINFORCING WIRE AND MESH BECOME EMBEDDED IN THE PLASTER BUILD-UP



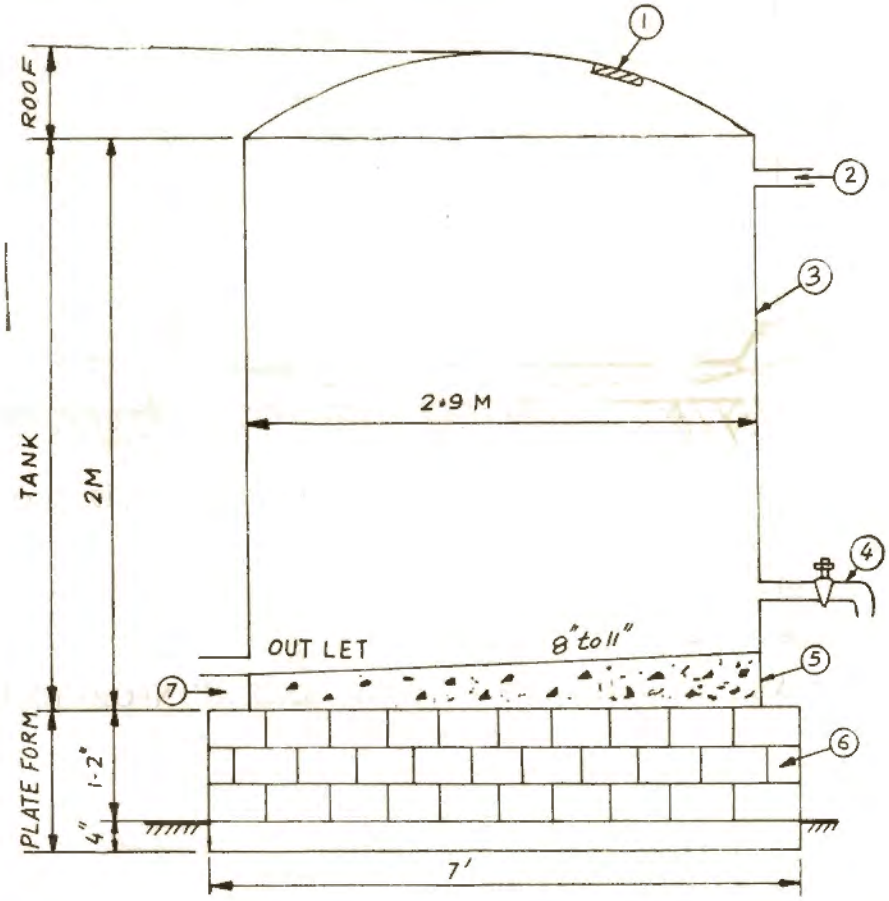
1. Hoop wire reinforcement steel 6 MM DIA AT 3, 7, 12, 13, 14, 15, 16, 18, 19, 20, C/C from bottom to top.
2. Mesh (1"×3"×12 Gauge)
3. Mesh (20 Gauge double layer).

FIG. 3—ASSEMBLING THE FORM WORK AND REINFORCEMENT



1. Chicken mesh 2. Top ring mould 3. Bottom ring mould 4. Bend up mesh into wall.

FIG. 4—RING MOULD AND REINFORCEMENT CASTING BASE SLAB



1. 1′×1′ Opening 2. Over flow pipe 3. 3 Layers of wall each approx 1 cm thick with 1 : 3 (cement sand mix) 4. Tap 5. R C C with 1. 2. 4 cement sand aggregates mix.
6. 1st class brick masonary with 1 : 3 (Cement Sand)

FIG. 5–ELEVATION OF 9m³ FERROCEMENT WATER STORAGE TANK

AUTOMATIC NEGATIVE LET-OFF MECHANISM FOR HANDLOOM

Prof. A. Venkatachalam
K. Sundaresan and
Prof. K. Jayachandran

In Handloom Weaving, uniformity of pick spacing is most important. For, such variations can produce visible, faults in fabrics. The uniformity of pick spacing depends upon the type of let-off mechanism employed in the Handloom. The present paper deals with the modification of the ordinary negative let-off mechanism in a handloom into-automatically controlled negative let-off mechanism, which can exercise a good control over pick spacing. It is found that the cloth woven from the handloom fitted with automatic let-off mechanism has less variation in picks/inch and the general appearance of the cloth is also better than that woven with ordinary negative let-off system.

INTRODUCTION

In Handloom Weaving, controlling the warp tension at a uniform level is a difficult problem due to complexities involved in it As the take-up motion draws the warp forward, the average warp tension rises from pick to pick till the beam slips and releases the warp. When the warp is released, the warp tension immediately reduces. It again builds up during the next few picks before the beam slips again. This variation is known as the pick to pick variation in tension. One of the important effects of warp tension variation is the irregularity in pick spacing This is due to the tension variation occuring during weaving from full beam to empty beam.

The let-off motions used on handlooms are only negative let-off type which are actually warp beam brakes. As the take-up motion draws the cloth forward, the warp is released from the beam. The warp beam is braked by negative let off which controls the free rotation of it. The negative let-off motion is shown in Figure A. The beam has ruffles on either side of it and a rope is wound on the ruffle. The two ends of the rope are connected to a system of levers which apply load on the system. This load prevents the beam from rotation. When the warp tension is greater than this load, the beam is turned against the friction on the ruffle. The tension in the warp (T) may be calculated as below :

$$Tt = \frac{W.\ AC}{AB}$$

$$\frac{Tt}{Ts} = e^{\mu\theta}$$

and $2 \times (Tt - Ts)\ d/2 = T.D/2$

Where,

D = Diameter of the warp at the beam
d = Ruffle diameter
W = Weight
A = Fulcrum
B = Point at which the chain is connected to the lever

C = Point at which the weight acts on the lever

Tt = Tight side tension in the chain

Ts = Slack side tension in the chain

T = Tension in the warp sheet

μ = Co-efficient of friction between chain and ruffle

θ = angle of lap of the chain on the ruffle in radians.

In this mechanism, as the beam diameter decreases, the warp tension will increase. The worker will have to sense the warp tension by feeling it with hand and accordingly, he will move the dead weight towards the fulcrum point. Now the load acting on the beam decreases which will result in decrease in the tension. There is always variation in tension due to human error.

The other disadvantages of the negative let off are :—

(1) The tension on the warp is not uniformly maintained through out the beam.

(2) The production gets affected due to the attention spent by the weaver on adjusting the position of the weight.

So, it becomes necessary to modify the negative let-off mechanism to an automatic one. This can be achieved by making the backrest floating rather than fixed. Depending upon the warp tension, the position of the backrest changes thus maintaining a constant warp tension throughout the beam.

THE PRINCIPLE OF AUTOMATIC NEGATIVE LET-OFF

The essential features of the system are shown in Figures B and C for the full and empty beam respectively. The braking force is applied to the wooden ruffles on both ends of the beam by ropes. It is important to ensure that the ropes do not stretch. The slackside of the rope is attached to the loom frame through a strong coil spring. The tight side is fixed to the weight lever BC. The shaft B extends through the full width of the loom. Two long levers AB, one at each side of the loom, are fixed to the shaft B and have bearings at their upper ends to carry the freely rotating back rest.

If friction at the back rest is neglected the tensions T on each side of the backrest are equal and their resultant force R bisects the angle TAT. This resultant force R tends the lever AB to rotate anticlock wise. Therefore the weight lever BC is raised thus reducing the tight side rope tension. When the system is in equilibrium, the tendency of R to produce anticlock wise rotation and that of the weight to produce clockwise rotation are in balance.

If the warp tension T increases, R would also increase and the lever AB would turn slightly anticlock wise. This will reduce the tightside tension of the rope and hence the braking force. As a result, the beam could rotate more freely to release the warp, reducing the warp tension. Conversely, if the warp tension decreases, the lever AB would move slightly clockwise, which would increase the cracking force. Thus the warp tension is kept at a constant level automatically.

When the beam is nearly empty as shown in Figure 'C', the resultant R is more effective in rotating lever AB, anticlock wise. The tension in the tight side of the rope will, therefore, be progressively reduced. Thus the system maintains a constant warp tension as the beam weaves down. The system is self-compensating for both short and long term variations in warp tension. If the slackside of the rope was connected directly to the loom frame, the system would be very much sensitive. Its senstivity is reduced by connecting the slackside of the rope to the frame through a spring of suitable characteristics.

DETAILS OF FABRICATION AND MOUNTING

The fixed back rest from the handloom was removed. It was then placed at the holes provided at the top end of the vertical levers. The vertical lever has a hole of 17 mm diameter for housing the back rest. It has also a hole of 20 mm dia-

meter at the bottom to fix it on the shaft. There were 2 small holes provided at its bottom meant for the bolt to pass through. The horizontal lever had a hole of 20 mm diameter at one end meant for fixing over the shaft and also 2 small holes meant for fixing the bolts through. This vertical lever, the horizontal lever and the coupling were assembled on the shaft and tightened by bolts. Similar such mounting was done on the other side of the loom. The drawings of vertical lever, horizontal lever, shaft, coupling and their assembly are shown in the Figures D, E, F, G and H respectively.

RESULTS AND DISCUSSION

First the handloom was run with ordinary let-off and then with the automatic negative let-off with same sort o fabric after modification. The fabric samples were observed for variation in picks per inch and the results are given below :—

	Average picks/inch	% co-efficient of variation of picks/inch
For cloth woven on handloom fitted with ordinary let-off.	44.8	6.77
For cloth woven on handloom fitted with Automatic let-off	45.1	2.85

From the above result, it is clear that the cloth woven from the handloom fitted with automatic negative let-off has less variation in picks/inch, compared to that with ordinary negative let-off. It was also observed that the general appearance of the cloth was better than that woven with ordinary let-off system.

CONCLUSION

By introducing automatic negative let-off in Handloom, uniform warp tension was maintained during weaving resulting in fewer loom stoppages due to less end breakage. Weaver's productivity was found to increase as the weaver has not to give attention in displaying the weight in let-off. The fabric was found to be more uniform in pick/inch and with better appearance. In our country, where the handloom industry is the largest cottage industry with 75 lakhs handlooms, introduction of automatic let-off will produce phenomenal economic and quality improvements. Such technological developments will become inevitable for the Indian handloom industry, to catch the foreign market, which is highly quality conscious.

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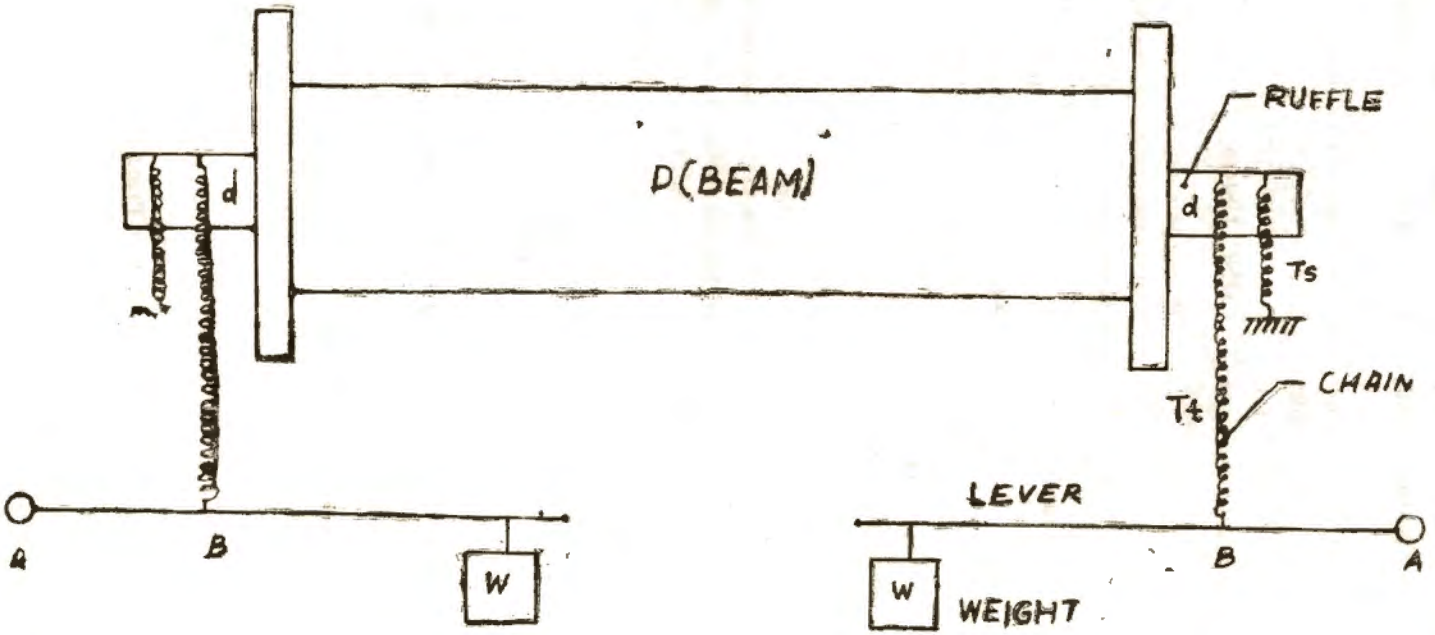
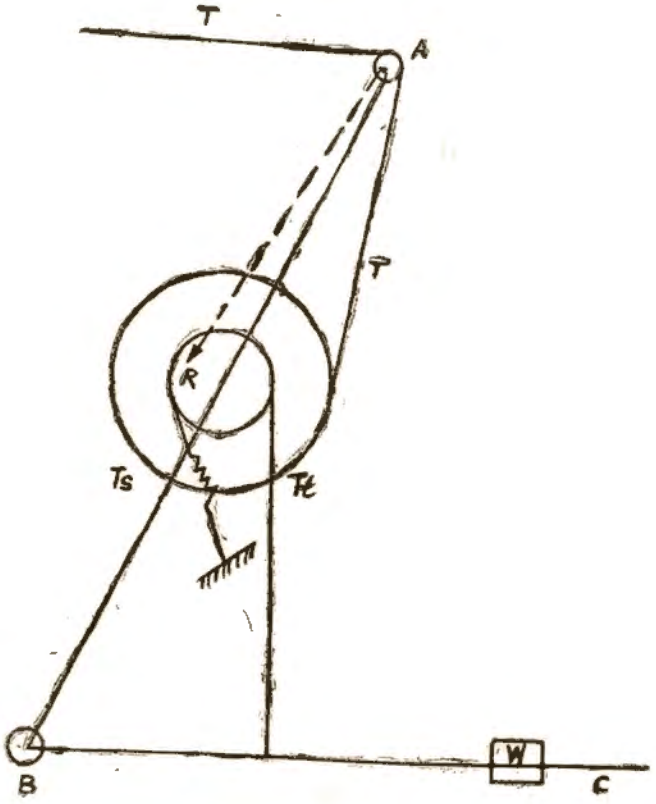
ACKNOWLEDGEMENT

The authors express their sincere thanks to Dr. S. Subramanyan, Principal, PSG Polytechnic Coimbatore–4, for his constant encouragement given during this work.

FIG. A

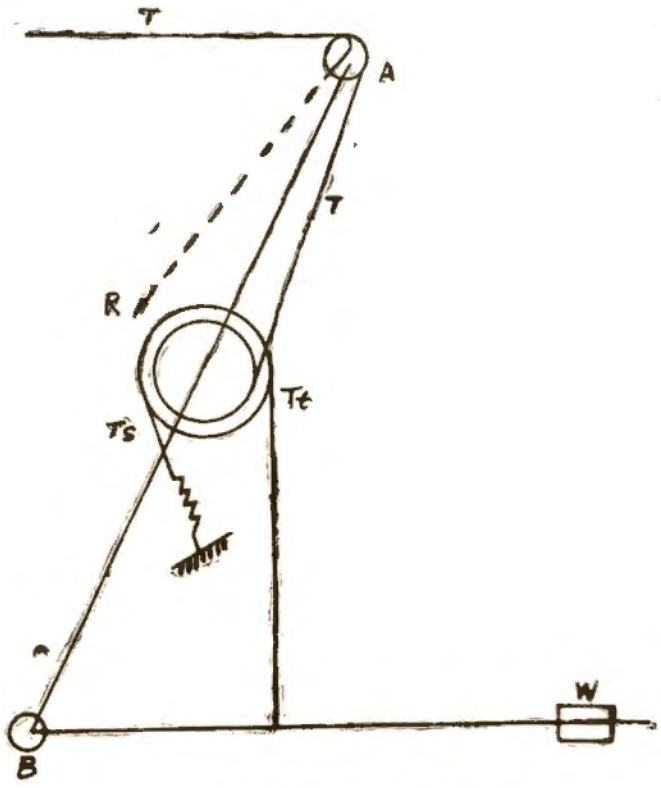


NEGATIVE LET-OFF MECHANISM



BEAM FULL

FIG - B



BEAM EMPTY

FIG. C

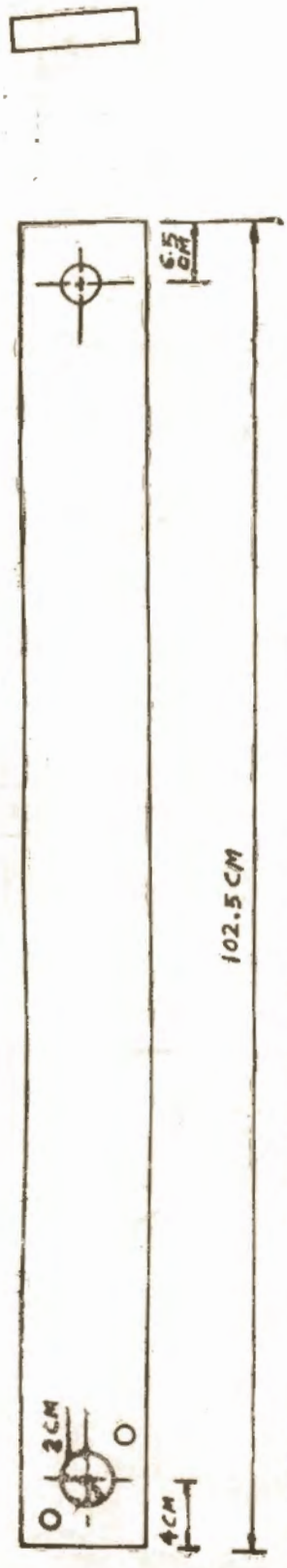


Fig. D—VERTICAL LEVER

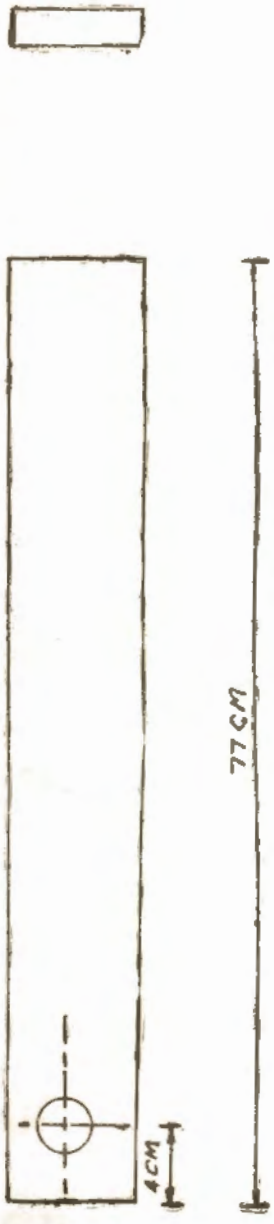


Fig. E—HORIZONTAL LEVER

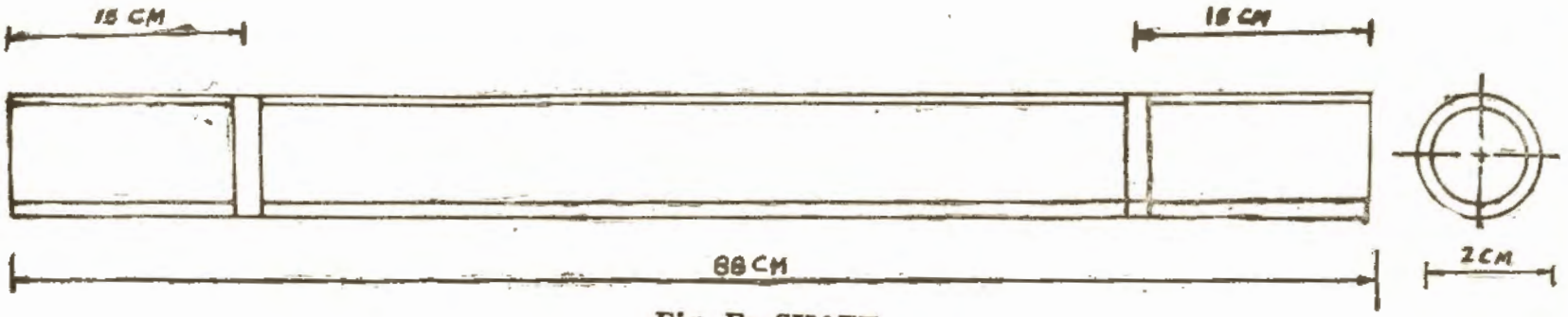


Fig. F—SHAFT

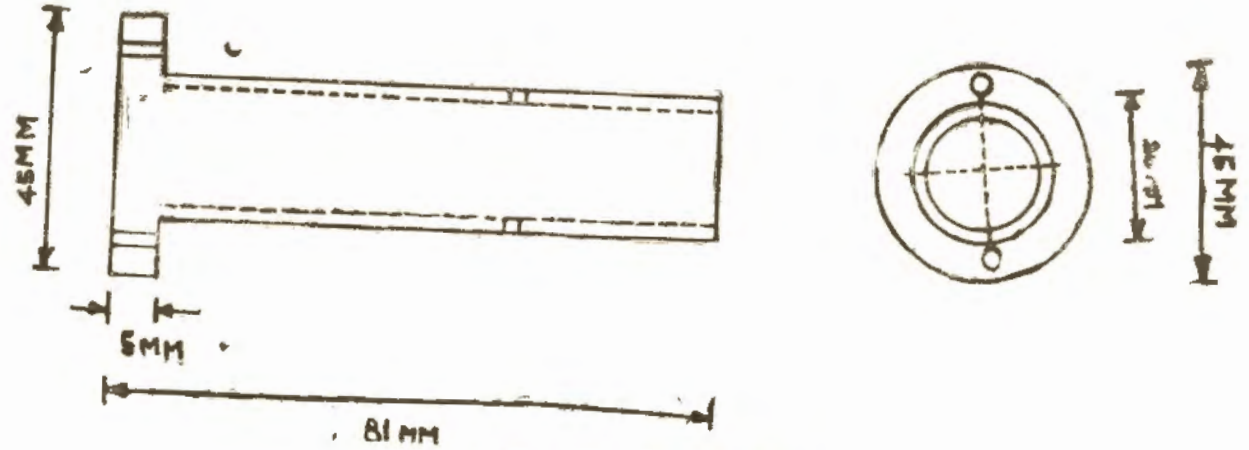


Fig G—COUPLING

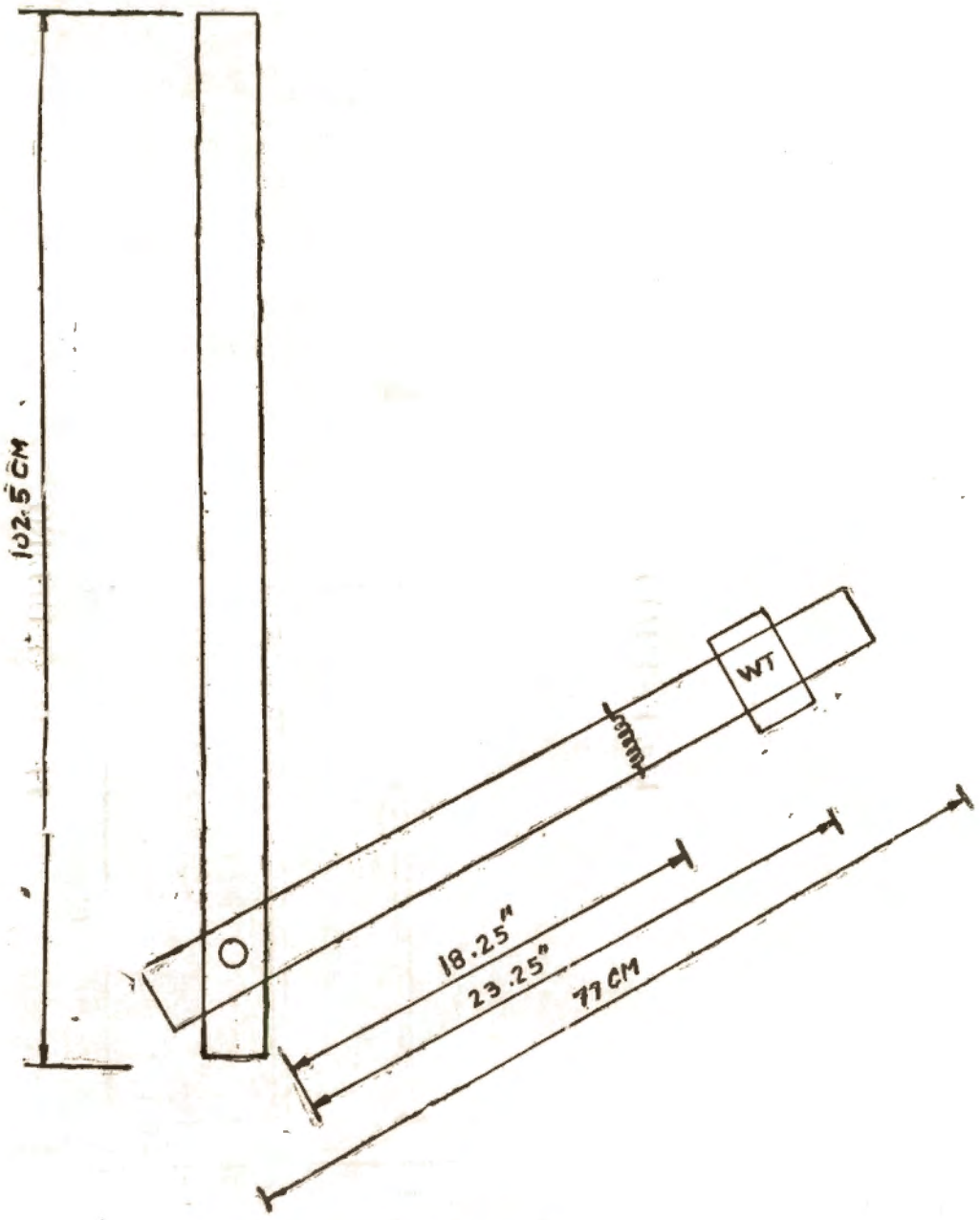


Fig. H

WASHING SOAP

MATERIAL REQUIRED :—(For 10 kg soap)

Mahua Oil	8 kg.
Sodium Silicate	2 kg
Caustic Soda	4 kg.
Water	2 kg.
Boiling Pan	1 no.
Stirrer	1 no.
Mould for soap	1 no.
Knife	1 no.
Containers	3 nos.

METHODS OF PREPARATION

Generally soap is made by three methods

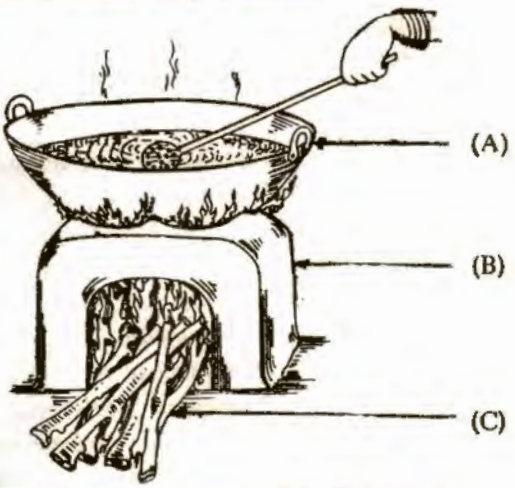
(1) Cold Process

(2) Semi Boiled Process

(3) Full Boiled Process

COLD PROCESS

1. Take about 1 kg of Mahua oil in boiling pan. heat it so that oil gets melted.



(A) Bowl, (B) Cook Stove. (C) Fire wood.

Fig. 1 Heating the Mahua oil

Fig. 2 Boiling Pan

2. Take about 4 kg. of Caustic Soda in container and add water gradually so that solution is prepared.

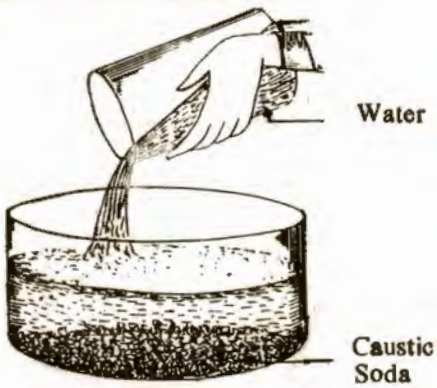


Fig. 3 Adding water to Caustic Soda

3. Add caustic soda solution to mahua oil gradually and stir continuously.

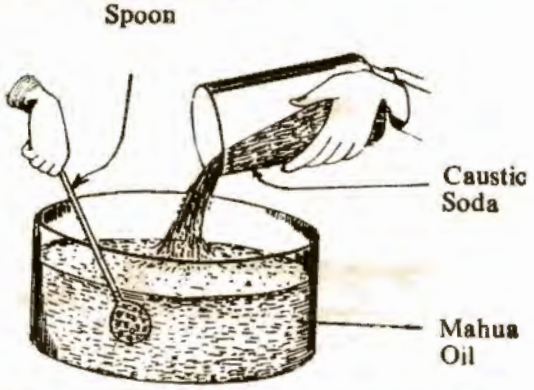


Fig. 4 Adding Caustic Soda solution to mahua oil

4. Take hot water (temp. upto 60°—70°C) and add about 2 kg. sodium silicate so that sodium silicate gets dissolved in water.
5. Add sodium Silicate solution in the mixture of oil and caustic soda.
6. Stir continuously and vigorously. When it is mixed homogeneously then fill in the soap mould.

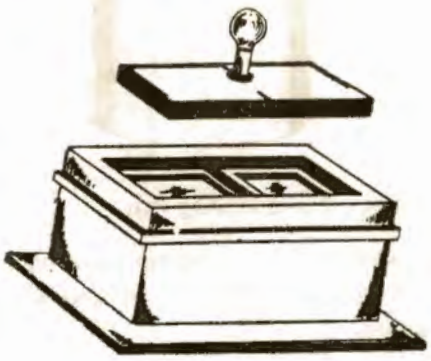


Fig. 5—Soap Stamp

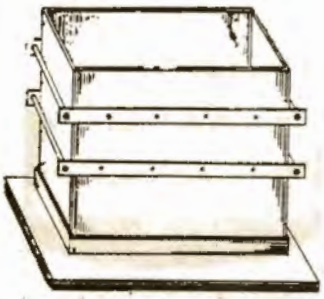


Fig. 6—Soap Mould

7. Cut the soap in the form of cakes and bars of desired size.

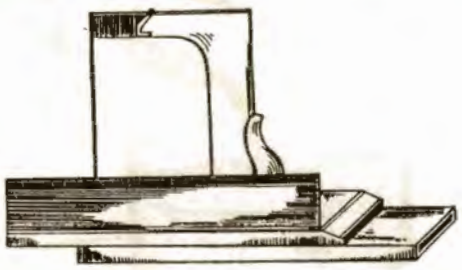


Fig. 7—Soap Bar Cutter

8. Cakes and bars taken from the moulds and pack in wax paper and send to market.

2. PREPARATION OF SOAP BY SEMI BOILED PROCESS

Ingredients

Coconut oil	200 grams
Mahua oil	1 kg
Caustic Soda	550 grams
Sodium Silicate	4 kg
Water	1.3 kg
Linseed oil	1 kg
Cotton seed oil	1 kg
Salt	100 grams
Maize	200 grams
Soap stone powder	800 grams

PROCESS :

1. Mix 1 kg. of Mahua oil, 200 gram coconut oil and 1 kg linseed oil and take it in big container.
2. The mixture is heated to 80°C temp.
3. Dissolve 550 gram of caustic soda in 1 kg water and prepare a solution. This process should be done one day before making soap so that solution gets cooled off
4. Now add the caustic soda solution into oil and stir vigorously and continuously.
5. Allow the mixture to boil off. Care should be taken that solution does not come out of the container during boiling operation. If it happens so then sim the flame and mixture should be scraped off with scraper. The solution will settle down and saponification process will be completed. When the saponification process is completed then mixture will be homogeneous and lustre will appear in mixture.

6. Add cotton seed oil to this mixture.
7. Allow the mixture to cool and settle down.
8. When soap gets solidified then cakes should be identified by trade marks, identification marks.
9. Cut the cakes/bars according to desired size. Soap is ready for despatch and pack it in waxed paper and send to market.

3. PREPARATION OF WASHING SOAP BY FULL BOILED PROCESS

The complete process for preparation of washing soap is divided into three stages.

1. Boiling the soap mixture and saponification process.
2. Preparation of grained soap and burnt charge of boiled mixture.
3. Soap fitting.

PREPARATION OF WASHING SOAP BY NEEM OIL

Ingredients

Neem oil	10 kg.
Caustic Soda	1.4 kg.
Water	10 kg.
Salt	400 grams
Rice Bran oil	300 grams
Coconut oil	300 grams
Rosin	500 grams
Sodium Silicate	400 grams
Boiling pan	1 no.
Big container	1 no.
Stirrer	1 no.
Soap mould	1 no.

PROCESS

First Stage—Boiling of Soap Mixture and Saponification Process

1. Heat Neem oil 10 kg. taken in boiling pan.
2. Prepare Causic Soda lye by dissolving 1.4 kg caustic soda dissolved in 7 kg water. This process will be carried out one day before making soap.
3. Add Caustic soda lye solution to oil mixture gradually and in small quantities.
4. Scrape the mixture of oil and lye solution with the scraper and stir vigorously.
5. Add completely the caustic soda lye solution to oil mixture when the lye is fully added then solution will becomes white when solution appears to be white then stop adding caustic soda lye.
6. Allow the mixture to be homogeneous and boil off completely.

Second Stage—Brine Charge of Boiled Mixture

7. Add about 400 grams of salt in the oil mixture by Sprinkling soap will and two layers will be formed. Grained Soap will come at the top surface and will have cured like appearance. Unspent lye, impurities in oil and salt and salt crystals will remain at the bottom. The solution will be of black colour.
8. When the mixture in containers gets—then leave the solution as it is. Let it remain for a period of 48 hours.
9. Pure soap will be deposited iu the upper layer, this should be seperated carefully. Unspent lye which is collected at the bottom of container can be seperated out. This lye also contains some amount of soap which can be seperated out by this method. In this way grained soap is formed.

Step—3 Fitting of Soap

10. Cut rosin into small pieces and add to oil mixture.
11. Heat the mixture of rosin mixed with oil so that rosin gets melted and mixed in oil.
12. When rosin is mixed completely then add caustic lye to this solution and scrape this mixture with scraper.
13. When whole lye is added then grained soap previously prepared is mixed to this solution.
14. When soap gets melted and mixed completely in the mixture then heating of the solution is stirred continuously.
15. Add scent to this solution.
16. Soap is filled in moulds and left for solidifying.
17. Next day when soap gets solidified then bars/ cakes can be cut of desired size.
18. You can put your trade marks, identification marks, on the cakes bars.
19. Wrap the wax/butter paper on the cakes so prepared.
20. Soap can be sent to market for sale. Soap is ready,

MANUFACTURE OF TOILET SOAP (FOR HOUSEHOLD PURPOSE)

Toilet soap can be generally prepared by three methods.

1. Cold Saponification process.
2. Remelting of soapstone and scented soap.
3. Milling process.

1, COLD SAPONIFICATION PROCESS FOR TOILET SOAP

INGREDIENTS

Coconut oil	10 kg.
Tallow	15 kg.
Castor Oil	1 kg.
Caustic Soda lye	13 kg.
Boiling pan	1 no.
Filter	1 no.
Stirrer	1 no.
Mould	1 no.

PROCESS

1. Take coconut oil and tallow in boiling pan.
2. Heat the oil so that oil gets melted and filter oil.
3. Add caustic soda lye to oil solution gradually and stir the solution continously.
4. When oil gets saponified completely then add scent and colour to desired level.
5. Fill the soap solution in mould for setting down.
6. Cut the cakes/bars according to desired size.
7. Put trade marks, identification marks on cakes as desired.
8. Wrap cakes in wax paper. Soap is ready.

2. BY REMELTING PROCESS

Refined groundnut oil	200 gram
Coconut oil	225 gram
Castor oil	25 gram
Caustic soda lye	225 gram
Carbolic acid	5 gram
Soap colour	0.5 gram
Water to dissolve colour	5 gram
Boiling pan	1 no.
Container	3 nos.
Stirrer	1 no.
Soap mould	1 no.

PROCESS

1. Prepare caustic soda lye solution in a container This process should be done one day prior to making soap.
2. Dissolve about 0.5 gram Red colour into 5 gram of water.
3. Prepare a mixture of Groundnut oil (200 gram), coconut oil (225 gram castor oil and heat this mixture to 90°C.
4. Add caustic soda lye and colour in hot oil.
5. When the mixture appears like honey and then stop heating.
6. Add carbolic acid and stir vigrously.
7. When mixture becomes homogeneous then fill up in mould.
8. Cut the bars/cakes of desired size.

SPOT LIGHT

A STRATEGY FOR SUSTAINABLE LIVING

A new action plan, Caring for the Earth—"A Strategy for Sustainable Living," has been launched simultaneously in more than 70 countries in October. The Strategy is the outcome of the collaboration between WWF, IUCN (The World Conservation Union) and UNEP (United Nations Environment Programme).

Caring for the Earth is intended as "broadly-oriented but practical guide to the policies we must adopt and the actions we must under-take" to ensure a sustainable life for present and future generations. It sets targets as means of focusing action in essential areas and of evaluating results. It recommends 130 actions by individuals, governments, groups, commercial agricultural and business interests.

The strategy identifies nine principles for sustainable living :

- Respect and care for the community of life.
- Improve and care for the community of life.
- Conserve the Earth's carrying capacity.
- Minimize the depletion of non-renewable resources.
- Keep within the Earth's carrying capacity.
- Change personal attitudes and practices.
- Enable Communities to care for their own environments.
- Provide a national framework for integrating development and conservation.
- Create global alliance.

BIOGAS FROM POULTRY WASTES

Poultry faeces might be an attractive source of methane or biogas, according to scientists at Kalyani University in West Bengal, who say these wastes could be used for large scale production of methane under optimal conditions.

According to the researchers, the carbon to nitrogen ratio of 16 to 18 in poultry faeces is higher than that of dairy cattle and this higher carbon-nitrogen ratio is congenial for the production of methane.

Although both aerobic and anaerobic conditions are applicable for methane production, the scientists say under anaerobic conditions, the yield of methane is about 50 percent higher than that under aerobic conditions. The optimum pH for methane production is 6.5.

Since the pH of faeces obtained from the birds is in the alkaline range, from 7.5 to 7.7 methane production under natural conditions proceeds suboptimally. This drew the researchers into developing methanogenesis for optimum yield.

The optimum temperature, they say, for methanogenesis from droppings of birds is 35 degrees celsius. Glucose, phosphate and ammonium ions have capabilities of increasing the biogas production.

The scientists said the yield may be substantially improved with supplements of appropriate carbon-nitrogen ratios and phosphates.

BIOGAS FROM DISTILLERY EFFLUENTS :

Renewable Energy Centre, College of Technology and Agricultural Engineering. Udaipur, has conducted studies on production of bio-gas from distillery effluent. The effluent collected from Udaipur Distillery Pvt Ltd., Udaipur has a temperature of 85.95°C, pH 4.1—4.51, is dark brownish in colour, TS 5.76%, BOD 44000 mg/1 and COD 116000 mg/1. The carbon to nitrogen ratio was found to be 31 : 1, which is favourable for methane production.

Based on the laboratory study the operating conditions of the pilot study were taken as : acid phase digestion-fluidized bed-3 days HRT. Methane phase digestion—upflow anaerobic filter packed with brick ballast porosity 50%—7 days HRT.

Within the period of experimentation the anaerobic digestion was found to have an optimum gas yield of 23.75 litres/litre, containing 64.5% methane. The biphasic digestion system shows that the process is clearly superior in terms of gas production, methane content, digester volume requirement and plant capital cost.

BIOGAS FROM TEA-LEAF WASTES :

Two gas plant owners late Shri Ram Singh and Shri Bhairoo Lal Kothari of BAP village in Jodhpur district, Rajasthan, had been initially utilising cattle dung for feeding their gas plants. But the continuous drought in the region repleted their cattle stock and it was out of desperation that the fed the plant with tea-leaf waste which was available with them in good amount as one of them owned a tea stall. The results were stunning and now they regularly use tea-leaf waste only, procuring it from their own sources and from also nearby tea-stalls. Earlier they tried vegetable waste also for feeding the plant, but the output of gas was much less, than in the case of tea-leaf waste. One kg. of Tea waste produces 12 cft gas which is equivalent to approximately 10 kg, of cow dung.

LOW-ENERGY WASTE GAS CLEANSING TECHNIQUE

An Austrian firm has made a sensational breakthrough with the use of the contact charging process to separate dust, flue ash and soot from waste gases. In laboratory tests 90 percent of the particles contained in flue gas were removed. The technique is suitable not only for large-scale industrial use. A further research project is to be launched to determine its suitability for automobile fume cleansing. In this way the harmful soot emitted by diesel engines could be filtered out. In the contact charging process the flue gas is passed over a high-voltage electrode. As the particles in the gas come into contact with the electrode, they are electrically charged and drawn towards an earthed grid, where they are separated out. Particle accelerations of upto 2,000 times that of gravity acceleration have been observed during tests. The principal advantage of the new process is that it requires far less energy than the corona charge technique currently in use, which also filters out particles by charging them.

HYDRAULIC LIME AND CEMENT FROM CALCIUM WASTES

Building researchers in Roorkee are putting to constructive use calcium-containing wastes from paper, fertiliser and sugar industries.

A team of scientists from the Central Building Research Institute (CBRI), Roorkee, has developed a process to make hydraulic lime from powdery calcium carbonate wastes from these three industries.

In the CBRI process, the wastes are mixed with silicaceous additives such as flyash and rice husk ash in different amounts and the mixtures fired at 1000 degrees celsius in a laboratory furnace.

Tests show that the samples made from the wastes and clay set within 30 hours at room temperature and have satisfactory compressive strength.

A second process developed at CBRI helps to make low-temperature cement from these wastes Cement from the sludges was found to be comparable to ordinary portland cement, both as such and on hydration.

The process will save energy and is useful in small-scale manufacture of cement.

WEED BECOMES SOURCE OF GREEN MANURE

A poisonous and problematic weed, Lantana camara, can be potential source of green manure,

according to recent research findings at the Himachal Pradesh Krishi Vishwa Vidyalaya.

Lantana, also known as wild sage, finds use in making compost and can reduce consumption of nitrogen fertilisers when mixed with them, say studies conducted at the agricultural university.

The plant can have as much as 30 kg of nitrogen in each hectare of crop when added to nitrogen fertilisers, the studies indicate.

During trials conducted in Himachal Pradesh, when 10 tonnes of wild sage were mixed with 90 kg of nitrogen, the yield of wheat in one hectare equalled that when 120 kg of nitrogen were added to it.

Chemical analysis shows that the green matter of sage contains more than 1.5 per cent potassium and more than 2 percent nitrogen, but is poor in phosphorus.

Addition of sage alone with fertilisers enchances the levels of total nitrogen, ammonium and available phosphorus, and despite being highly poisonous, it does not inhibit nitrification.

Mixing sage with cowdung and rock phosphate in a 20:8:1 ratio also improves the quality of compost.

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fax 0049 7723 5373

A WEEDLESS GREENHOUSE

Soil solarization for greenhouse crops is proving commercially viable in Japan, Italy and Jordan.

Its potentials is especially great in Japan, where more than 30 000 hectares of plastic greenhouses were used in 1985 for such vegetable and fruit crops as strawberries, eggplant and tomatoes, and more than 3000 hectares were used for flowers.

In Sicily, 8000 hectares of crops are cultivated in plastic houses with more than 83 percent of the area dedicated to solanaceous (sun-loving) crops, such as tomato (40 percent), pepper (29 percent) and eggplant (14 percent).

In these greenhouses, which are covered with transparent plastic films such as polyethylene or vinyl chloride, solarization is often the method of choice to disinfest soil. Experimenting in Italy, Drs Girolamo Caritia, Nicola Greco and G. Cirvilleri found solarization to be as effective and less costly for the purpose than fumigation with methyl bromide.

Technology

Solarization can be applied in a number of ways in different greenhouse applications. In Japan, where it has succeeded in a climate that is marginal for the effectiveness of outdoor soil solarization, an organic amendment, such as shredded rice straw, is usually rotary tilled into soil within the greenhouse. This can be supplemented with calcium cyanamide to increase the decomposition of organic material

and improve fertility. Approximately 10-20 tons of rice straw and 1000 to 1500 kilograms of calcium cyanamide are worked into the soil per hectare.

Shallow furrows are made in the soil for temporary irrigation after the surface is covered with transparent plastic film. (There was no appreciable difference in soil temperatures produced by vinyl chloride or a polyethylene film.) Enough water is used to wet the soil to a depth of at least 60 centimetres. The greenhouse is then completely closed for four weeks during July or August.

Using this procedure, Drs T. Kodama and T. Fukui obtained maximum soil temperatures ranging from 50°—60°C at a depth of 10 cm. After solarization, plastic sheeting is removed and the soil bedded-up for planting.

Among the main diseases and pathogens controlled were bacterial wilt *Pseudomonas solanacearum*) in solanaceous crops, Fusarium and verticillium wilts *Fusarium oxysporum* f. sp. *ycopersici* and *Verticillium dahliae*) of tomato and eggplant.

In strawberry, the largest crop solarized in Japan, the process controlled Fusarium wilt the fruit's main disease, and also the problem of root knot caused by a species of *Meloidogyne* nematodes. Similar results have been obtained in Sicily and the Jordan Valley.

Field soils that have been solarized can also be used for greenhouse and nursery operations, as the beneficial effects of the process persist when soil is transported to other areas, Moreover, the soil can be left fallow until needed. The release of nutrients and survival of micro-organisms such as root-colonizing bacteria (*Bacillus* species) that spur plant growth persist for about two years after soil is solarized.

DEAD ALGAE SOLUTION DECONTAMINATES WATER :

Dead plants and organisms—primarily algae - have been found to be very effective at adsorbing heavy metal ions, according to a report in the journal Chemistry in Britain.

According to a scientist at the New Mexico State University at Las Cruces, the proprietary process produces a biological ion-exchange resin.

Algasorb patented by Bio-Recovery systems——a company founded by the scientist Professor Dennis Darnall——adsorbs heavy metal ions from solutions because of their binding, or biosorption, to various functional groups in or on the algal cells.

Algasorb is produced by caging algae in a silica gel polymeric material. The caging protects the algal cells from being destroyed by other micro-organisms and results in the formation of granules Algasorb functions very much like a commercial ion exchange and can be packed into columns.

When contaminated water is flushed through the column, any heavy metal ions will be hooked onto the Algasorb. When the Algasorb is saturated the metals can be stripped away and the Algasorb reused.

The journal has quoted Darnall as saying that Algasorb is particularly effective at removing heavy metals from waters containing organic residues and is being tested for removal of uranium ions from groundwater.

THERMOPLASTICS FROM WHEAT :

Japanese researchers have developed a method for producing highly biodecomposable thermoplastics from the proteins in wheat (gluten).

The new method jointly developed by the Hyogo Prefectural Industrial Technology Center. Nagata Sangyo and Dr. Y. Yamashita of Kyoto Institute of Technology adds glycerin and emulsified silicone oil to gluten, to impart thermoplastic nature and strength to it.

The researchers are planning to commerciallise the process, considering that it can produce biodec-

composable thermoplastics at a much lower cost than the microorganism-aided process.

The process is simple powdered gluten. after being mixed with glycerin, glycol, emulsified silicone oil and urea, is dried and then pressed under heat. Gliadin and glutenin, major components of gluten having bonded hydrogen and sulfur are solidified while dry.

These bonds, however, are weakened when exposed to water to form gaps, into which hydrophilic groups and hydrophobic molecules are introduced to impart thermoplasticity and strength to the gluten.

The treated gluten, after being dried, is pressed under a pressure of 150 kg per square metre into approximately 300 micrometres thick, semitransparent sheets. It has been confirmed that these sheets are decomposed in four weeks when buried in soil.

The sulfur-free sheet is more resistant to decomposition, lasting an additional one to two weeks. The sheet containing glycerin and sulfur has a tensile strength of 250 kg per square centimetre, sufficient for use in shopping bags. However, increasing the quantity of urea working as the pasticizer, decreases the tensile strength.

RECLAIMING WASTE WATER

Earth has massive amounts of water-some 1,400 million cubic kilometers of it—yet the supply of fresh water is limited. About 98% of the water is in the oceans and seas, and most of the rest is locked up as ice. We do with a tiny .027 percent of freshwater from rivers, lakes, springs, and underground aquifers.

Industrial development and population growth over the years have produced water shortages in many parts of the world. Meanwhile, human and industrial wastes are increasingly contanminating this precious resource. For example, the Ganga has Leen polluted severely, and India has mounted a massive effort to cleanse it.

Most methods used for waste water treatment have been mechanical. They are costly and energy intensive. In the search for alternative technologies that are simple, efficient, and cheap, scientists have demonstrated that aquatic plants, such as the water hyacinth, have great potential for wastewater treatment and reclamation because of their photosynthetic systems.

The biological process works something like this : the plants are grown hydroponically in a filter made of rocks through which waste water flows. The roots, which are home to large numbers of bacteria and other micro-organisms, extend into the waste water. These microbes feed off the minerals and organic chemicals that pollute the water. While digesting the pollutants, the microbees produced by products such as sugars and amino acids, which are absorbed by the plant roots as food. The plants, in turn, supply oxygen and nutrients to the microorganisms for their rapid growth.

This symbiotic relationship allows waste water to be purified by the plant roots, and moreover, the plants' abundant new leaves help restore oxygen to the air and also regulate the level of carbon dioxide and other atmospheric gases. The large amount of harvested plant material resulting from the process is a potential source of energy, animal feed, fertilizer, and other valuable products.

In the past few years, a number of cities have installed various versions of this aquatic plant-based technology for purifying their waste-water. For example, San Diego, California, has set up a water treatment plant using water hyacinths and Denham Springs, Louisiana, uses canna lilies for treating its waste water.

AT IN POST-MODERN TIMES :

AT-Association of Germany on behalf of GATE will hold a workshop on "Appropriate Technology in Post-Modern Times", from May 11—15, 1992 at Frankfurt, West Germany.

The title of the workshop tries to reflect on the changing role of AT in times when the doubt in large industrialism has become common sense. Does AT still have a future? Is there still a need to support the work of so called AT Institutions and organisations ?

For further information Contact :

GATE
Dag-Hammarsk jold-Weg
D-6236 Eschborn
Federal Republic of Germany.

RAIN FOREST CAMPAIGN :

German NGOs working in the development and environmental sectors are calling for a charter to protect the rain forests. They are planning a "Rain Forest Campaign '92" to keep attention focussed on the destruction of the virgin forests. In this way they hope to influence the UN conference on Environment and Development in Rio de Janeiro in June 1992.

For further information contact :

Arbeitsgemeinschaft Regenwald
and Working Group (ARA)
Klasingstrabe 17
D-W-4800 Bielefeld
Federal Republic of Germany

SCIENCE AND TECHNOLOGY WEEK

ASIAN Committee on Science and Technology (COST) will organise a Conference and Exhibition on the "Third Asian Science and Technology Week" from 17-24 September '92 at Singapore.

The theme of the conference are : Biotechnology, Food Science and technology. Non-Conventional Energy. Marine, science Micro-electronics and computers and Material science and technology.

For further information contact :

Conference and Exhibition Management
Service Pte Ltd.
1 Maritime Square 09-43
World Trade Centre
Singapore 0409.

CONFERENCE ON NUTRITION :

FAO and WHO will jointly organise a World Conference on Nutrition in December 1992 at Rome.

The agenda will include study of the causes and factors of malnutrition, their amplitude and geographic distribution. The impact on populations of developing nations, and emergency and long-term regional. national and international responses to the problem will be examined.

The conference aims to sensitize international opinion to the size, causes and consequences of poor diet, and to mobilize financial resources to ameliorate the problem.

The conference will gather representatives of FAO/WHO member countries, NGOs, international and intergovernmental organizations as well as industry experts.

For further information contact :

Food and Agricultural Organisation
Via delle Terme dic aracalla
1-00100 Rome
ITALY

ENERGY MANAGEMENT AND CONSERVATION :

Institution of Engineers (India), Bhubaneswar, will organise one day Seminar on "Energy Management and conservation in Industries" on July 20, 1992 at Bhubaneswar.

Energy saving under the present shortage conditions has become a subject of great concern. It has been realised that considerable energy saving can be achieved by development of energy efficient motors and lighting systems for industries and matching of motors with pumps in rural sectors. The objective of the seminar is to give an insight into the state of the art of technology of energy saving and bring out recommendations after proper discussion by the participants.

The main topics to be covered in Seminar are : Energy conservation methodology. Energy conservation in power plants, Reduction of T & D Losses, Energy conservation in induction motors used in industries, Energy conservation in transport sectors. Energy conservation in industrial lighting. Energy saving in domestic appliances and Role of electronics in energy saving.

For further information contact :
Mr. P. C. Mahapatra
Organising Secretary
The Institution of Engineers (India)
Sachivalaya Marg
Unit IV
Bhubaneswar-751001.

ENVIRONMENTAL TRAINING :

Government institutes Inc. in their annual training schedule, will conduct a two days "Environmental Training : Requirements, Strategies, and Resources for Environmental Managers and Trainers" from June 2-3 1992 at Washington. Dc.

This training will helps to understand the legal requirements for training as well as the components of a cost-effective environmental training programme. This training will also help to learn who should be trained, what kind of training they need, how often they should be trained, what types of training resources from both public and private sources are available for use, environmental trainer liability, selling training plant to management, and environmental education initiatives.

For further information contact :

Government institute, Inc.

4 Research Place, Suite 200

Rockville, MD 20850

USA.

MONITORING ENVIRONMENT IN INDIA

To-day environmental awareness gained greater importance. Environmentalists all over the country are considering the different aspects of the global warming, marine transgression, solar radiation, deforestation and wildlife extinction as a threat to environment. The effects of pollution have reached a stage where the normal existence of mankind is being threatened.

The atmospheric pollution, population explosion, rapid industrialization and urbanisation are further deteriorating the environment.

We are in a position to realize that all our activities, industrial, agricultural are dependent on the renewable natural resources of our planet-air, water, soil, flora and fauna and the inter-actions between them. These are now known as our life support system and our main objective should be to use them on a sustained yield basis. The need of the hour is that all government institutions, public and private organisations, must come forward to put earnest efforts to project the planet, earth and its fragile environment.

The chief objective of this book is to create awareness among the Indian masses about the evil effects of environmental degradation, and the remedial measures to be adopted to preserve the fragile ecosystem. This volume consists of very interesting papers about the ecology and environment, and will be useful to all those who care the environment and the nature and its aestetic set up.

"Monitoring Environment in India", by S. K. Chadha, published by ESS ESS publications, New Delhi, pp. 115, English Rs. 125/- 1991.

ENERGY-ENVIRONMENT-DEVELOPMENT

Energy.Enviroment Development are three equally important facts of national development process for any country. This fact is even more relevant to the least developed countries as desired development pace in these countries are much higher and its consequence on environment often has been neglected in the past resulting in environmental degradation.

The environmental concerns of energy use have been debated for a long time now, but these have assumed more significant proportions in recent years with the prospect of global warming and related adverse climatic changes looming large. Unfortunately, while a number of developed countries have reached a stage where there exists almost a negative link between economic growth and energy consumption, this is not so in developing countries.

This book is the compilation of the proceedings and papers of the 12th Annual International Association for Energy Research Institute, at New Delhi. The objective was to promote an exchange of information and strategies relating to the energy and environmental aspects of sustainable development between the developed and developing countries. Broad topics under which papers were presented and are published in two volumes are : Energy and sustainable development, Simulation and modeling, Energy and ecology : evaluation and planning, Energy policy issues, Energy and ecology : the green house effect, Renewable energy options.

Both the volume contains valuable material presented and debated by a distinguised set of researchers, leaders of industry, and government officials, the spirit of attempting to define the dimensions and

contours of a global problem and to attempt providing direction for solutions and strategies for the future.

"Energy-Environment-Development (Two Volumes)" by R. K. Pachauri, Leena Srivastava and Kapil Thakral (eds), published by Har-Anand Publications in association with Vikas Publishing House, New Delhi, pp. 976, English, 1991, Rs. 950 (per set).

THE SAFE DISPOSAL OF HAZARDOUS WASTES

The inappropriate and often careless handling of municipal and industrial wastes, including those that are hazardous, has all too often created problems worldwide for human health and the environment. Effective control of hazardous wastes is of paramount importance for proper health and environmental protection and natural resource management. Developing countries, as they experience rapid industrial growth, have a particular and urgent need to initiate programmes for hazardous waste management.

This three-volume manual is intended for administrators and technical staff, primarily in developing countries, who have responsibilities for waste management, public health and environmental protection. Information presented in this publication includes the classification of hazardous waste, its effects on health and the environment, the planning and implementation of programmes in hazardous waste management, hazardous waste treatment and disposal technologies, including economic and institutional considerations.

The main emphasis of this manual is on the management aspects and on the technologies that may be appropriate for implementing a regionwide hazardous waste management program. Chapter 1-5 contain information on the classification of hazaradous waste, their effects on health and the environment and the planning and implementation of programmes for hazardous waste management. Chapter 6 and 7 deal primarily with the hazardous waste treatment and disposal technologies, including economic and institutional considerations.

A particularly useful section of this manual includes the examples of various operating system for hazardous waste tracking and disposal, waste survey questionnaires and techniques and landfill design and management practices.

"The Safe Disposal of Hazardous Wastes : The special Needs and Problems of Developing Countries". (Three Volumes) by Roger Bastone, James E. Smith, Jr, and David Wilson (eds), Published by World Bank.

RURAL DEVELOPMENT IN SOUTH ASIA

Recently, it has been widely recognised by decision-makers and thinkers that both population growth and ecology affect deeply the development process. Hence, appropriate population planning and ecology management are necessary so that these do not constrains development process but conduce to its effective performance. Sustainable development with due attention to population planning is now getting to be accepted by policy-makers to serve as the basis for a reformulation of development strategies and restructuring of development programmes derived from these strategies.

Rural development has now been recognised by academicians, planners and policy makers as the centrepiece of national development. It implies "transformation of rural life and activities in all their economic, social, cultural, institutional environmental and human aspects".

This book is in four volumes : Volume One critically analyses the national policies, programmes and organisations of rural development in India, Volume Two analysed the national experiences of rural development in Pakistan. Volume Three re-

viewed the experiences of Bangladesh and Volume Four examined the rural development scene in Nepal and Bhutan.

This book which is based upon the earned author's personal observation and experiences of rural development programmes and organizations would not only be of interest in academic circles and training institutions but also among planners, policy makers and rural development agencies to gain increasing knowledge of socio-economic development processes and problems for better evolvement and implementation of rural development programmes.

"Rural Development in South Asia" by B. S. Khanna published by Deep and Deep publications, New Delhi, 1991, Rs 1100/- (Set of Four Volumes).

PRIMARY RESOURCES AND ENERGY IN THE THIRD WORLD :

A resource is any-thing that contributes to the process of production. In other works, a resources is a resource only with the confines of the needs and objectives of a given economic system, and more specifically of the social, technological, economic and institutional characteristics of that system. In an economic sense, resources do not-exist, they are created.

Resource exploitation is one of the cornerstones of Third World development. Minerals form one of the main trade flows linking Third World countries into the world economy. Some countries rely heavily on their mineral export earnings, and most depend on oil imports to fuel the development process.

Third World mineral producers, however, have little control and their fate, multinational companies dominate the industry and have, with the help of first world governments, thwarted Third World attempts to improve their position. At the same time, a dual energy crisis threatens the Third World. The high cost of commercial fuels retards economic development, while in rural areas shortages of fuelwood geopardize the very survival of the poor.

The solutions to these problems lie in the complexities of the wider development process. John Sussan explores the issues and arguments involved, using a variety of cases studies from across the Third World. The book is divided into two parts, Part one deals with Minerals and Development and Part Two analyses the Energy. Survival and Development.

"Primary Resources and Energy in the Third world, by John Soussan, published by Routledge, New York pp. 114.

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Organised National Seminar on Rural Technology (1981), on behalf of Ministry of Rural Development, Govt. of India. State level workshops on technology transfer for state Govt. of Himachal Pradesh (1983) & Karnataka (1984), International Training Programme on Appropriate Technology sponsored by UNESCO (1983), A. T. Orientation Programmes for senior officers of Science Policy Centre of Govt. of Iran etc.

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