Leaflet No. 9/86-87

Government of the Union of Myanmar
Ministry of Forestry
Forest Department

Studies of Energy Source from Different Types of one Stick Fuel - Wood Stove

U Saw Yang Aung C.Doo, B.Sc. (For.) (Rgn.) M.S. (Hawaii),
Head of Division
U Saw Melvin, B.A. (Rg.)n Film Operator,
Daw Khin Mya Swe, B.Econ., (Stats.) (Rgn.), Deputy Research Officer
Forest Research Institute.
1987

ထင်းတစ်ချောင်းမီးဖို အမျိုးမျိုး အသုံးချမှုနှင့် ၄င်း၏အပူ စွမ်းအင်ကို လေ့လာခြင်း

ဦးစောရန်အောင်စီဒူး၊ B.Sc. (For.) (Rgn.), M.S (Hawaii) ဌာနမှူး
ဦးစောမဲလ်ဗင်? B.A. (Rgn.) ပြစက်ရိုက် ။ ပြစက်မောင်း
နှင့်
ဒေါ်ခင်မြဆွေ၊ B.Econ. (Stats.) (Rgn.) ဒု-သုတေသနမှူး
သစ်တောသုတေသနဌာန

စာတမ်းအကျဉ်းချုပ်

သွပ်ဖြင့်ပြုလုပ်သော ထင်းတစ်ချောင်းမီးဖိုနှင့် မြေအမျိုးမျိုးဖြင့် ပြုလုပ်ထားသော ထင်းတစ်ချောင်းမီးဖို၏ ခံနိုင်ရည် နှင့် မီးအပူစွမ်းအင်ကို လေ့လာထားသော စာတမ်းဖြစ်ပါသည်။ မြေအမျိုးမျိုး စမ်းသပ်ရာ၌ မင်းလှမြေဖြူစေး၊ ရမည်းသင်းမြေဖြူစေး၊ ကြပ်တည်းမြေများ ပါဝင်ပြီး မြေရောစပ်ရာ၌ အချိုးအစား အမျိုးအမျိုးဖြင့် ရောစပ်လျက် အပူခံနိုင်ရည်ကို စမ်းသပ်ပါသည်။ မီးဖိုများကိုလည်း အရွယ်အစား အမျိုးမျိုး ပြုလုပ်လျက် မီးအပူစွမ်းအင်များကို စမ်းသပ်ထား ပါသည်။ အချင်း ၉″ နှင့် အမြင့်၁၃″ ရှိသော မီးဖိုတစ်လုံး၏ ပျမ်းမျှတန်ဘိုးမှာ ၁၄၂/ (တစ်ရာ လေးဆယ့်နှစ်ကျပ်) ဖြစ်ပါသည်။

Study of Energy Source from Different Types of one Stick Fuel - Wood Stove

U Saw Yang Aung C.Doo, B.Sc. (For.) (Rgn.) M.S. (Hawaii),
Head of Division
U Saw Melvin, B.A. (Rg.)n Film Operator,
Daw Khin Mya Swe, B.Econ., (Stats.) (Rgn.), Deputy Research Officer
Forest Research Institute.

Abstract

The paper dealt with comparison of energy source from one stick fuel stove made from iron sheet and different clay. Different mixture of clay proportion of durability in the manufacture of stove and energy source from different sizes of stoves were studies. The average cost of production for a stove with 9" diameter and 13" high was fourty two kyats.

Contents

1. Introduction

The Forest Department of Burma has increased the establishment of Fuelled plantation in order to meet the demand of increased population.

On the onehand applying energy technology in the country has also become a priority in order to use fuelwood as effectively as possible.

On that account the Forest Department has development one stick-fuelwood stove using iron sheet as the outeer case. the stove has been quite acceptable in many places. However, the Iron Sheet is not readily available for large scale production, so the Forest Research Institute has taken up to solve the problem by looking into a substitute; hence, this research paper dealth with one stick-fuelwood stove using various kinds of clay available in the country.

2. Literature Review

A few decade back scientist has developed different kinds of stove especially for the developing countries. The widely used stove are oil Barrel stove, wood conserving cooking stove, wood burning cookstove, saw dust stove, solid Fuel Cooking stoves, and many other different types of energy stove. (1976. ken Darrow and Rick Pam)

Suppliment energy for rural development such as solar energy, Biomass energy and other gaseous energy source also has become widely uised. (1981 Advisory Committe on Technology Innovation).

The objective of developing these stove are;

(1) Low in capital costs;
(2) Use local materials wherever possible;
(3) Create jobs, employing local skills and labour;
(4) Are small enough in scale to be affordable by a small group of farmers;
(5) Can be understood, controlled and maintained by villagers wherever possible,without a high level of Western-Style education;
(6) Can be produced out of a small metal-working shop, if not in a village itself;
(7) Does notr involve patents, royalties, consultant fees, import duties, shipping charges, or financial wizards, practical plans can be obtained free or at low cost and no further payment is involved.

3. Materials And Methods

Different types of clay were used in the manufacture of one stick fuel stove. Clay from Yemethin, Minhla, Yezin, (Paddy field) were collected and soil texture were analysed.

The following proportion of soil mixture was adopted in the manufacture of stove.

	Soil Type	Proportion
(1)	Yemethin soil (မီးခဲမြေဖြူစေး)	1
(2)	Yezin and Pyinmana soil (ကြပ်တည်းမြေ)	3
(3)	Paddy field soil (စနယ်မြေ)	2
(4)	Charcoal (မီးသွေး)	1½
(5)	River sand (သဲ)	1

To prepare a stove, the above soil were grinded thoroughly and seived to collect stone and debris. (Fig 1)

The above proportion of soil were mixed and kept for 24 hours. After 24 hours water was added to the mixture and rolled until the mixture became sticky. (Fig 2)

A stove has two parts (1) The outer case and (2) The inner case. A mixture of salt, slaked lime, and burned rice husk in the proportion of 1: 2: 3 were added in between the two cases to absorb heat released from fuel-wood.

In the preparation of stove the outer base has to be moulded first. (Fig. 3)

For a 12 inches diameter stove the preparation of the base was 12 ½ inches in diameter to give allowance for contraction when drying.

The base was constructed to a height of 7 inches and air dried for 24 hours. After air drying the rolled sticky clay were put step by step onto the base until the height was 14 inches (Fig. 4)

The completed outer case was air dried for 3 days and ventilation and Fuelwood bracket were constructed onto the case. (fig.5) Again the case was dried for 20 days for hardening.

A Cylindrical inner case was constructed with a 5 inches top diameter outer case (Fig.6). Ash holes were made at the base, after being air dried for 3 days. (Fig.7) The case is again air dried for 20 days.

The kiln to bake the stove has a dimension of 12 feet in length 8 feet in width and 8 feet in height for a 100 stove capacity. (Fig.8) The time taken for baking was about 5 to 7 days, 3 days for coking and 3 days for hardening. (Fig 9 & 10)

4. Results

Soil collected from different parts of the country have a certain percentage of clay in all the cases. (Table 1)

Table 1. Particle size of soil collected from different parts of the country.

Sr. No.	Sample	Partical size content			Texture
		Sand %	Silt %	Clay %	
1.	Yezin Soil (ရေဆင်းကြပ်တည်းမြေ)	25.990	16	56	clay
2.	Yemethin Soil (ရမည်းသင်းမြေဖြူစေး)	16.378	22	52	clay
3.	MinHla Soil (မင်းလှမြေဖြူစေး)	29.649	20	46	clay
4.	Pyinmana Soil (ပျဉ်းမနားကြပ်တည်းမြေ)	33.666	20	46	clay
5.	(Paddy Field) စနယ်မြေ	11.894	18	62	clay

However paddy field soil from yezin has a mare percentage of clay than any other soil collected. Since all the soil and has a certain amount of clay the quality of pots moulded has been quite acceptable.

Testing of Calorific Value

To determine the time of boiling, 2000 gm of water were put in the various pots and boiled using Zaungpalwe and Taukyan as fuelwood. a least five replicates had been conducted in the experiments. Both the clay and Iron stove were put for testing. (fig. 11 & 12) The calorific value was determined as follwos :

$$H = (t_2 - t_1) (M_p S_p + M_w S_w)$$

Where H = Calorific value

t_1 = Initial time

t_2 = Final time

$t_2 - t_1$ = difference of time

M_p = Weight of pot

S_p = Sperific heat of alluminium = 0.069

M_w = Weight of water

S_w = Sperific heat of water = 1

The average time taken for a 2000 gm of water to boil was 23 minutes. Most of the heat emitted from the stoves were about the same. (Table 2)

The calorific value calculated averages at 148024 (H). Neither a (12") diameter stove nor a (9") diameter stove has advantage over one another. A total amount of 148 gramms of wood was consumed, within 23 minutes, to get 2000 gramms of water to a boiling point.

Table (2) Determination of Calorific Value of One Stick Fuelled Stove

Sr. No	wt of pot M_p	wt of pot M_w	Temp of water			Duration			wt of fuelwood			Heat from water and pot $H= (t_2 - t_1) (M_w S_w + M_p S_p)$	type of stove
	(gm)	(gm)	t_1	t_2	$t_2 - t_1$	T_1	T_2	$T_2 - T_1$	M_{F1}	M_{F2}	$M_{F1} - M_{F2}$		
			(C°)			(min;)			(gm)				
1	403	2000	23	99	76	9:55	10:13	18	625	456	169	152027 Cal	CS (12")
2	358	2000	23	95	72	9:56	10:21	25	626	458	168	144024 Cal	CS (9")
3	349	2000	23	100	77	9:59	10:14	15	475	292	183	154024 Cal	IS (12")
4	319	2000	23	92	69	10:00	10:29	29	583	483	100	138022 Cal	IS (9")
5	367	2000	23	98	75	10:03	10:30	27	591	494	97	150025 Cal	CS (12")
6	367	2000	23	95	72	10:05	10:25	20	528	203	125	144025 Cal	CS (9")
7	335	2000	23	100	77	10:07	10:30	27	510	341	169	154023 Cal	IS (12")
8	366	2000	23	97	74	10:10	10:35	25	446	270	176	148025 Cal	IS (9")

Mp = wt of pot
M_w = wt of water
Sw = Specific Heat of water = 1
Sp = Specific Heat of Alluminium = 0.069

t1 = Initial temperature
t2 = Final temperature
t1 = Initial Time
T2 = Final time
MF1= Weight of Fuel before testing
MF2= WT of fuel after testing

4.1 Costing

The costing for each stove may be calculated as follows : (basing on 50 stoves)

	Kyats	
1. Labour Charges	960	
2. Fuelwood for baking	300	
3. Cost of Clay Soil	418	
4. Chemicals (ဖျော်ရည်)		200
	1878	

Therefore the cost of each stove was ks 37.56.

5. Conclusion

The advantage of clay stove over Iron sheet stove is that, clay is easily available in the country, as where Iron sheet has to be imported which involved foreign Exchange. Moreover, the corrosive action of salt on Iron sheet rapidly damages the outer case of the stove (Fig. 13).

Another advantage is that many of rural population has the know how to bake pots in their own ways. A proper guidance and education will still improve their methods of moulding and baking.

During the process of the present experiments, it was found that improper baking results in the deformation of the stove (Fig. 14). A correct mixture ofclay to mould the stove and an exact timing in baking was important.

An improved technique for moulding has been underway, which involved mechanical and electrical power. If the technique come to a success the process of making stoves will not only be enhanced but also greatly reduced the cost.

Literature Cited

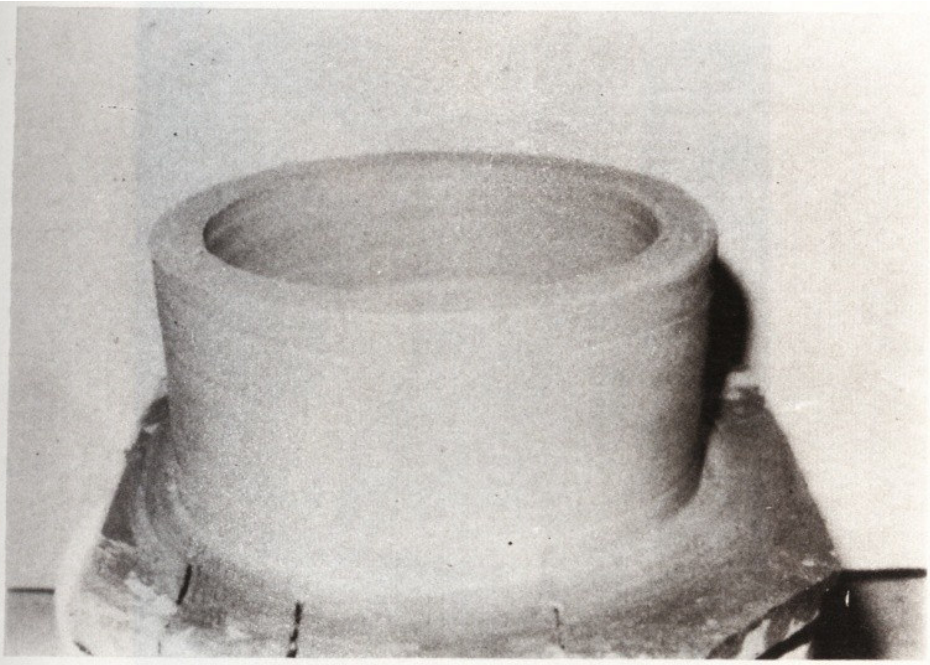
1. Darraw, Ken and Rick. Pam (1981). Appropriate Technology source Book. Volume one. Volunteer Asia Inc. U.S.A.
2. Ken and Rick. Pam (1981). Appropriate Technology source Book. Volume two. Volunteer Asia Inc. U.S.A.
3. Advisory Committee on technology innovation 1981. Energy rural Development National Academy press, Washington D.C.

(Fig.1)

The soil were grinded thoroughly and seived to collect stone and debris .

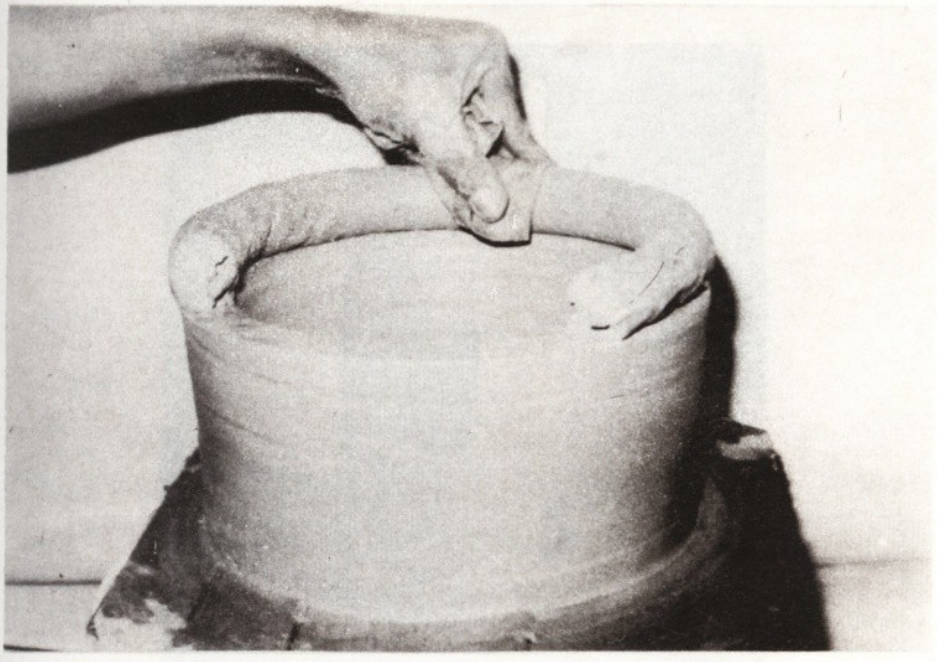
(Fig. 2)

The soil was mixed thoroughly and rolled until the mixture became sticky .



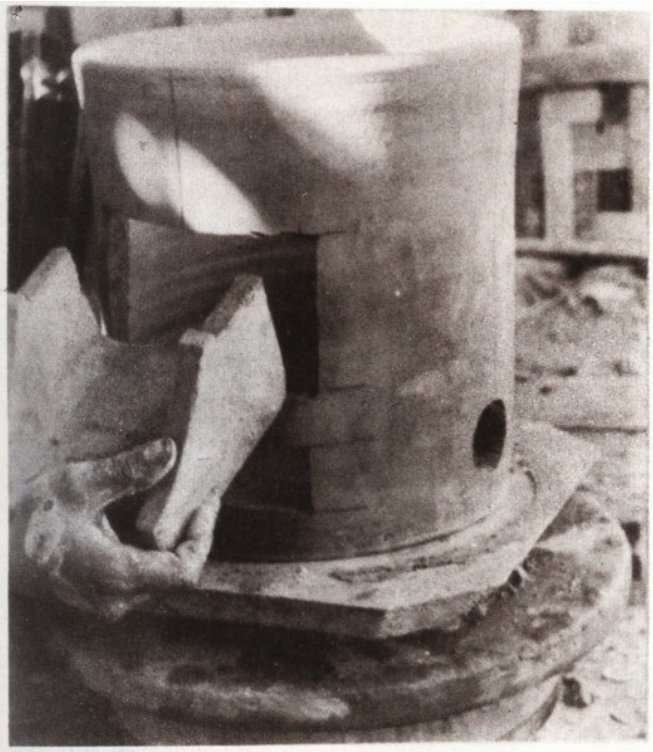
(Fig. 3)

The initial stage of preparing the outer case of one stick fuel wood stove.



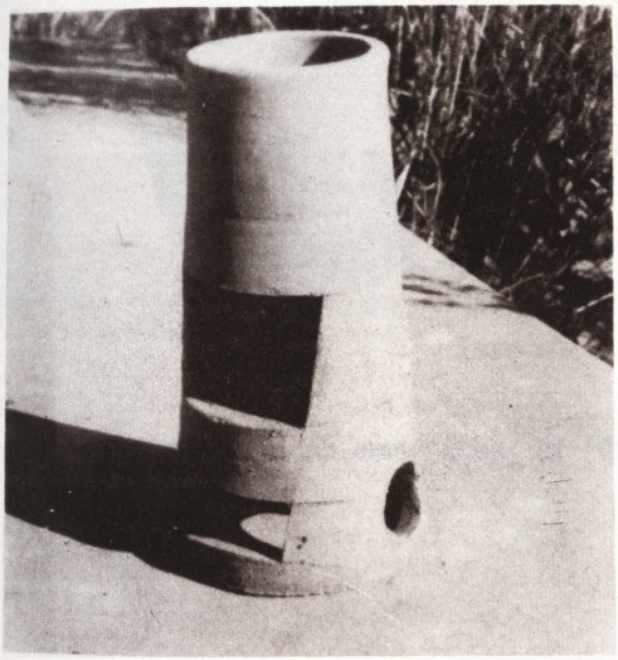
(Fig. 4)

A step by step building of the outer case of one stick fuel wood stove.



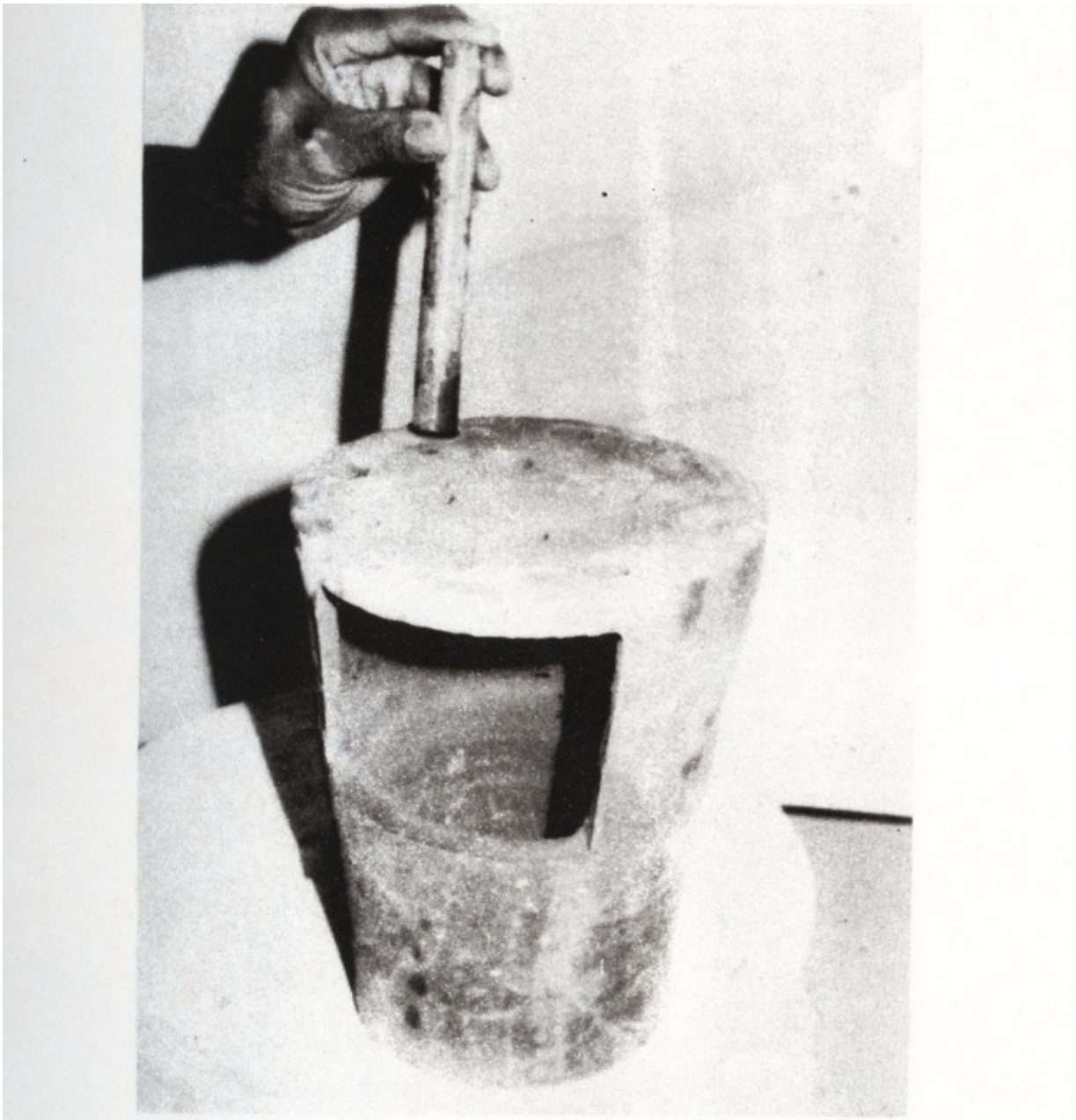
(Fig. 5)

Preparing fuel wood bracket and air ventilation of the stove.



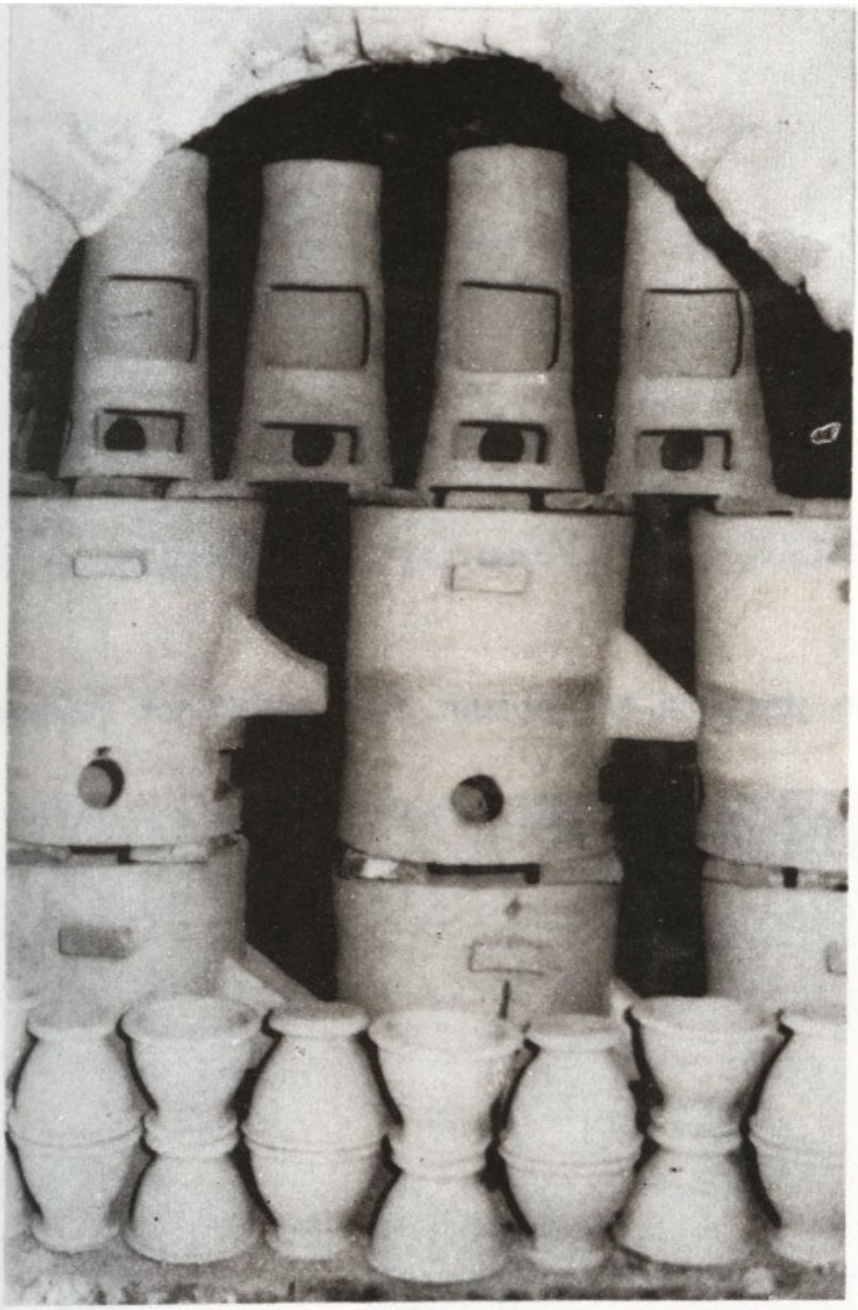
(Fig. 6)

An inner case of one stick fuel wood stove.



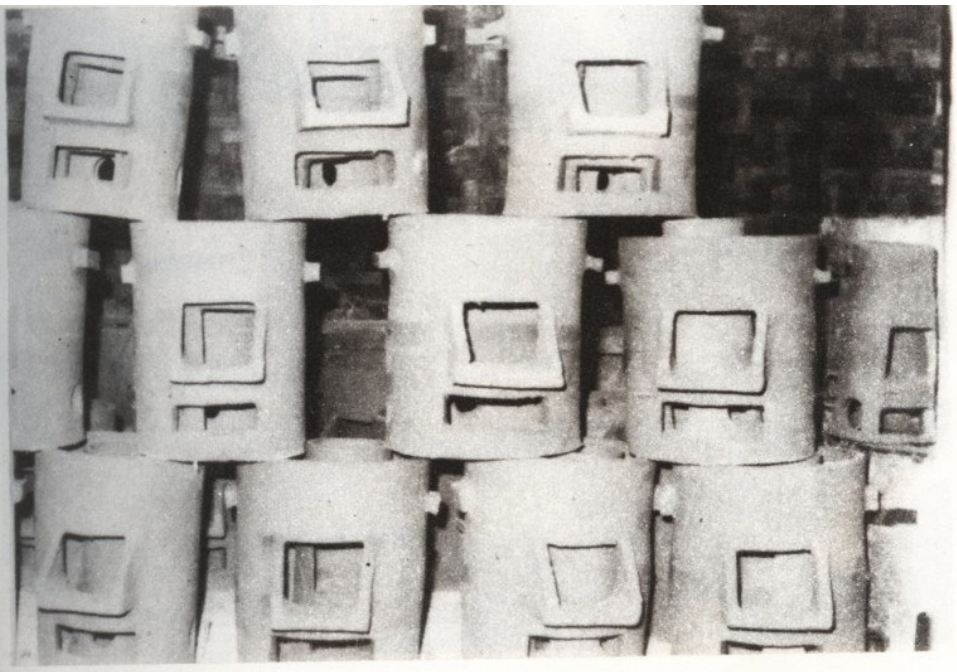
(Fig. 7)

Boring ash hole at the base of inner case of the stove.



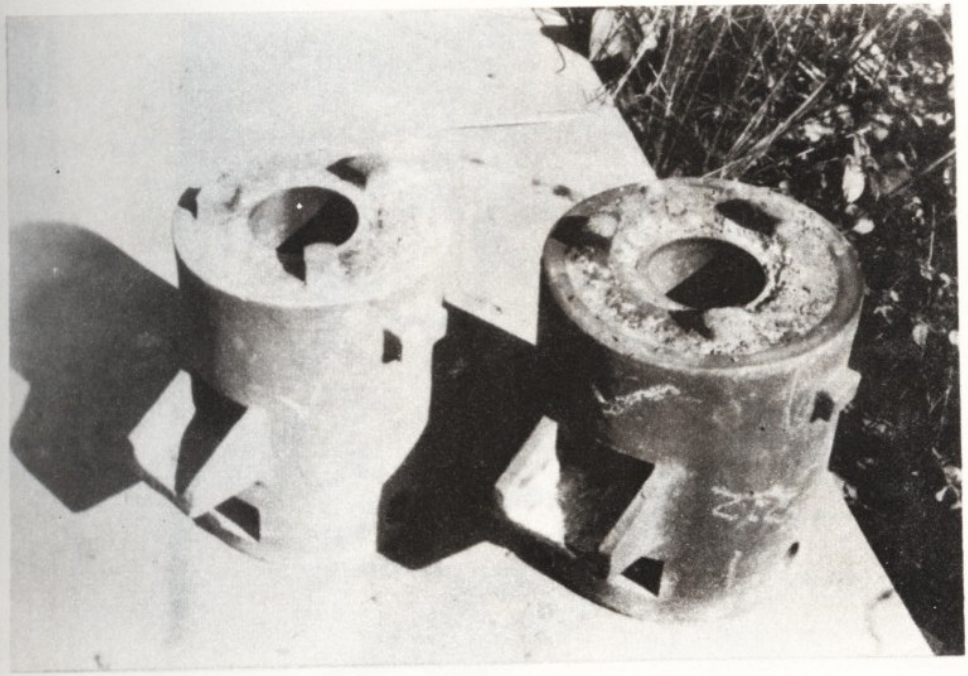
(Fig. 8)

A 50 stove capicity kiln with the stoves ready for baking.



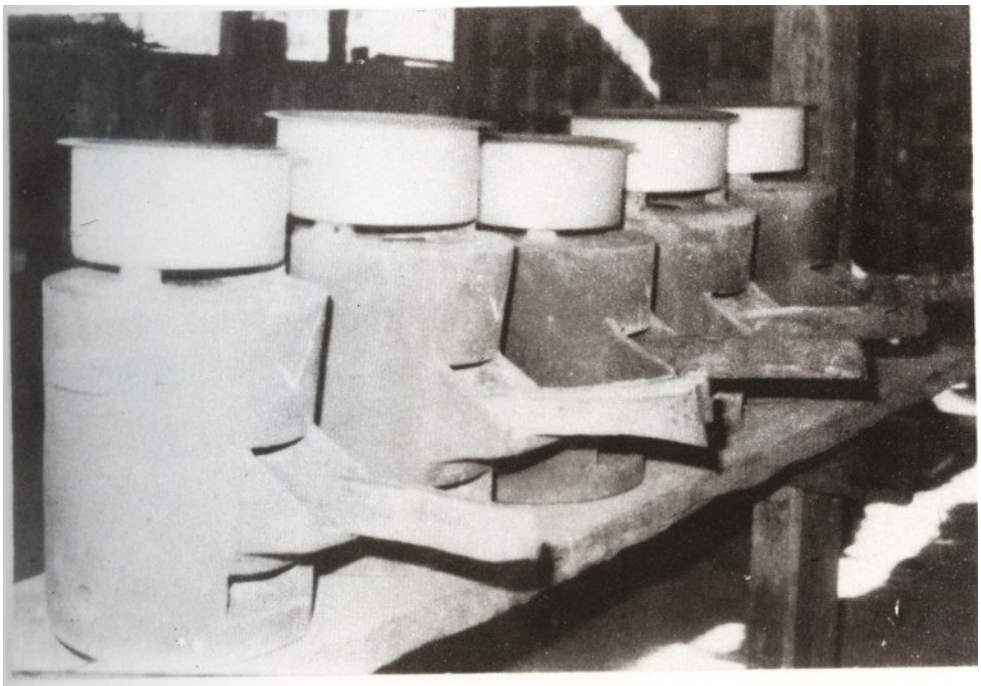
(Fig. 9)

The baked stoves ready for filling with mixture of lime, salt and burned husk.



(Fig . 10)

Completed stoves ready for use.

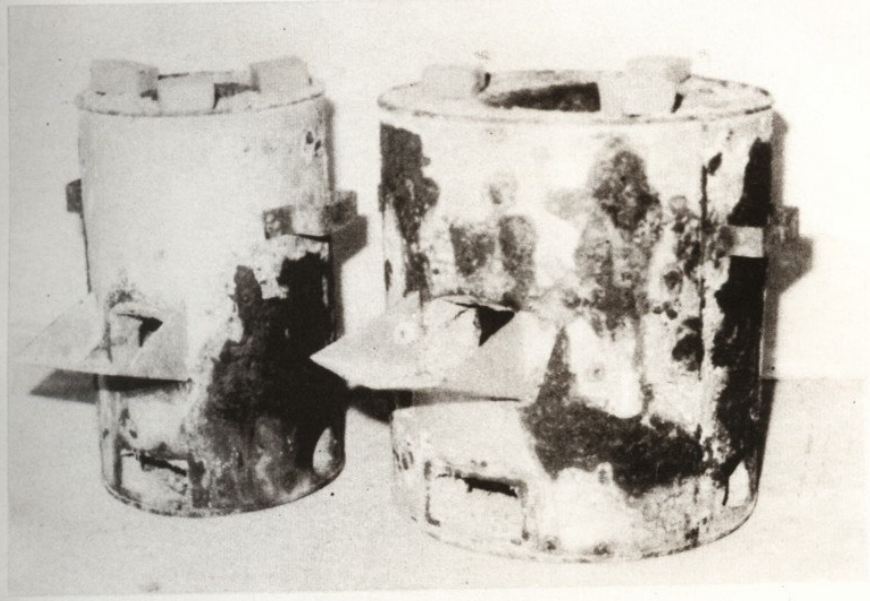


(Fig. 11)

Testing the calorific heat produced by clay stoves.

(Fig. 12)

Testing the calorific heat produced by iron-sheet stove.



(Fig .13)

Salt corrosive action on iron sheet stove resulting in damages on the outer case of the stove .

(Fig .14)

Improper baking results in deformities and indurable stove.