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# RESEARCH AND DEVELOPMENT ON VARIOUS METHODS OF SPINNING SHORT STAPLE COTTON

DP/VIE/86/014/11-05

VIET NAM

Technical report: Development of appropriate spinning technology*

Prepared for the Government of Viet Nam
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of J. Sharma, expert in appropriate spinning technology

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Vienna

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* This document has not been edited.

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## PREFACE

A short -term consultancy project DP/VIE/86/014/11-05 was offered to me by the United Nations Industrial Development Organisation (UNIDO) for one month to review the work already carried out by Textile Research Institute (TRI) and to participate in development of entirely new appropriate technology equipment at TRI.

Assignment task has been carried out as per term of references given to me. Some idea about setting up a cotton service centre with new machines, its infrastructure and organisational pattern is given additionally. Appropriate size of a cotton processing centre has been worked out for its efficient and smooth running. Economical and social benefits of the centre have been shown in the project proposal.

The report has been made after careful studies. The demerits revealed on the spot study of village technology were scrutinized and suggestions were offered suitably to modify the appropriate spinning technology equipment on the basis of the technology evolved by TRI Hanoi. This is likely to increase the textile production which will ameliorate economic conditions of cottage artisans who had not hither to been obtaining benefits commensurate to their efforts owing to traditional technology which they had been adopting so far.

In the preparation of the report, in such short time several officers offered their cooperation and support, I express my deep sense of gratitude to them. Specially, I express my gratitude to thank NPD Md Bau for her active participation in discussion, her guidance, valuable suggestions and interest taken in directing her staffs to furnish me required information efficiently and smoothly. I would be failing in my duty if I do not express my gratefulness to m counterpart CTA Mr. Roy Nield who passes me his advice and good wishes for a successful mission through NPD.

I also cannot forget to thank Mr. De, the head of the spinning department, Mr Dung, Mr Phong, Mr. Lai research and development staffs of TRI who extended their full cooperation and furnished information as and when were required during the mission.

## Table of Contents


| Sno. | Title | Pg No. |
|---|---|---|
| 1. | Explanatory Note | 1 |
| | 1.1 Value of local Currency | 1 |
| | 1.2 Abbreviation | 1 |
| 2. | Executive Summary | 2 |
| 3. | Introduction | 4 |
| 4. | Background & Needs | 7 |
| 5. | Activities & Outputs | 19 |
| | 5.1 Training of local staff on hand operated equipment | 19 |
| | 5.2 Review of the work already carried out by TKI in the field | 19 |
| | 5.2.1 Ginning machine (studies including performence, demerits of machines & suggestions to overcome them) | 20 |
| | 5.2.2 Opening machine ( -do-) | 26 |
| | 5.2.3 Carding machine ( -do ) | 31 |
| | 5.2.4 Drawing machine ( -do-) | 36 |
| | 5.2.5 Spinning frame ( -do-) | 42 |
| | 5.3 To participate in development of entirely new machine | 46 |
| | 5.4 To assist in drawing up specification & design | 47 |
| | 5.5 To assist in manufacturing & testing of prototypes | 47 |
| | 5.6 Spot study of traditional spg. equipment used in villages | 49 |
| | 5.7 Visits | 51 |
| | 5.7.1 Textile mills visit | 51 |
| | 5.7.2 Village visit | 52 |
| | 5.7.3 A visit to Weaving centre | 53 |
| | 5.8 Counter part | 53 |
| | 5.9 Communication | 53 |
| | 5.10 Seminar discussion | 54 |
| | 5.11 Model of a project proposal with its cost benifits | 55 |
| | 5.12 Requirement of infrastucture & organisational pattern for setting up a cotton processing centre | 60 |
| 6. | Constraints seen in development | 65 |
| 7. | Findings | 66 |
| 8. | Recommedations | 68 |
| | 8.1 Research & development | 68 |
| | 8.2 Training | 69 |
| | 8.3 Infra structure | 69 |
| | 8.4 Financial | 70 |

## 1. Explanatory

1.1 Value of local currency 4500 Vietnamese dongs = 1 US dollar during period of mission.

1.2 Abbreviations

| | |
|---|---|
| CTA | Chief Technical Adviser |
| Est | Estimate |
| JD | Job Description |
| NPD | National Project Director |
| MOLI | Ministry of Light Industry |
| TRI | Textile Research Institute |
| N/A | Not Available |
| M/C | Machine |
| Spg | Spinning |
| Wvg | Weaving |
| ATDA | Appropriate Technology Development Association |
| KVIC | Khadi Village Industries Comission |
| gm | gram |
| SW | Spinning Wheel |
| AT | Appropriate Technology |
| R&D | Research and Development |
| yn | Yarn |
| rpm | revolution per minute |
| mm | milimeter |
| m | meter |
| kwh | Kilowatt hour efficiency |
| No | Number |
| LHS | Left Hand Side |
| RHS | Right Hand Side |
| CI | Cast Iron |
| AS | Alloy Steel |
| Ne | English count |
| Nm | Metric count |

## 2. Executive Summary

The mission of expert in Appropriate Spinning Technology took place within period 29/07/90 to 04/09/90.

The concept of the project DP/VIE/86/014 is very much related to the Vietnamese Government's plan to raise the production of consumer goods especially clothing of indigenious raw material (cotton)for increased utilisation.

The objective of the mission was to review the work carried out by TRI, to assist TRI for development of new appropriate spinning technology equipment , to test prototype machines and to train staff on the hand operated equipment.

Farmers of hill area of Northern provinces in Vietman grow cotton on their small pieces of land for their own use only. Spinning and weaving in the area is traditional. they are using equipments which are very simple and made of wood. The production of the equipment is very low and the quality is too inferior to make any fine cloth. The process they follow, is tiresome and time consuming that they make hardly anything in the whole day. The farmers are very poor. The poor artisans are in search of a low cost technology which can give them some relief from their hardship.

TRI realised the farmers'/artisans' difficulties and developed a set of cotton processing machine which includes ginning, carding, drawing and spinning machine. Machines are simple and more productive in comparison to traditional equipment.

However, to make the machines more useful and economically viable in commercial use, some development, modification and changes have been reccommended such as to develop a new opening machine suitable for spinning process, to design double roller ginning machine, to develop revolving flats, proper undercasing, coiler and feed lattices in carding, and to design a new creel and coiler for draw frame etc.

To improve further earning of farmers, innovations of 12 spindle and 24 spindle charkha and doubling charkha are suggested.

Roving frame (4 spindle hand operated on principle of ring spinning) should also be introduced to improve quality of yarn and production of draw frame.

Training of TRI staff on design and manufacture of spg m/c and in setting up a cotton processing centre seems very essential as TRI is new in the field.

A model cotton service centre should be set up with financial support of UNIDO and Vietnamese Government.

A clear policy and concrete programme to promote technology should be laid down by Government of Vietnam.

More funds should be made available for Research and Development work to enable TRI to design new equipment in spinning and weaving fields.

Development of appropriate spg technology will prove useful to the farmers to raise their earning,to encourage them to grow more cotton in their fields.

## 3. INTRODUCTION

Textile industry is very old and important industry in the world. It has more employment potential than any other industry. It was completely cottage industry before mechanization. Even after centuries of introduction of machines in the industry, it is alive in cottages and giving livelihood to masses living in rural area in developing countries. It creates more opportunities of employment with lesser capital investment as compared to any other industry.

The textile manufacture comprises three sub- process:

1 - Spinning of Yarn
2 - Weaving of Yarn
3 - Finishing of cloth

From technology point of view, these processes are different from each other. Each process has different machine and technique but they have common aim to provide employment opportunity. If these processes are combined together, it will facilitate the management in handling the sale, purchase. procurement of raw material etc.

Textile manufacturing is popular in cottage as well as in high technological field. In small scale industry three sub processes are done at different places while in high technology field, these are undertaken in the same premises. They are centralised in a campus.

In high technology textile manufacturing, the machines are modern and sophisticated, which are fully automatic electronically controlled. Machines require very high skilled labour to operate and to maintain them properly. The production capacity of these machines is so high, that they render the masses unemployed . In this field, all processes provide employment opportunity only to the trained workers .

On the other hand, where cloth manufacturing is done on small scale, condition is quite different. Spg process comprises of ginning, opening, cleaning, carding,drawing, roving,spinning, reeling, and winding are caried out in a decentralised way in cottages. Spg. process requires more labour as compared to other two textile manufacturing process. It is experienced that if simplest machines manufactured with least investment are used in cloth making, one weaver can keep 20 spinners engaged for making yarn to feed his loom, if he makes a well designed cloth. A finisher is in a position to attend the work of finishing of such 10 weavers cloth.

If some improved equipment with more investment i.e. intermediate technology are used, the ratio of spinner to weaver 20 : 1 can be brought down to 4 : 1. The ratio of weaver

to finisher 10 : 1 can be reduced to 3 : 1. But the intermediate technology requires higher capital investment as machines are more expensive. When we compare the amount of labour required to produce given amount of cloth in high technology equipment we find it reduced to one thousand times as compared to simplest small scale cloth manufacturing process. But to start manufacturing with modern technology it requires heavy capital investment as compared to simplest technology process. For a weaker section it is difficult to think about this technology. If we use intermediate technology the ratio of investment can bring down 1 : 100 ratio as compared to simplest technology.

When we compare the production, we find that modern technology equipment is cheaper than that of intermediate technology or simplest technology equipment. However, situation becomes typical in the area where textile worker is not ready to accept the modern technology. They are happy to use their cruder method with low capital investment. They like such equipment which can be made at low cost by local indigenous craft man. On such a junction birth of appropriate technology takes place which provides simplified and improved low cost equipment to raise the production.

For a long time, in the name of "Appropriate Technology" only the development of small tools, equipment etc. has been carried out. In some cases workers are trained to carry out work by improved methods. Help for setting up cooperative societies for improvements of rural area worker's life is also provided. The experience shows that they have barely touched the surface of the problem and except for making marginal difference here and there, nothing of lasting significance is obtained.

Textile Research Institute Hanoi for the last few years studied the problems of rural artisans in the field of spg. technology. They went to rural artisan's houses who are engaged in making cloth from generation to generation and found that they are using old crude equipment whose productivity is very low. The artisans are making cloth for their own use only and work only in their spare time, they do not bother for more production. No artisan depends totally on the production of his equipment. TRI realised that if some improvement is carried out in their tools, it will bring new era to them. This improvement can be made with low investment which will improve minimum five times of their earning. As a result of this study, TRI took decision to design machine with financial support of UNIDO and Vietnamese Government to ease the problem of rural artisans. They worked in the following processes:

1 - Prespinning Process:- It consists of ginning, carding, drawing, etc, to provide suitable material in the shape of sliver to cottage spinner.

2 - Spinning Process :- It consists of cottage spinning frames with minimum 6 spindle to give a reasonable wage to the spinners.

The first set of prototype machine has been developed. The aim of developing of the first set of machines is to test the acceptability, viability aspects of the machines, and also technological and organisational pattern in the field so that these could be extended in all cotton growing areas in the hills of the Northern provinces.

In general following machines are used under spinning technology:

| Machines | Function of the Machine |
|---|---|
| 1 -Blowroom | -Opening, cleaning, mixing of different varieties of cotton and making cotton lap to feed next machine in process |
| 2 - Carding | -Removal of short fibres, dirt, leaf, fibre individualization and partial parallelization of fibre and formation of sliver. |
| 3 - Drawing | -Parallelization of fibre and making a uniform sliver. |
| 4 - Roving | -Initial drawing out of sliver into a sort of thick form thread called roving, slight twisting and winding on to bobbin. |
| 5 - Spinning | -Final drawing out of roving into yarn twisting and winding on to bobbin. |
| 6 - Reeling and cone Winding | -Removing yarn from spg. bobbin, winding either into hanks or cones. |

## 4. BACKGROUND AND NEEDS

The manufacture of cloth has got the biggest employment potential after agriculture in any country. Manufacturing of cloth involves three seperate divisions.

1- Spinning fibres (natural, man made, animal) into yarn
2- Weaving of Yarn into cloth.
3- Processing and finishing of cloth.

Prior to industrial revolution, which in fact means before introduction of mechanical power in the industry, these three divisions were carried out manually in separate cottages scattered in villages and small towns. One set of cottages used to be engaged in spinning of yarn,second in weaving of yarn into suitable cloth and third used to do finishing.After introduction of mechanised technology in cloth manufacturing all three stages i.e. spinning, weaving and finishing became centralised and came to be known as textile industry and all the textiles industries got concentrated in urban areas. One of the major potentials of providing employment to rural areas was thus lost.

Though, with the advent of mechanized technology in textile industry it affected all the 3 divisions but its affect on cottage textile industry was much more pronounced on spinning side. The hand spinning was not able to compete with the cost of production and also failed to produce the quality of yarn produced by machanised technlogy. As a result, the hand spinning technology was almost wiped out all over the world.

Handloom weaving also was discontinued in developed countries. However,it continued on a subsistence level in many of the developing countries because of a large hereditary artisan class who could not find employment outside its trade. These artisans shifted from producing largely acceptable type of cloth to special cloth - which could not be produced in high quantity or whose production was not as remunerative as that of other type of cloth in large scale mills. As cottage spinning disappeared in rural area, handloom weavers had to shift to use yarn manufactured in large scale textile mills which were established for supply of yarn to the handloom weavers.

Processing and finishing of cloth was also affected badly in rural areas as all the textile mills came up with a heavy and well machanised finishing plant.The capacity of the plant was very high as such it was also very tough for cottage artisans to compete in the finishing cost and quality with large mills. Poor artisans left their job and came out for searching job in urban areas. Some of them had to continue their profession on the starvation level also as they did not find any means of their survival.

## PRESENT SITUATION AND FUTURE PROJECTION OF COTTON DEVELOPMENT

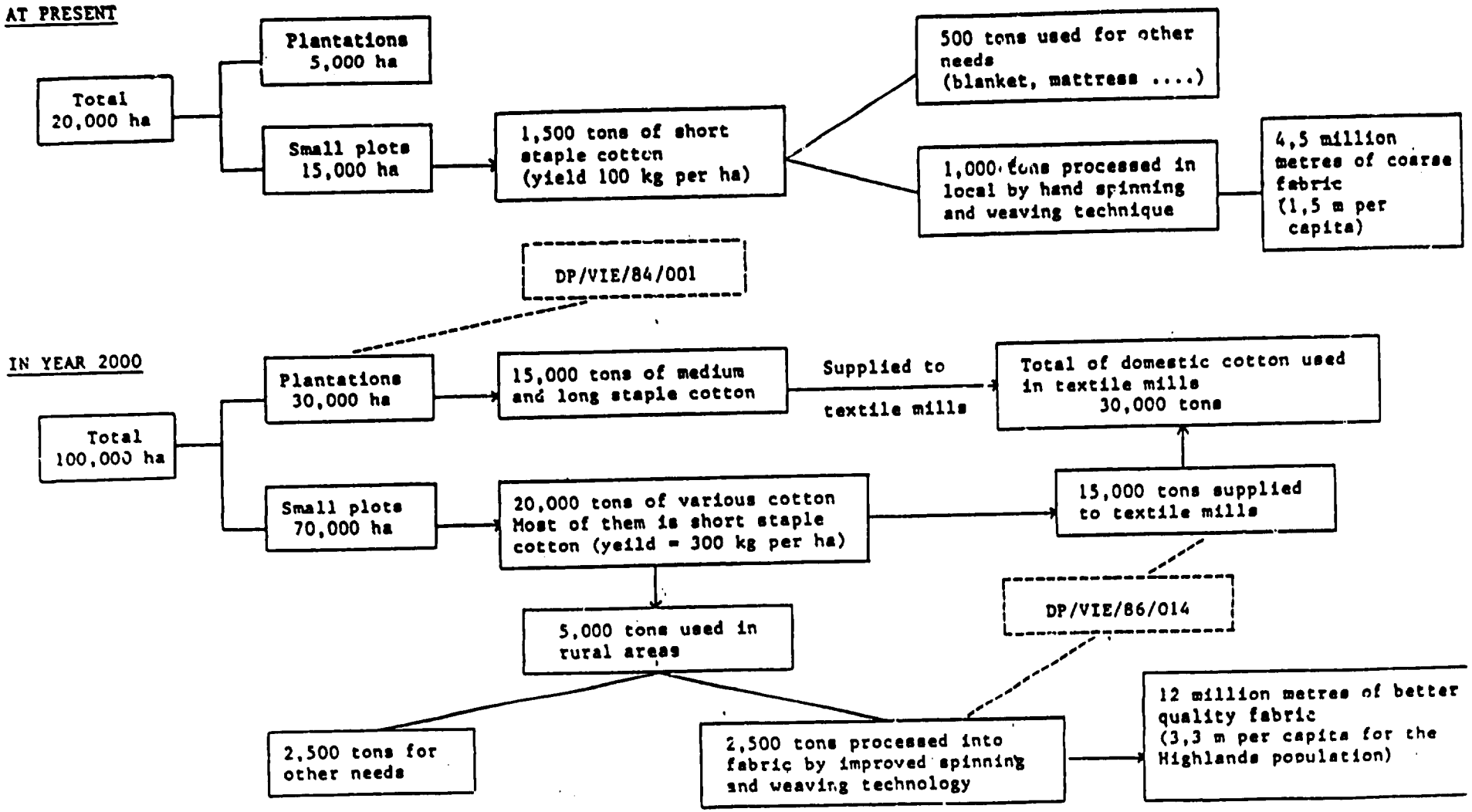



FIG: 1

In the composite textile mills, which carry out spinning, weaving and finishing under one shed, the yarn is taken directly from spinning department to the weaving dept to make the cloth. Cloth produced in weaving department is transferred to finishing section. No transportation or packing is required. But for the supply of yarn to the handloom weavers, the yarn has to be packed and passed through a number of intermediaries before it reached to the handloom weavers. During this process, at least 20 -25 percent extra cost is added , which thus decreases the earning of weavers to a subsistance level, the capital formation was completely stopped throwing the weavers to work on borrowed capital which further lower their earning to the starvation level. Most of weavers have left their trade. It is difficult for any textile mill to operate economically until it has its own spinning department. It would be very difficult to compete in the market, if it has forced to purchase yarn from out side. However, the continued existence of handloom weaving on purchased yarn in developing countries shows their inherent strength and stability of the self employed labour as against centralised employed labour.

There is no proper decentralised spinning technology for initiating the programme of cottage or small scale cloth production in the rural area on a decentralised basis for upgrading the work of existing handloom weavers. Weavers do not get yarn at their door. They had to go long distances for buying yarn. Many types of loom like traditional loom i.e. pit loom and frame loom and improved loom like semi automatic loom, power loom, loom together with dobby and jacquard arrangement to weave more complex patterns of cloth are available.Given parity in the cost of yarn both qualitatively and economically , the handloom weavers in rural cottage can not compete with the mill production.Some reduction in cost of various ancillary operation i.e. beam winding, sizing, reeling dyeing and calendering are no doubt needed but again there is no great technical problem involved, it is a more organizational problem of getting groups of weavers to come together and collectively make use of machinery that is already available there which has a minimum operating capacity more than sufficient for an individual weaving family.

So if a breakthrough can be made and an technologically sound and economically viable decentralised cottage spinning could be evoled then the textile industry could be established in cottages in developing country. The economic conditions of the cottage weavers where they still exist could be improved from starvation level to a viable level.

II / **Vietnam background** :

The textile industry in Vietnam comprises about 88.000 spindles and 11,000 looms , roughly equally divided between the

Table 1

| Name of mill | No of spindle installed 1000 | Idle dpindle ( 1000) | Utilised spindle |
|---|---|---|---|
| Thangloi | 182,672 | 10,000 | 118.672 |
| Namdinh | 122,560 | 10,000 | 112,562 |
| Hanoi | 99,912 | nil | 99,912 |
| Nhatrang | 99,864 | nil | 99,864 |
| 8 March | 66,131 | nil | 66,131 |
| Dongnam | 64,680 | 8,320 | 56,360 |
| Vietthang | 62,208 | 6,000 | 56,208 |
| Vinhphu | 60,384 | 13,056 | 47,320 |
| Vinh | 53,860 | 12,000 | 40,860 |
| Hue | 51,360 | 12,000 | 39,360 |
| Hoatho | 20,000 | - | 20,000 |
| Khanhhoi | 4,000 | | 4,000 |
| Total | 853,431 | 71,386 | 782,055 |

Out of above spindles, 400.000 spindles were installed in 1980 which are termed as new spindles. These spindles have been installed with the finances made available by the capitalist countries like Italy, France, Japan etc. More than 50% spindles running in the country are about 50 to 60 years old. These spindles are termed as old spindles. The mills are planning to replace the old spindles in phases with their own financial resources. In Vietnam few open end spinning machines (all imported) have also been installed. As per information available only 1120 rotors are in operator in the country. The yarn production share of these rotors is only 0.13% of the total production

Table No. 2

( Cloth Production in millions meter)

| | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 |
|---|---|---|---|---|---|---|---|---|---|---|
| Total cloth production. | 166.869 | 156.375 | 223.35 | 267.848 | 329.113 | 362.789 | 390.189 | 361.21 | 362.6 | 284.28 |
| Production in decentralised sector. | 32.285 | 46.42 | 70.458 | 86.856 | 120.00 | 159.000 | 184.00 | 158.00 | 150.00 | 90.00 |
| Percentage (%) | 19.35 | 29.70 | 31.55 | 32.43 | 36.46 | 43.87 | 47.16 | 43.74 | 41.37 | 31.66 |
| Production in mill sector. | 134.584 | 109.955 | 152.892 | 180.992 | 209.113 | 203.789 | 206.189 | 203.21 | 212.6 | 194.25 |
| Percentage (%) | 80.65 | 70.3 | 68.45 | 67.57 | 63.54 | 56.17 | 52.84 | 56.26 | 58.63 | 68.34 |

North and the South and generally operating at 50% of installed capacity. Details of spindles and their utilization mill wise in Vietnam can be seen from table 1 on page 10 Yarn production increased from 31,000 tons in 1981 to 51,000 tons in 1985 and fabric production from 116 millions meters in 1981 to 203 millions meters in 1985 (i.e. 3.4 m per capita). Trend of cloth production in mill sector and handloom / powerloom running on decentralised pattern in the country are given in table 2. The intention of the Government of Vietnam is to increase the fabric availability to 8 m per capita by year 2000 . Assuming a population increase from the present 60 millions to 70 millions by year 2000, this would mean requirement of about 150,000 tons fibre raw material of which 100,000 tons would be cotton. The present cotton consumption is 60.000 tons per year - virtually all of it is imported.

Of the 100,000 tons cotton requirement in the year 2000 the Government plans to cover 30,000 tons through local production half of this would be through new plantation and other half will be through existing cotton grower**. The latter variety is the "short fibre cotton " to which title of this project refer. This variety is grown on small plot mainly in the Northern part of the country by the villagers who convert it into coarse yarn and make fabric by using primitive hand spinning and weaving techniques. The present production is limited to about 1000 tons of lint cotton per year roughly equivalent to 1.5 m per capita among the northern hill tribes who grow and process it for their own use . The stated goal of the Government to have 15,000 tons of this small holder cotton available to the mill sector by the year 2000 is ambitiuos but not unrealistic.The Government intend to pursue it by increasing the area under cotton cultivation and the yield per hectare by making available spinning part of cotton for local use. Schematic illustration of the Government plan can be seen from figure 1 on page 8.

At present, the area under cotton cultivation in rural area is about 2000 ha and the yield is 150 kg/ha . Assuming that yield can be increased to 500kg/ha which would still be only about one third of a normal plantation yield. The area under cotton cultivation should be increased five fold to 10,000 ha by the year 2000 in order to produce 17,000 - 18,000 tons of lint cotton per annum . The rural communities would process 2,000 - 3,000 tons of this for their own use and rest 15,000 tons would be available for the mill sector .

For the northern hill tribals with the population of some 3 millions, 2,000 - 3,000 tons short fibre lint cotton would be required to provide about 3.3 m coarse cloth per capita (twice of their current consumption) which will be sufficient to cover their need with that type of fabric .

---

* Hirsutum 25 - 30 mm
** Arboreum 16 - 25 mm

Table No.3

Status of cotton growing in Vietnam (Vinance wise)

DT - Cottown growing area - 1000 ha
NS - Cotton yield - 0.1 tons/ha
SL - Total cotton yield - 1000 tons.

| | YEARS | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1985 | | | 1986 | | | 1987 | | | 1988 | | |
| | DT | NS | SL | DT | NS | SL | DT | NS | SL | DT | NS | SL |
| Total production | 6.8 | 3.09 | 2.1 | 2.9 | 3.6 | 4.63 | 13.17 | 3.24 | 4.27 | 12.5 | 3.41 | 4.18 |
| a)Production in North Vietnam | 6.48 | 3.03 | 2.0 | 0.23 | 3.3 | 3.43 | 10.22 | 2.88 | 2.94 | 10.2 | 3.12 | 3.16 |
| b)Production in South Vietnam | 0.32 | 0.06 | 0.1 | 2.67 | 4.3 | 1.2 | 2.95 | 4.5 | 1.33 | 2.3 | 4.79 | 1.02 |
| Production Provincewise | | | | | | | | | | | | |
| Ha Tuyen | | | | 1.26 | 4.8 | 0.6 | 0.71 | 4.54 | 0.32 | 0.72 | 4.72 | 0.34 |
| Cao Bang | | | | 0.79 | 3.5 | 0.28 | 0.78 | 3.27 | 0.26 | 0.8 | 3.5 | 0.28 |
| Lai Chau | 1.12 | 3.46 | 0.39 | 1.74 | 3.8 | 0.66 | 1.8 | 3.63 | 0.65 | 2.01 | 3.73 | 0.75 |
| Son La | 1.36 | 3.57 | 0.49 | 2.38 | 4.1 | 0.98 | 2.73 | 2.72 | 0.74 | 2.59 | 3.44 | 0.89 |
| Hoang Lienson | 0.77 | 3.4 | 0.26 | 0.91 | 2.5 | 0.23 | 0.08 | 2.6 | 0.02 | 0.8 | 2.75 | 0.22 |
| Ha son Binh | | | | 1.17 | 1.4 | 0.16 | 1.22 | 1.09 | 0.13 | 1.11 | 1.62 | 0.18 |
| Nghe Tinh | | | | 0.61 | 2.7 | 0.16 | 0.38 | 3.48 | 0.13 | 0.97 | 2.47 | 0.24 |
| Phu Khanh | | | | 0.78 | 4.4 | 0.34 | 0.83 | 3.86 | 0.32 | 0.85 | 3.29 | 0.28 |
| Thusan Hai | | | | 1.33 | 4.7 | 0.63 | 1.07 | 4.52 | 0.48 | 0.47 | 4.04 | 0.19 |
| Dong Nai | | | | 0.18 | 7.1 | 0.13 | 0.73 | 6.07 | 0.44 | 0.51 | 7.65 | 0.39 |
| Lan An | | | | | | | | | | 0.12 | 8.33 | 0.1 |
| Cuu Long | | | | | | | 0.13 | 1.92 | 0.024 | 0.04 | 2.5 | 0.01 |

Five fold increase in the area under cotton cultivation should not present a problem , provided the farmers have any incentive for substituting cotton for other cash crops such as ground nut, tapiocas and beans. Also it should be possible to incease the yield to about 500kg/ha , provided that measures are taken to make available to the farmer suitable seed, fertiliser and insecticides. An FAO project is addressing this issue. The trend to increase the cotton cultivation area and its yield province wise can be referred to table 3. The various varieties of cotton grown in the country and their characteristics are shown in table 4. Count of yarn and their technical parameters, produced out of the Vietnamese cotton can be referred to table 5(a).

The extremely short fibre length cotton of small holder causes problems at all stages of spinning process as the standard , commercially available production equipment normally is not intended for this type of raw material. It is necessary to adjust it or in some cases to modify it to accomodate the short fibre. It will be the task of the Textile Research Institute to advise the textile mills how to adjust and modify their production processes and to be ready for this task when small holder cotton is available for the mill consumption in significant quantities and to do so external assistance is needed to provide the necessary laboratory and pilot plant equipment , expert and training of the Institute's staff. TRI is the only textile institute in the country which is engaged in the development of machine and process to help textile mill. TRI also conducts studies about the performance of mills and utilization of their existing capacity . It also surveys the products manufactured by textile mills and advises them how to make optimum use of their machines and materials .

The sections which require updating to enable the Institute to carry out research on the use of short staple cotton are the spinning department and testing section, associated with it are the cotton fibre and yarn testing laboratory and the miniature spinning section. At present, the spinning department possess a range of equipment of Eastern European and Chinese origin, covering the processing stages from carding to ring spinning. This should be augmented by an integrated blowroom that would enable the opening of raw cotton and making it into lap suitable for feeding into cards. This will make it possible to transform raw material cotton into yarn at the Institute without having to have the opening stages carried out elsewhere - a practice which not only be inconvenient but also impractical when dealing with the relatively small quantities of raw material usually viable for research purposes. Also in the most instances, the performance data from blowroom is important for the investigation and this can be proposed that the range of the

TABLE NO. 4

VARIETIES OF COTTON GROWN IN VIETNAM AND THEIR CHARACTERISTICS

| Type of cotton | Staple length SL. 2.5% | UR % | Maturity % | Bundle Strength 1000 PSI | Micro-naire |
|---|---|---|---|---|---|
| TH 2 | 22.5 | 50 | 85 | 88.400 | 5.0 |
| TH 1 | 25.5 | 46 | 77 | 75.500 | 3.5 |
| Gyayvit | 26.0 | 45 | 75 | 74.000 | 4.0 |
| MCU. 9 | 30.5 | 45 | 77 | 90.000 | 3.4 |
| MCU - 5610 | 29.5 | 48 | 78 | 90.000 | 3.9 |
| L 47 | 33.2 | 45 | 68 | 95.000 | 3.0 |
| C 6002 | 31.5 | 47 | 75 | 100.000 | 3.4 |
| LAi F 1 | 35.4 | 47 | 74 | 99.000 | 4.9 |

Menzufi + MCU -9

Table No. 5(a)

Yarn count produced from cotton grown in country and their tests

| YARN COUNT | Count CV % | U% uster | single yarn test | Test CV % | Twist per m | Thin places /1000m | Thick places /1000m | Neps /1000m |
|---|---|---|---|---|---|---|---|---|
| 1) N 14-Open end. Yarn. cotton used TH 2 | 2.8 | 116 | 771 | 8.8 | 480 | 0 | 136 | 512 |
| 2) N 17-OE Yarn, cotton used TH 2 | 5.6 | 16.7 | 886 | 8.4 | 617 | - | - | - |
| 3) N50 Combed knitting yarn cotton used MCU -9 | 11.00 | 11 | 343 | 7.9 | 770 | 3 | 144 | 614 |
| 4) N-76 combed yarn, cotton used MCU-9 | 2.5 | 12.3 | 198 | 7.82 | 834 | 8 | 334 | 272 |
| 5) N 102 combed thread yarn cotton used MCU -9 | 1.99 | 13.8 | 142 | 8.9 | 927 | 16 | 448 | 336 |
| 6) N-76 combed thread yarn- cotton MCU-9 | 2.03 | 12.0 | 213 | 7.87 | 858 | 8 | 408 | 352 |
| 7) N-102 Combed yarn cotton MCU-9 | 2.06 | 12.6 | 149 | 8.96 | 955 | 56 | 640 | 408 |
| 8) N 76 Polyster cotton. | 2.90 | 11.0 | 224 | 8.61 | 926 | 86 | 408 | 259 |
| 9) N-14 Appropriate Spg. Technology equipment. | 5.7 | - | 695 | 12.8 | 454 | - | - | - |

machine in blowroom is minimum possible and it is recommended that cotton can be passed through it twice to achieve the necessary degree of opening and cleaning. In addition to this, the Institute requires equipment for a technique more suitable for spinning a very short staple cotton than ring frame which they now pocess. A small sized open end rotor machine will be suitable for the purpose.

Both the fibre and yarn testing laboratories are equipped for slow manual testing methods which restrict the amount of the testing that can be carried out and consequently limit the lines of research that can be pursued. In the fibre test laboratory this can be overcome by installing rapid methods for measuring fibre length (Digital fibrograph) fibre fineness maturity percentage (IIC Shirley maturity meter) and strength ( Pressley) A Shirley analyzer or its equivalent will be provided so that the trash content of the cotton can also be measured and in addition to this a micronaire instrument with its associated accessories will be required so that the micronaire value of cotton can be determined ( Micronaire value is a value of fibre fineness and maturity combined. Its virtues are that it is an easy measurement and its significance is widely understood by spinner ).

The yarn testing section will be equipped for rapid test for single yarn strength and its variability ( Uster Dynamat ) and for measuring yarn irregularity, fault level and cleanliness (on the Uster Evenness Tester).These last two instruments enable detailed analysis to be made of the effect of changes in processing condition at the stages along the yarn production sequence.

A miniature spinning plant will permit the spinning of sufficient yarn from a 42 gm sample of cotton to enable the measurements of count and a visual assessement of its appearance to be made. From this information it is possible to determine the commercial spinning limit of cotton and the quality of the yarn which will be produced . The equipment can also be used to prepare slivers suitable for feeding to the open end spinning machine, thus enabling miniature tests to be carried out also on this novel system both quickly and with very small quantity of fibre.

At the other end of the small scale processing of small holder cotton into coarse count yarns and fabrics from which farm clothing will continue in the northern rural communities where it is grown. If the present, primitive and totally inadequate methods and equipment for ginning, opening and spinning could be improved , it would provide an added incentive for these farmers to increase their cotton cultivation. The present equipment productivity is so low that increasing it in ten folds or more should present few technical problems. It is largely a mere question of choosing from various available

technologies and equipment that could be easily adapted to the conditions in these villages and manufactured at the lowest possible cost.

The Textile Research Institute has already started work in this area and produced a few prototype of ginning , opening and spinning equipment, currently used in the villages. However further development work is necessary to perfect these and to experiment with alternative techniques. For this the Institute needs external assistance to give it access to potential source of appropriate technology and to guide its staff in the development work.

## 5. Activities and Output

### 5.1 Training of local staff in operation of the hand operated equipment

Local staff working in TRI are engaged on development of appropriate technology equipment for a long time. They are acquainted with the working of the machines. A 5-member team of working staff has already been trained in operation and maintenance of AT spinning equipment running in India. Further, they were also trained on hand operated equipment in TRI Hanoi. They were taught about the maintenance of each machine for their efficient working. Staff was also explained about the various faults which can occur in machines and how they can be rectified at their level. A trouble shooting chart was prepared and handed over to all concerned staff members.

### 5.2 Review of work already carried out by TRI in the field.

About 60% area of Northern Vietnam is covered by hills and mountains where the farmers grow cotton on their small piece of land for their own use. There is a tradition in hill areas that before getting married a girl has to make cloth for her husband and his family members from her own hand - spun yarn. Therefore, from an early age, her parents teach her hand spinning and weaving . Thus hand spinning and weaving became the traditional profession in each farmer's house. The cotton grown in the hill area is of short staple length. It contains high percentage of immature fibre. Farmers carry out cotton processing, spg and weaving manually in their cottages. Farmers use their traditional equipment in making the cloth as detailed below.

1. Hand ginning
2. Hand opening
3. Hand carding
4. Hand spinning(single spindle bamboo S.W)
5. Handloom weaving
6. Hand dyeing and finishing

The new technology has not reached so far to the rural artisans. They still use only their crude and simple equipment made by local crafts men from indigenous material available in the villages. The yarn made on these equipment is very coarse, uneven and weak. This can be used only for making coarse and rough use fabric like cotton blanket, carpet ( Dari) and pillow covers.

The artisians are so skilled in their trade that they also make some typical cloth on their simple equipment if they are provided textile mills yarn. They know to make some common design into the cloth and to choose number of the ends and picks for making a particular design. These artisans are confined to make design into the cloth which are popular in the village.

If the artisans are provided with some improved technology they will make fine cloth in various designs acceptable in the market. The most tedious and difficult task in their profession is the cotton processing . It is time taking and tiresome to the operators. If cotton processing system is improved and simplified the spinners will have more time to be utilised for yarn making which will increase their earning in the long run . The improved yarn will also facilitate the working of the handloom weavers and they will manufacture cloth for others' use besides their own requirement.

TRI has studied the tools and equipment and the difficulties faced by the rural artisans closely. On the basis of their study TRI realised that rural artisans should be provided with simple and low cost technology which may facilitate their working and improve the quality of their product and their production. Therefore, they have developed a set of cotton processing machines including ginning, opening, carding, drawing and spinning frames. During the mission these machines were studied minutely from the technical and economic point of view, taking into consideration their shortcomings, and performance. Suggestions are given to improve their working and to make them more useful in their continuous operation. Study of the various machines is summarised as below :-

5.2.1 Ginning machine

On principle of single roller Macarthy gin, small easily portable ginning machine has been designed. Single leather roller of 150 mm dia and 500 mm working width is mounted on a shaft. Machine is having one fixed knife which is always in contact with leather roller by means of strip springs fitted in machines. There is one moving knife which is fitted near leather roller on a shaft. This knife can be set closer or wider to the roller as required for a good ginning, by tilting the shaft forward or backward. On feed side of the leather roller, one inclined feed plate is fitted with machine. Under the feed plate some round iron rods which act as grid bars, are fixed. Such a distance is maintained between rods so that they allow to fall down the cotton seeds, when they are separated from fibre. No seed cotton can be passed through the grid bars.

Seed cotton is laid on the feed plate by hands. Feed plate due to its reciprocating motion , forwards the seed cotton near to leather roller and moving knife.The surface of leather roller is moving upward, at this point the moving knife, oscillating nearer to leather roller, detach cotton seeds from the fibres. The fibres are forwarded upward and pass to lint cotton receiver. The seed separated from fibre falls down into the box kept under the grid bars. The Feed plate, further pushes cotton to leather roller. Thus cycle continues. Material flow through

the machine parts can be seen from figure 2

Leather roller . moving knife . feed plate etc are getting motion from 0.6 KW electric motor by means of gears. pulleys and belts fitted in the machine. Driving arrangement of various parts of the ginning m/c can be referred from figure 3. Technical particulars of machine are :

| | | |
|---|---|---|
| Leather roller dia (mm) | | 150 |
| Leather roller working width (mm) | | 500 |
| Gauge between leather roller and moving knife | (mm) | 0.5 |
| Pressure on fixed knife | | could not be measured |
| Roller temperature (running time) | | 40° C |
| Moving knife's oscillation per minute | | 150 |
| Production per hour (100% efficient) | (kg) | 10 |
| Actual production per shift 8 hours | (kg) | 60-70 |

**Working observation**

The machine was run barely for two hours and found that machine parts were working well and then some Quavvit cotton was fed into the m/c . The cotton was of short staple length (26 mm) It contained very high % age of leaves, immature fibres and foreign matters. The ginning of m/c was found very poor. It could not separate some seeds from fibres which were entangled badly. Some broken seed were also seen in ginned cotton. Ginned cotton was having higher % of the waste. The machine did not gin the cotton which got a little moisture due to the rainy season.

To recheck the working of the machine, it was fed with small quantity of TH 2 cotton. The cotton was more clean and having less number of leaves and foreign matters. The cotton was dried in sunlight for some time and passed into machine, the working of the machine was found improved as compared with earlier test. It ginned more cotton with better quality in the same time. The ginned cotton collected from the machine was tested and its results obtained are as per table 6. The result shows that the machine is more productive and it gins better than traditional machine. Besides this, as per the information received from TRI, they sent the machine to the field trial last year and observed that its working was satisfactory. However from the commercial point of view and with continuous operation of m/c at a cotton processing centre, following drawbacks were noticed.

1. Machine production is low .
2. Roller speed can not increase further, as the roller gets heated up and create a fear of catching fire in cotton.

# GINNING MACHINE (MATERIAL FLOW)

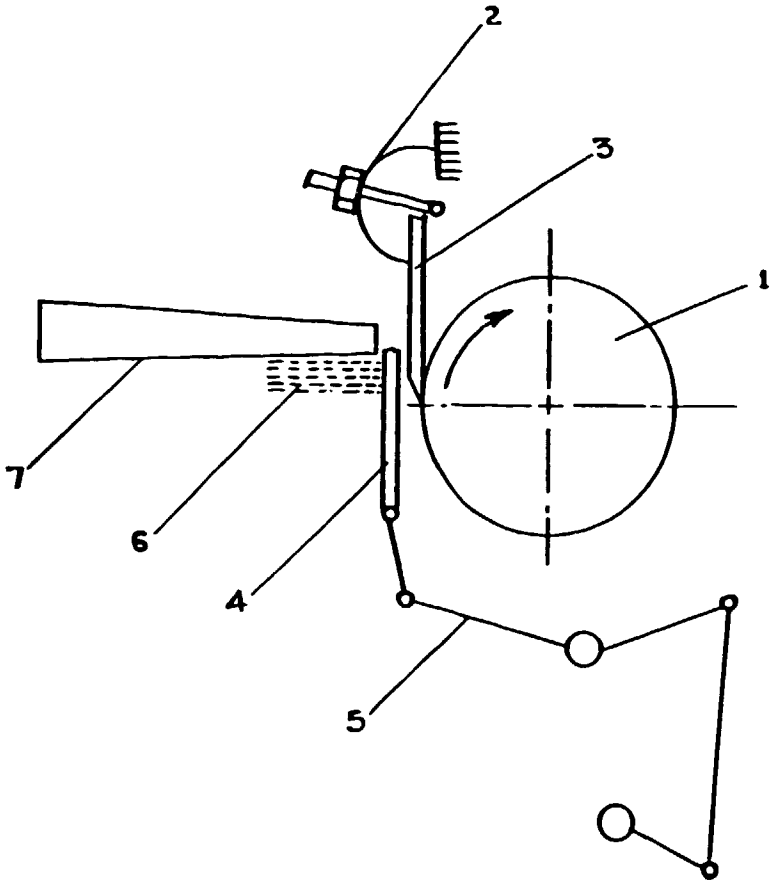



FIG.- 2

1. Leather Roller
2. Spring
3. Fixed Knife
4. Moving knife
5. Crank shaft
6. Grid bars
7. Feed Plate

| | |
|---|---|
| - Diameter of leather Roller | 150 mm |
| - Speed of leather Roller | 150 Rpm |
| - Frequency of moving knife | 510 times per min. |
| - Capacity | 70 kg.seed cotton. |
| - Motor | 0.6 kw - 960 Rpm. |

# SINGLE ROLLER GINNING MACHINE
## (DRIVING ARRANGEMENT)

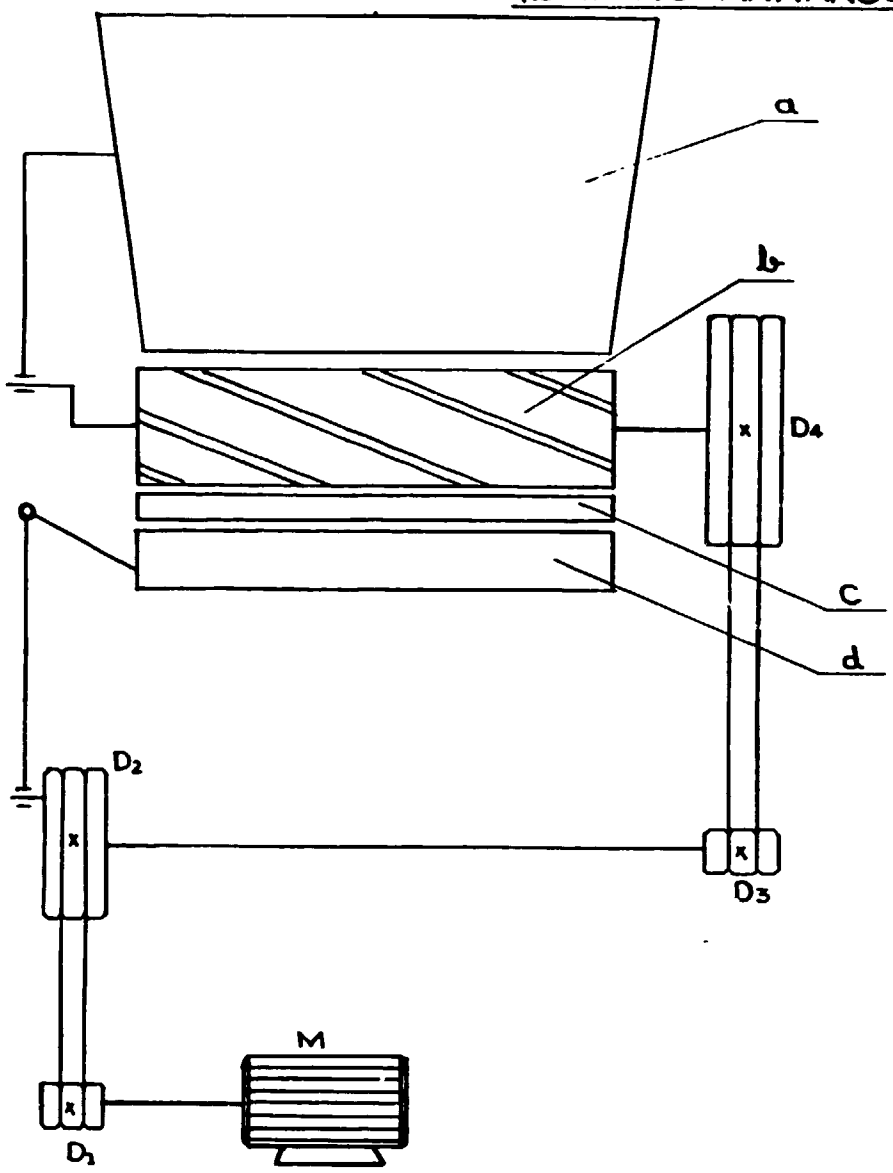



FIG.- 3

| | | |
|---|---|---|
| D1 | 75 mm | a.Feed table |
| D2 | 95 mm | b.Leather Roller |
| D3 | 95 mm | c. Fixed knife |
| D4 | 355 mm | d.Moving knife |

M: Motor - 0.6 kw - 960 Rpm

3. There is no accuracy in the machine parts due to the non availability of facilities of a good Engineering workshop at the time of the manufacturing of the machine. With the result it is not possible to obtain the gauze less than 0.5 mm between leather roller and moving knife.
4. Guide plates are not provided on the side of the leather roller which allows cotton to accumulate on the roller's side shaft.
5. Some parts of the machine like cranks, lever etc who give the oscillating motion to the moving knife, appear delicate and can not bear the load when machine is operated at higher speed.

The characteristics of cotton processed on the above machine are as per table 5.

## Suggestions to improve the Ginning machine

The improvement of ginning machine is measured by

I. Reduction of the trash contain in ginned cotton
II. Reduction in cut seed
III. Reduction of the lint fibre on seeds
IV. Prevention of leaking oil and grease into lint.

To improve working condition and to increase production capacity of the ginning machine, following changes are recommended.

1. Working width of leather roller i.e. 500 mm may be increased to 600 mm.
2. Lever and the crank which give reciprocating motion to moving knife and feed plate may be fabricated with standard material. Thickness of iron flats and diameter of rods used in the m/c may be increased so that machine can be run at higher speed with lesser bear and tear.
3. Diameter of leather roller may also be increased to 170 mm
4. Instead of single leather roller, two roller covered with rough grained leather of bigger diameter (as suggested earlier ) should be designed.
5. To facilitate the ginning and to obtain clean cotton, a preopening roller may also be introduced in the m/c . The roller will open the seed cotton and also remove heavy impurities, dust and foreign matter.
6. Instead of wooden bearing housing, cast iron housing may be introduced to give a trouble free service in the field for a long time.
7. To reduce load on the motor, all moving parts of the machine should be fitted either with bearing or brass

brushes and each moving part should have a proper lubrication.

If above changes are incorporated in the machine, it will run at higher speed and will gin more seed cotton .The quality of the cotton will be improved to a great extent.The production of the machine will go up to 120 to 150 kg per 8 hours instead of present level of 60 kg per 8 hours. Of course with these modifications the cost of the machine will grow up, but when we compare the quality and amount of production, it will be cheaper

This will facilitate, the working of other machines in the spinning process like carding ,drawing, roving frame and spinning wheel.

**Table No. 5**

Characterstics of the cotton

| | |
|---|---|
| Variety of Cotton - | TH - 2 |
| Staple length 2.5% mm span length | 23.96 |
| UR % | 57.13 |
| Maturity value | 5.40 |
| Maturity ratio | 84.20 |
| Strength ( 1000 PSI) | 73.93 |

**Table NO. 6**

The results of the ginned cotton -

Characterstics of cotton

| | |
|---|---|
| Staple length 2.5 % SL | 19.0 |
| Fibre strength ( 1000 PSI ) | 74.04 |
| Percentage of lint cotton | 34.6 |
| Percentage of broken seed and cotton with coveredseed | 0.6 |
| Output per hour ( kg) ( 100 % effeciency ) | 10.00 |

**Table NO. 7**

Results of Carding machine

| | |
|---|---|
| Sliver count ( Nm ) | 0.486 |
| CV m % | 10.1 |
| Trash % in sliver | 0.75 |
| Neps per gm | 59.0 |
| Cleaning effeniency | 63.8 |
| Output per hour (kg) | 1.8 |

**Table No. 8**

Carded sliver was processed in drawing machine . first on one delivery as a breaker head and second delivery as a finisher head. The results obtained of the test are as below:

| | |
|---|---|
| Sliver hank ( Nm ) | 1.01 |
| Uniformity ( CV m % ) | 1.01 |
| % of hook fibre | 2.2 |

**Table No. 9**

Sliver obtained from drawing machine was processed on spinning frame and the results obtained are as below.

| | |
|---|---|
| Yarn Count ( Nm) | 16.0 |
| CVm % | 6.2 |
| Single yarn strength (g) | 339.2 |
| CVp % | 18.4 |
| Elongation % | 6.4 |
| Twist per meter | 452.0 |
| Twist CV % | 8.00 |
| Tenacity gm/tex | 6.3 |

Test Analysis

In carding machine cotton is fed by unexperienced hands who feed the cotton unevenly and thus uneven sliver is produced. Flats of machine are chocked and cylinder & doffer are loaded frequently, which cause formation of high neps in carded web.

### 5.2.2 OPENING MACHINE

The opening and cleaning machines play a very important role in manufacturing a good quality yarn. In large textile mill this process is done by passing cotton through the different machines in line which beat and open the cotton . The most of the dust , seed and leaf fall down and a clean cotton is passed to a machine which converts it into a sheet form. called lap". Machine used for opening and cleaning and making a lap is called

"Blowroom". Blowroom is highly expensive and uneconomical for the small scale cotton processing centre. However, it is economical for the large scale spinning mill whose production is higher.

For small scale, a single beater opening machine is suitable to clean the cotton. Cotton can be passed twice or thrice through the machine as required to improve cleaning of cotton .

The opening machine developed by TRI is simple in design. It is made on a wooden frame .It claims to open 80 kg cotton per 8 hours. The main part of the machine is a wooden roller. The roller is made of 12 wooden sections of equal size. Each wooden section is having steel nails in rows . These nails act as saw for opening cotton. Other parts of machine are feed roller, delivery roller.and intermediate roller. The rollers are made of steel. These rollers are mounted on wooden frame. Frame is also attached with feed and delivery lattices.

Technical particulars of the machine are as below :

| | |
|---|---|
| main wooden spiked roller's dia ( mm) | 200 |
| main wooden spiked roller's working Width ( mm) | 400 |
| Feed roller's (top and bottom) dia ( mm) | 18 |
| Delivery roller's (top and bottom)dia (mm) | 20 |
| Main roller speed ( rpm ) | 900 |
| Total no. of spikes on roller surface | 6000 |
| No of the spiked rows on roller surface | 60 |

Machine is fitted with electric motor, gears ,pulleys, chain & belts. The driving arrangement of its various parts is shown in fig. 4.

**Working of Machine**

TH2 cotton received from ginning machine is fed to the opening machine.The machine is run continuously for 2 to 3 hours with regular feed of cotton . Machine parts are running smoothly, but it is found that it beats the cotton harshly. It increases % of short fibre . Cleaning efficiency of the m/c is very low. It leaves a large number of cotton leaves, broken seeds and other foreign matters in the open and clean cotton. To improve cleaning of cotton, same cotton was passed twice and thrice through machine but no significant improvements are found. It is concluded that machine is suitable only to open the coarse cotton which is used to make coarse fabric like cotton blankets,cotton carpets etc. The cotton flow through the machine

# OPENING MACHINE (DRIVING ARRANGEMENT)

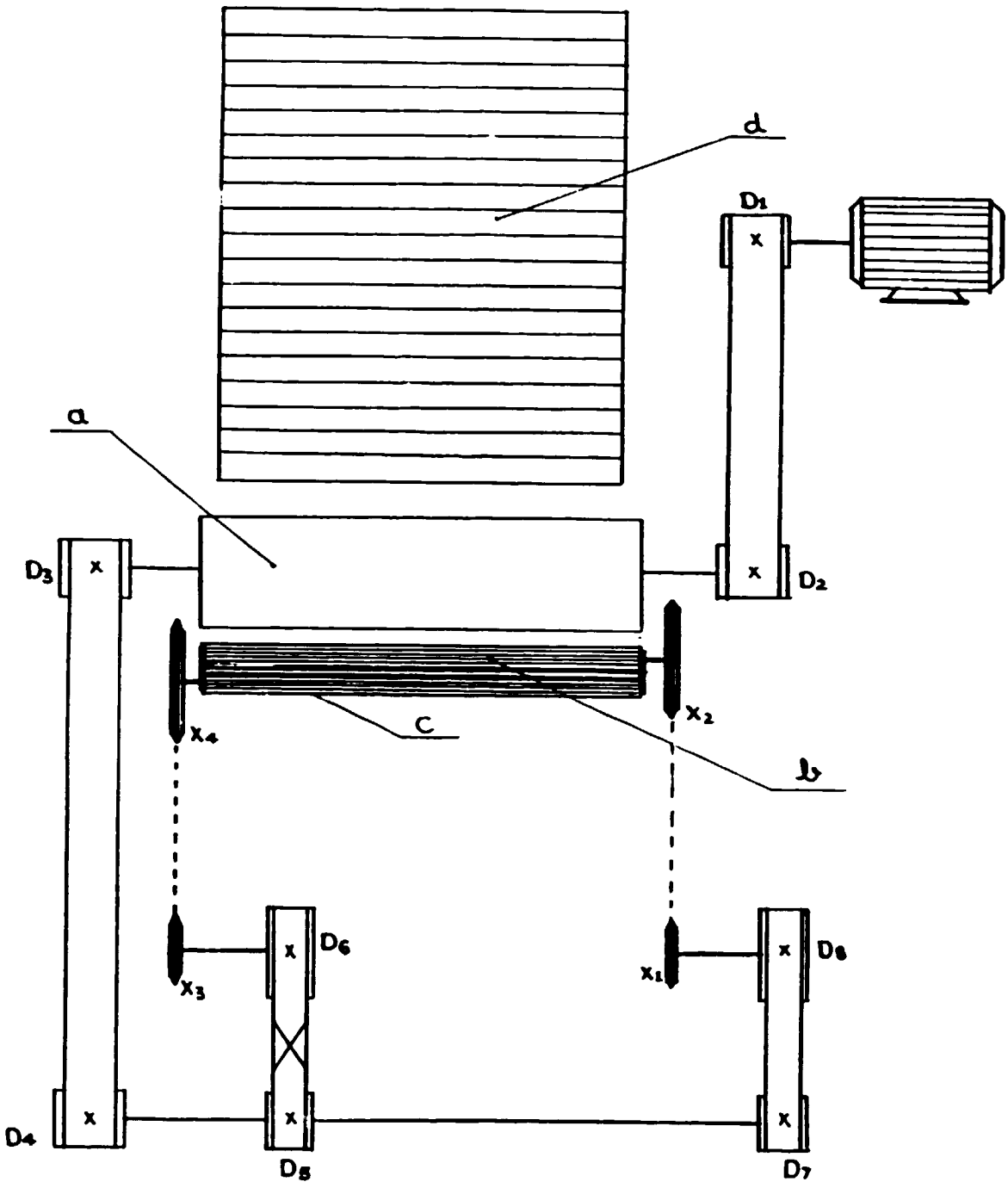



FIG.-4

D1=D2=50 MM
D3=D5=75 MM
D4=200MM
D6=160 MM
D7=75 MM
D8=160 MM

X1=X3=18T
X2=X4=46T

a:Needle Roller
b:Feed Roller (top)
c:Feed Roller (bott)
d:Conveyor

# OPENING MACHINE (FLOW OF MATERIAL)

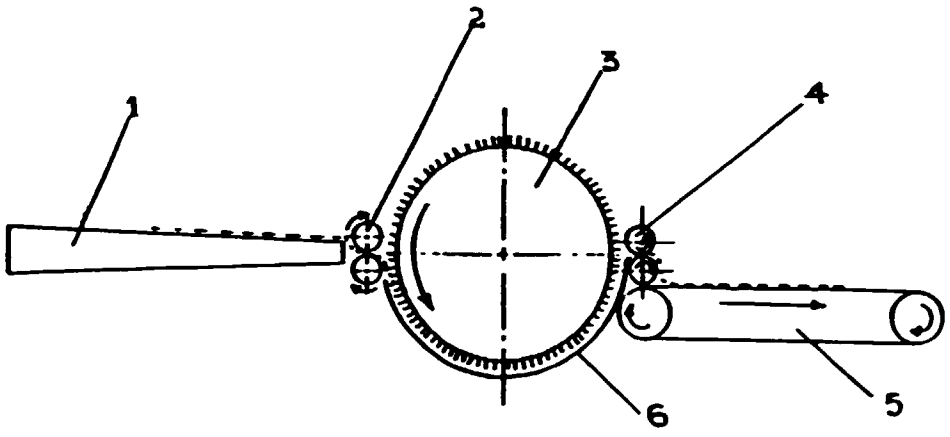



FIG.- 5

| | | |
|---|---|---|
| 1. Feed table | 2. Feed Roller | 3. Main spiked roller |
| 4. Delivery Roller. | 5. Conveyor | 6. Under casing. |

| | |
|---|---|
| Diameter of spiked roller | 207 mm |
| Speed of spiked roller | 900 Rpm |
| Speed of delivery roller | 1.47 m per minute |
| Speed Conveyor | 1.8 m per minute |
| Capacity | 8.0 kg. per hour |
| Motor | 0.6 kw - 960 Rpm. |

is illustrated in fig 3.

It appears that the machine does not suit for opening the cotton in sequence of spinning process. because it increases % age of short fibre and does not remove cotton impurities up to the mark which is important for a good spinning. If the machine is used in the spinning process. following drawbacks are noticed

1. Machine gives very harsh blow to cotton fibers which causes the damage to fibres and increases the percentage of short fibre in the cotton.
2. Cleaning efficiency of the machine is very low.
3. Feed rollers do not have the sufficient pressure at their nip points to grip the cotton properly. Cotton gets slip from their nip into the form of small tuff when the spiked roller beats it at the time of feeding.
4. Feed lattice is stationary. No regular feeding arrangement is attached there.Every time cotton is fed into the feed rollers manually.
5. The under casing fitted under the spiked roller does not help to improve the cleaning of cotton.

To overcome above shortcomings of the machine and to make it useful in AT spinning process . following modifications and changes are suggested.

1. Instead of spiked roller . a simple beater with 3 spiked legs or arms. on the principle of krishner beater may be developed and the cotton should be passed twice or thrice through the m/c as required to obtain desired level of cotton opening.This machine will not beat cotton harshly and will check the damage of the fibre to a great extent.
2. A small willow machine should also be developed to clean cotton. The opened cotton will be passed through willow machine which will clean the cotton without damaging fibres.

   Both these machines will be simple in design and will be made of indigenious material available in villages.
3. Instead of two plain feed roller . a feed plate with a flutted feed roller should be designed to grip the cotton at the feed. A simple lever with dead weight arrangement should be fitted to give a uniform pressure on feed roller.
4. Moving lattice should be designed so as to deliver the material regularly to feed roller.
5. Material should be fed uniformly on feed lattice by a trained person
6. Two star wooden roller of about 100 mm dia should be fitted on feed lattice with positive drive arrangement. It will press the cotton and make it in a form of sheet to feed the beater.

7. Small wooden box should be designed to collect the open cotton, instead of its falling on the dusty floor.
8. Spiked roller's undercasing should be replaced by grid bars of simple design. The grid bars should be fitted under opening rollers with a support of iron strips bent in arc form. The slotted holes should be made in the strips, to adjust grid bars up or down to change the gauges between grid bars and beater's arm.
9. A closed dust collector should also be designed and fitted under the opening roller.
10. Main opening roller and other moving parts of the m/c should be fitted with ball bearing and a proper arrangement of their lubrication should be developed to ensure the smooth working of the machine.
11. Diameter of the opening roller should be increased to 300 mm and its working width should also be increased to 500 mm.

On having the above changes in the machine, it will produce a clean cotton and the machine production will also be doubled in comparison with the present.

### 5.2.3 Carding machine

A simple small card by using old standard 40" width card machine's main frame,some gears and pulleys (after making some modifications to match the specification of card ) is developed.Cylinder and doffer are manufactured new one.These are made of steel sheet. Lickerin, feed plate, feed roll and calendar roll are also made from old parts of standard card machine by reducing them according to requirement. The width of each part have been chosen as per the width of main cylinder.

Technical particulars existing in the card machine are as below:

| | |
|---|---|
| Working width (mm) | 450 |
| Main cylinder diameter (mm) | 690 |
| Doffer diameter (mm) | 394 |
| Lickerin diameter (mm) | 234 |
| Stationary flat ( No.) | 21 |
| Feed roller dia (mm) | 56 |

The cylinder, doffer and lickerin of the machine have been mounted from the metallic card clothing imported from USSR long back by TRI. No specification of clothing were made available. However, from the working of the card it appeared that clothing was suitable for cotton carding.

The card machine is not fitted with a card coiler a small round iron disc is fitted. The disc gets motion by means

of rope pulley, gears from a shaft fitted under the doffer comb. The sliver delivered from the calendar roll is collected in a small can resting on the disc.

## Working observations

Before putting up the machine in working order, setting of its various parts and other technical parameters were checked and found as below :

| | |
|---|---|
| Cylinder speed (rpm ) | 220.00 |
| Doffer speed (rpm) | 6.33 |
| Lickerin speed (rpm) | 541.00 |
| Calendar roller delivery (m/min) | 36.46 |
| Tension draft between doffer & Calendar roll | 1.55 |
| Total draft ( feed roll to calendar roll ) | 55.08 |
| Pressure on the feed roll ( ko) | 35.00 |

**Gauzes :**

| | |
|---|---|
| Cylinder to doffer ( 1/1000") | 5 - 12 |
| Cylinder to lickerin ( do) | 17 - 22 |
| Cylinder to flat ( do ) | 7 - 22 |
| Feed plate to lickerin ( do ) | 10 - 17 |
| Doffer to Doffer comb ( do ) | 12 - 17 |
| Cylinder to Cylinder undercasing | could not be |
| Lickerin to Lickerin undercasing | Checked |
| Cylinder front plate to cylinder | |
| a/ top | 17 - 27 |
| b/ bottom | 17 - 22 |
| Cylinder back plate to cylinder | |
| a/ top | 22 - 34 |
| b/ bottom | 17 - 22 |

The parts of the machine are not made accurately . The gauze found between cards components, are far different from gauzes maintained on a card machine. The machine is not fitted with proper undercasing . A thin metal sheet has been bent in curve form to match the cylinder surface. The holes of 1.5 mm dia are made in the body of sheet which allow to drop down the dirt/dust. The curved sheet is fitted in the main frame with the help of Z brackets . No provision has been made to check their gauzes. In fact this arrangement does not function as a undercasing as in case of standard card. It just helps in transfering the fibers to doffer and do not allow the fibres to drop down in the way. The existing undercasing of the m/c does not allow to drop down the broken seeds, leaves, short fibres and other impurities .

# CARDING MACHINE (FLOW OF MATERIAL)

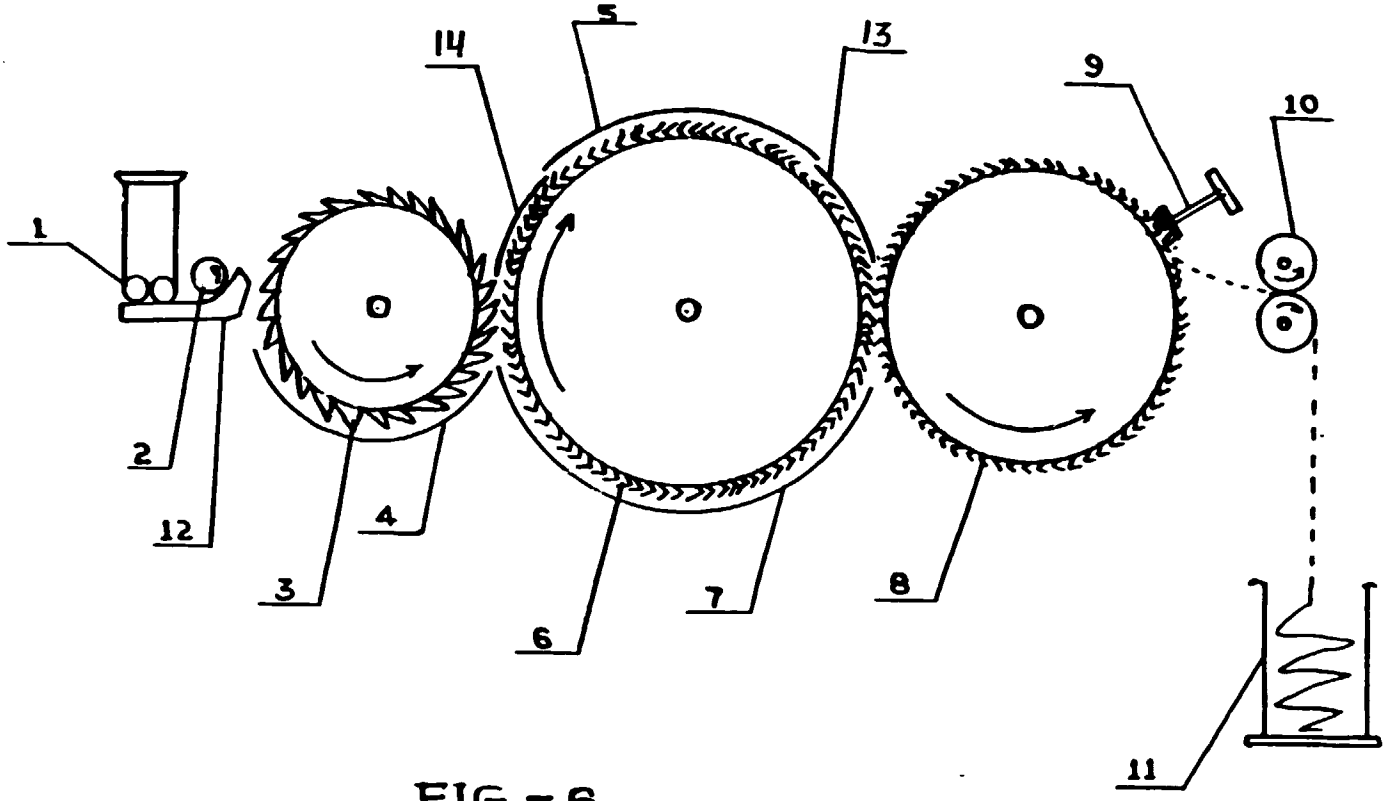



FIG.- 6

1. Couple Feed Roller
2. Feed Roller
3. Lickerin Roller.
4. Under casing (lick)
5. Flat
6. Cylinder
7. Under casing (cyl)
8. Doffer
9. Doffer comb
10. Calendar Roller
11. Can
12. Feed Plate
13. Front Plate
14. Back Plate

# CARDING MACHINE (GEARING ARRANGEMENT)

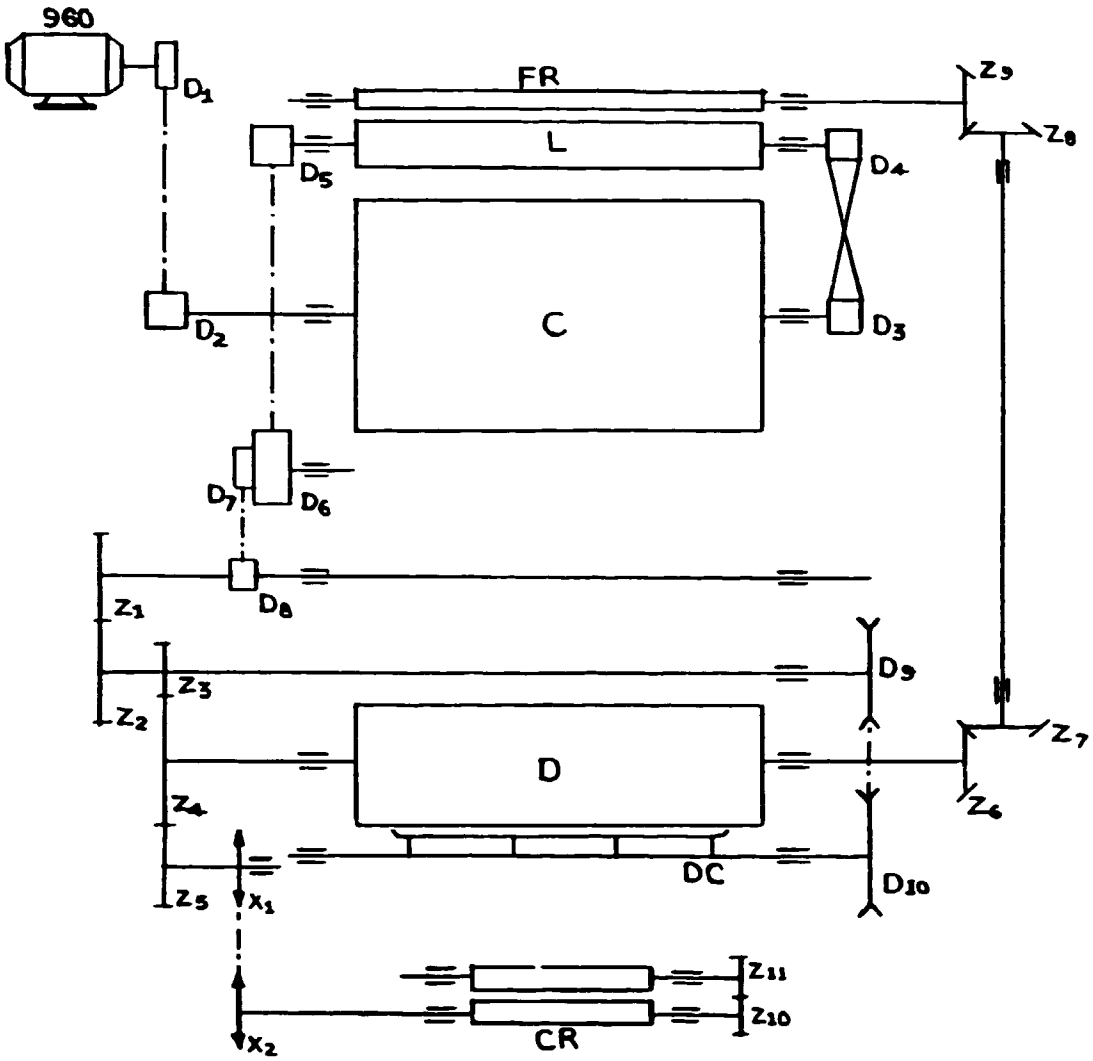



FIG.-7

| PULLEY (diameter in mm) | | GEARS (No. of Teeth) | |
|---|---|---|---|
| D1 - | 70 | Z1 - 24 T | C - Cyl |
| D2 - | 350 | Z2 - 90 T | D - Doffer |
| D3 - | 350 | Z3 - 24 T | L - Lick |
| D4 - | 125 | Z4 - 96 T | CR- Cal roll |
| D5 - | 130 | Z5 - 30 T | FR- Feed roll |
| D6 - | 250 | Z6 - 20 T | DC- Doffer comb |
| D7 - | 90 | Z7 - 20 T | |
| D8 - | 250 | Z8 - 20 T | |
| D9 - | 200 | Z9 - 105T | |
| D10- | 84 | Z10- 34T | |
| | | Z11- 34T | |

All 21 flats of the m/c are stationary, resting freely in slots made on steel bend fitted on side frames. ( L.H. & R.H. frames).The flats have been made from old 40" width card's flats

The card was manually fed. During the first trial carding machine was fed with Guayvit cotton It was dirty and unopened cotton. Within 10 minutes of the running of machine, its cylinder was loaded with fibers and flats are badly chocked with seeds , leaves and short fibers. Machine produced uneven sliver full of impurities and neps. It was because that the cleaning and carding of cotton were done between flats and cylinder with the results the short fibers, dust & leaves etc are accumulated in flats & cylinder and chocking them badly in a short time operation.

Later during second trial TH-2 clean cotton was made available for trial of machine. It was a clean cotton and contained few leaves, less short fibres and foreign matters. The machine was cleaned well, its cylinder, doffer and flats were stripped off. Machine was run and fed manually for 90 minutes, working of the machine was found improved. For an hour it ran continuously and the sliver produced on machine was more clean and uniform than earlier test. Neps were also reduced to some level. After 60 minutes, machine was stopped and cylinder & flats were examined visually and found that both were chucked, these were stripped off again (all the time stripping was done by hand brush as no stripping roller was available in workshop) and machine was put again in operation for next 30 minutes. Flow of material through different components of the carding machine can be seen from fig 6. Carding machine's parts are getting motions by means of pulleys, belts, and gears from an electric motor. The driving arrangement of these parts are shown in fig7.

Waste under the cylinder and lickerin was checked and found that there was only dust, no seed, leaf or short fibre was there.

Card sliver delivered from the calendar roll was collected in a card can. The sliver was not coiled properly and was fluffy.Only a little quantity of the sliver could be collected in sliver can due to improper coiling and bulkness of sliver. The sliver layers get sticked among themselves as it does not get any twist as should have been in a sliver on a standard carding at the time of coiling .

The card sliver was tested and its results are shown in table 7.

It was found from the result that machine was producing better sliver than sliver manufactured on traditional equipment. If we will use machine continously on commercial basis following serious drawbacks appear.

1. Machine does not have a uniform feeding arrangement
2. Flats are stationary which are getting chocked and need

frequent stoppage of machine for their stripping.
3. Under casings do not do their function properly.
4. Carding sliver is licking among its layer in card can.
5. Due to the improper machining and inaccuracy into various parts, correct gauzes can not be maintained.
6. Production of machine is too low.
7. Speed of cylinder is low for a proper carding action.
8. Speed of machine can not increase as the moving parts like cylinder, doffer etc run on bush.

Suggestions to overcome the shortcomings of machine :

1. A new long feed lattice should be designed and fitted on the back of the machine in such a way that it delivers cotton to feed roll regularly. A particular weight of a cotton on a particular area of lattice may be laid to ensure uniform feeding of the carding . Two wooden star roller should be also fitted on the lattice. The roller should be driven with chain drive arrangement for pressing the cotton and to feed it in a sheet form.
2. Revolving flats should be developed .
3. A simple and small coiler should also be designed.
4. Accuracy of the parts should be checked in their manufacturing process.
5. Carding machine accessories like grinding, burnishing and stripping rollers should be developed .
6. Working width of cylinder should be increased to 610 mm.
7. Cylinder should be fitted with double row ball bearings or roller bearings so that it can run on higher speed to improve the carding action.
8. A new comb box should also be designed
9. A new cylinder and lickerin undercasing should be designed
10. Front and back plates should be modified to obtain their correct guazes.

### 5.2.4 Draw Frame

A small single head draw frame with two deliveries has been developed. Each delivery is having 3/3 drafting arrangement which is mounted on aninclined roller stand. Top and bottom rollers of small dia have been selected to process short staple cotton fibre.Each delivery is independent to select draft and roller settings seperately. Drafting arrangement gets motion from a common shaft called as main driving shaft. The driving arrangement of draw frame can be seen from fig 8.

Front and back calendar rollers are mounted horizontally parallel to each other in a steel frame. Front roller is kept in contact of the back calendar roll by means of a steel coil spring to press the sliver between the rollers nips. The coil

# DRAW FRAME (GEARING ARRANGEMENT)

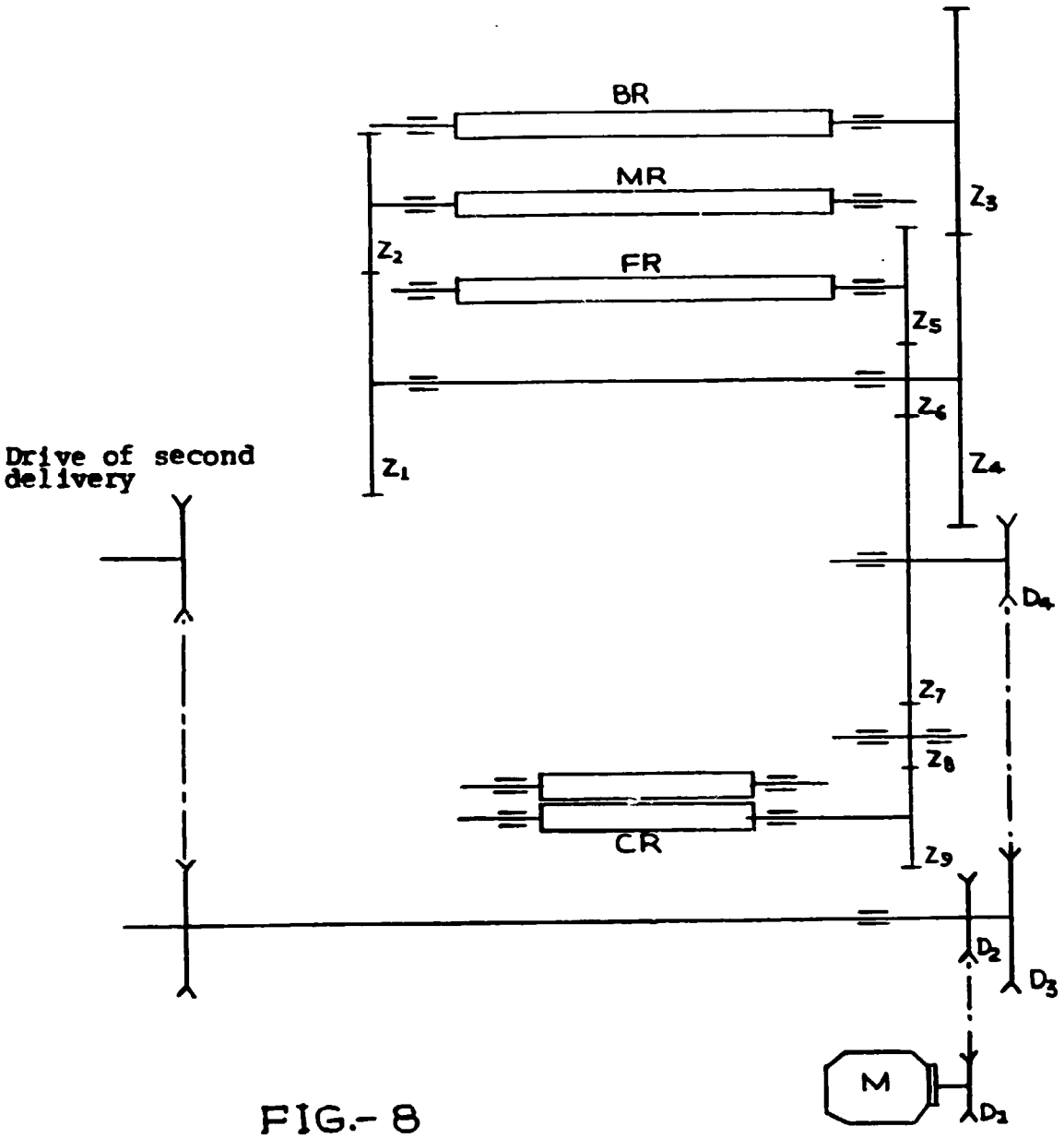



FIG.- 8

Driving arrangement for one side delivery.

GEAR (NO. of teeth )

| | | | |
|---|---|---|---|
| Z1 | - 28 T | FR | - Front Roller |
| Z2 | - 40 T | MR | - Middle Roller |
| Z3 | - 54 T | BR | - Back Roller |
| Z4 | - 27 T | CR | - Calendar Roller |
| Z5 | - 20 T | D1 | - Motor Pulley ( 50 mm dia) |
| Z6 | - 60 T | D2 | - Main shaft pulley(160 mm) |
| Z7 | - 20 T | D3 | - Driving Pulley ( 90 mm) |
| Z8 | - 20 T | D4 | - Pulley ( 185 mm) |
| Z9 | - 38 T | M | - Motor (0.6 Kw & 960 Rpm) |

spring rests in the front calendar roller's housing to push back the front calendar roller to keep it always in contact of the back calendar roller. Under each calendar roller, a small revolving iron disc is fitted on which a sliver can rest. The disc is getting motion from main shaft. Two fixed round iron bars are fitted on anangle iron frame at the back of the main frame. These bars support and guide the sliver which is running in machine and work as the creel of the frame.

Technical particulars of the machines are as below :

| | |
|---|---|
| Frame size ( m ) | 2.1 x 0.95 x 1.2 |
| Drafting arrangement | 3/3 |
| Bottom roll dia ( mm) | 22 |
| Top roll dia (with cots)(mm) | 22 |
| Calendar roll dia ( mm) | 40 |
| Drafting angle | 20 |
| Top roller weighting arrangement | Lever and dead weight |
| Top roller weight in kg | |
| Front roll | 18 |
| Middle roll | 18 |
| Back roll | 16 |
| Bottom roller settings | |
| Front zone between blocks (mm) | 9.5 |
| Back zone -do- | 7.0 |

**Working particulars**

Machine was run for one hour and its working was watched closely. One delivery of the m/c was used as breaker head and other delivery as finisher head. Each delivery was fed with four ends of sliver. The breaker delivery was fed with carded sliver. The sliver delivered from breaker head was collected in open pan. Four ends of this sliver were processed together through finisher delivery. Draft and setting of both deliveries were kept the same. Drafts kept in various drafting zones during operation are as below :

| | |
|---|---|
| Tension draft | 1.028 |
| Total draft | 5.75 |
| Break draft | 1.375 |
| Front roller speed (m/min ) | 4.09 |

All parts of the machine were functioning properly. Finisher head sliver was collected in a pan and was sent for testing. The results obtained are as per table 8.Flow of the material through different parts of machine can be seen from fig 9.

Machine appears useful for the rural artisians as it produces more uniform sliver than the sliver produced on the

# DRAW FRAME (COTTON FLOW)

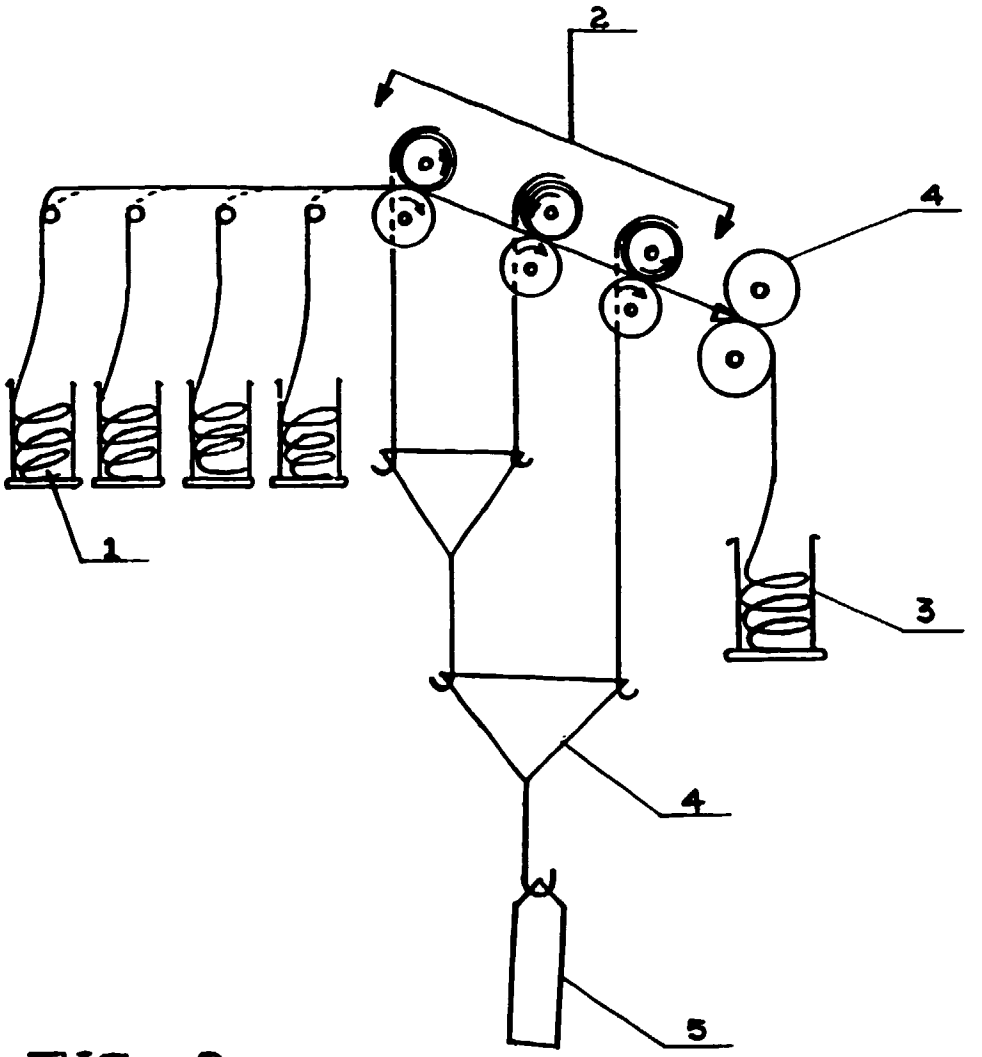



FIG.- 9

1. Feed Sliver 2.Drafting zone 3. Delivered Sliver
4. Cal roller

| | |
|---|---|
| Draft 5.75 | |
| Diameter of Top and bottom rolls | : 22 |
| Drafting inclination | : 30° |
| Speed of delivery Roller | : 120 Rpm. |
| Capacity (production) | : 1 kg/h |
| Dimension of main frame (mm) | : 1100 * 350 * 1015 |
| Weight | : 60 kg. |
| Motor | : 0.5 KW - 960 Rpm |

traditional equipment. A good quality yarn is produced from good quality sliver on the spinning frame (charkha).

If the machine is used continuously in commercial use. following drawbacks will appear.

1. Main frame and machine parts are so delicate that they will not last foralong time in unskilled hand, at village level.
2. Frame is not attached with coiler. (untwisted sliver is collected into pan.Sliver licks among its layer which deteriorate the evenness of the sliver).
3. The bottom rolls are running in cast iron roller slides and no bushes or bearings have been provided in roller slides. It causes damage to the bottom roller.
4. Existing top roller weight arrangement does not seem satisfactory as it is difficult for anoperator to handle it. A uniform pressure on the roller is not obtained .
5. Bottom rollers are running eccentric and top rollers cots are damaged badly. It spoils uniformity of the sliver and affects the working of the frame.
6. Sliver is dragged on stationary rods of the creel. It increases unevenness in sliver.
7. The workmanship of the machine parts is found poor.

To make the machine useful for commercial use in a small scale cotton processing centre following modifications / changes are suggested

1. Frame should be made of a durable and standard materials.
2. Frame should be fitted with coiler (a new small coiler suitable for drawframe should be developed )
3. Drafting and calendar roll should be surface hardened and same may be straightened accurately within 2/1000"
4. New calendar roller should be designed. These rollers will be fitted in their housing in such a manner that different gauze can be maintained between rollers for different sliver hanks.
5. A new creel with two revolving lifter roller should be developed.The surface speed of the roller should be synchronised with the speed of back drafting roll so that there may be no dragging of the sliver.
6. Sliver guides should be designed to feed sliver to drafting rolls properly.
7. Instead of dead weight arrangement, a spring weight arrangement should be developed to ease the working of the operator.
8. Breaker and finisher heads should be used as a separate drawframe.
9. Top rollers end bushes should be improved. Bottom roller should be run in bearing blocks.

# TREADLE OPERATED S.W. (GEARING ARRANGEMENT)

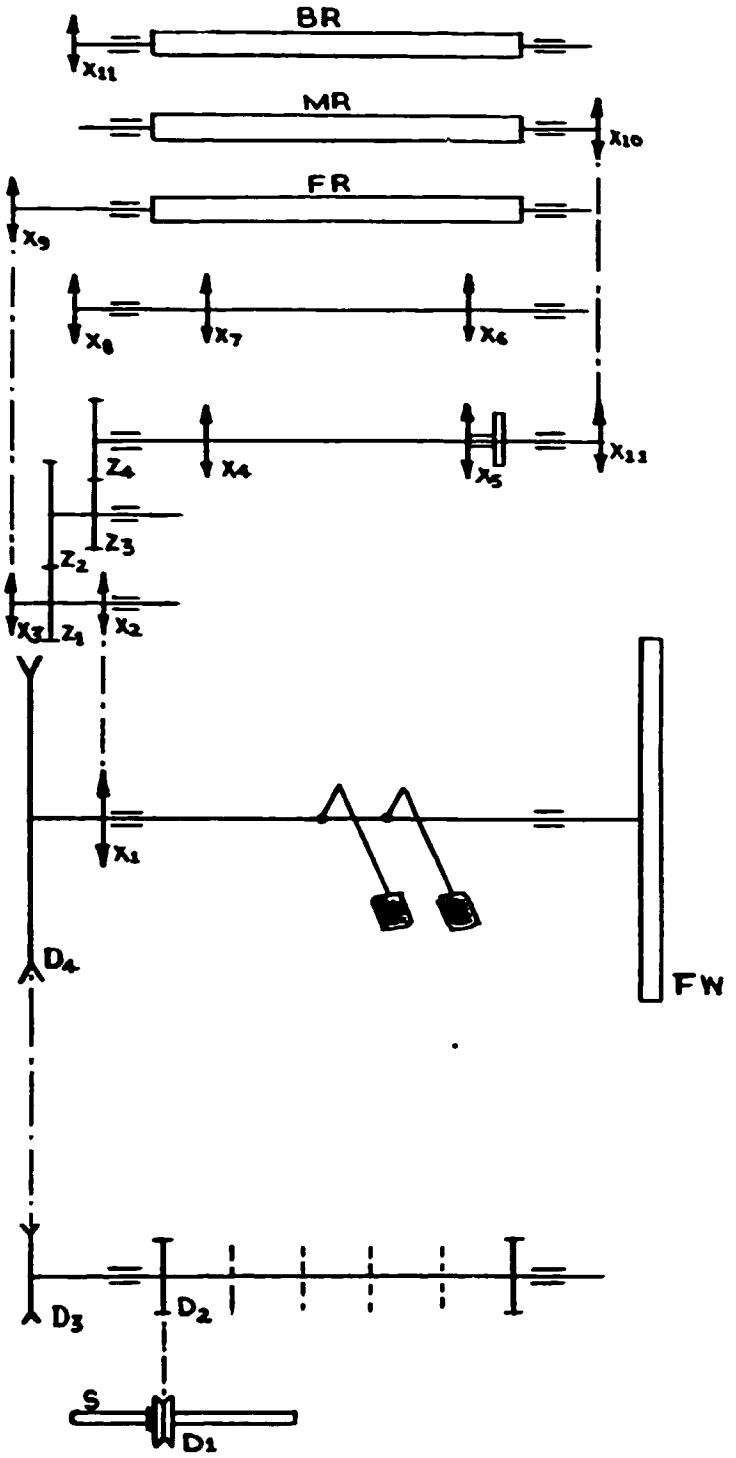



FIG.- 10

| CHAIN SPROCKET (No of Teeth) | | Gears (No of Teeth) |
|---|---|---|
| X1 - 43 T | X9 - 10 T | Z1 - 36 T |
| X2 - 20 T | X10- 20 T | Z2 - 48 T |
| X3 - 10 T | X11- 20 T | Z3 - 18 T |
| X4 - 12 T | X12- 10 T | Z4 - 60 T |
| X5 - 10 T | S - Spindle | D1 - 24 mm (dia) |
| X6 - 30 T | FR - Front Roller | D2 - 190 mm |
| X7 - 18 T | MR - Middle Roller | D3 - 52 mm |
| X8 - 14 T | BR - Back Roller | D4 -460 mm |
| | FW - Fly wheel | |

10.All the critical parts like roller.bearing housing.roller slides and bushes should be manufactured precisely.

### 5.2.5 Spinning Wheel (Charkha)

Six spindle treadle operated and paddle operated spinning wheels have been developed. Second hand drafting material obtained from the textile mills is used. Bottom fluted rollers have been made as per specification of the S.W from old drafting rolls. Old used top rollers with cots, without cots cradles and aprons have been procured from the mill. Angle iron frame of simple design has been fabricated.

The technical particulars existing on the both spinning frames are as below :

| Technical particulars | Paddle operated Charkha | Treadle operated Charkha |
|---|---|---|
| Spindle gauze ( mm) | 75 | 65 |
| Ring dia ( mm) | 51 | 48 |
| Lift ( mm) | 90 - 100 | 100 - 125 |
| Spinning angle ( degree) | 45 | 45 |
| Spindle wharve dia(mm) | 20 | 25 |
| Main driving pully dia (mm) | 155 | 180 |
| Fly wheel attached | yes | yes |
| Paddle speed ( rpm ) | 50 - 60 | 50 - 60 |
| Draft range | 16 - 25 | 13 - 17.5 |
| Twist range ( tpm ) | 400 - 600 | 350 - 500 |
| Drafting system | 3/3 apron roller | 3/3 apron roller |
| Weight arrangement | top arm | dead weight lever |
| Front top roller weight ( kg) | 10 | 8 |
| middle - do- | 6 | 6 |
| back -do- | 6 | 6 |
| Bottom roller settings- | | |
| Front zone (mm) | 45 fixed | 28 - 35 variable |
| Back zone ( mm) | 33 - 38 | 29 - 40 |
| Front bottom roller dia (mm) | 25 | 22 |
| second -do- | 25 | 22 |
| back -do- | 22 | 22 |
| Yarn winding system | ring rail moves up and down every time to a distance equal to lift of frame. | step by step winding goes up from bottom to top |

# PADDLE OPERATED S.W.

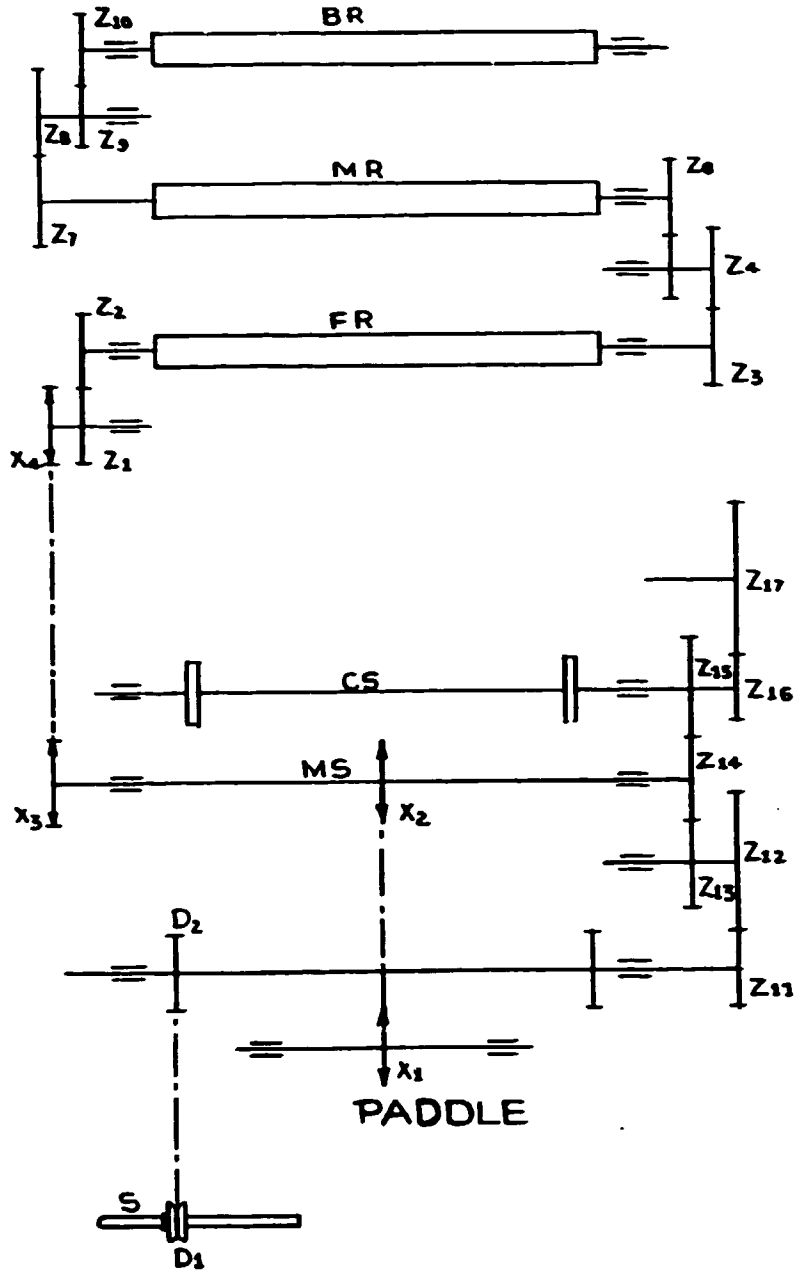



FIG.- 11

Z1 - 45 T
Z2 - 40 T
Z3 - 20 T
Z4 - 60 T
Z5 - 20 T
Z6 - 66 T
Z7 - 20 T
Z8 - 40 T
Z9 - 42 T
Z10- 32 T
Z11- 29 T
Z12- 60 T
Z13- 22 T
Z14- 38 T

Z15 - 66 T
Z16 - 20 T
Z17 -129 T

FR - Front Roller
MR - Middle Roller
BR - Back Roller
MS - Main Driving Shaft
CS - Cam Shaft
X1 - 33 T ( Sprocket)
X2 - 20 T
X3 - 14 T
X4 - 18 T

**Working Observation of Spinning Frame -**

The charkhas were operated by expert personally during his mission for many hours and found the working of the frame satisfactory. The charkhas were also operated by the Institute's staff (man & woman), who also did not find any difficulty in the operation . Institute is not having any load measuring equipment to check the power required to run the charkha. Therefore, it was not possible to measure the power required to operate charkha . However no difficulty and no tiredness was experienced even after 3-4 hrs. continuous operation of charkha .

The charkhas were fed directly with the sliver obtained from draw frame and the yarn was manufactured on charkha. The yarn was tested in IRI testing laboratry and the results are summarised as in table 9. Driving arrangenment of treadle and paddle charkha can be seen from fig 10 and 11 respectively and flow of material in charkha can be referred from fig 12.

The spinning wheels are giving better results than traditional single spindle bamboo charkha. Quality of yarn is better and production of charkha is about six times higher than the production of traditional charkha. To make the charkhas more productive, and technically suitable and economically viable, following shortcomings are to be removed

1. Chain driving arrangement of drafting rolls should be replaced by gear driving arrangement as the chains give the jerk at the time of the start and causes breakages of ends.
2. Bottom rollers are running in cast iron roller housing which causes damages to the rollers ends .
3. The charkhas are fitted with old worn out rings which effects their performance.
4. Spindles fitted in charkha are /" lift tape drive which require more driving power as compared to small bend drive spindle. So existing tape drive spindles should be replaced by bend drive spindles.
5. In the treadle operated charkha weight arrangement is inconvenient to the operator.
6. Bottom rolls, used in charkhas are eccentric and worn out.
7. Accuracy has not been maintained in manufacturing the machine.

Suggestions to improve the performance of Charkha :

1. Instead of dead weight arrangement charkha should be fitted with spring weight.
2. To reduce the load of spindle , bend drive small spindle should be developed.

# SPINNING WHEEL [FLOW OF MATERIAL]

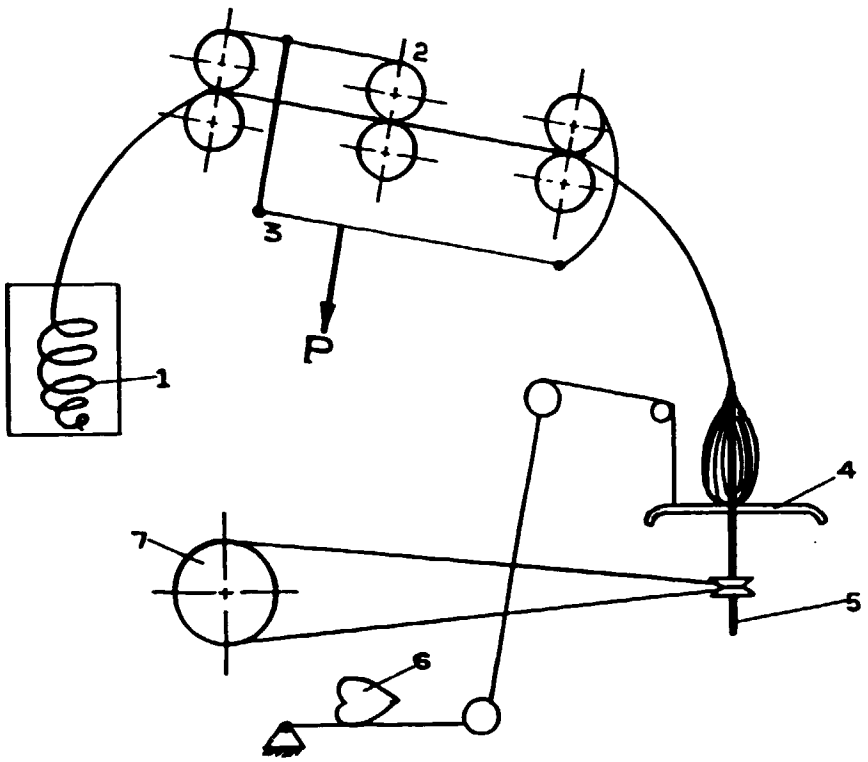



FIG. 12

1. Sliver 2. Drafting zone 3. Weight spring
4. Ring rail 5. Spindle 6. Cam

| | | | |
|---|---|---|---|
| Count of sliver | : 0.83 - 106 | Count of yarn | : 13 - 17 |
| Draft | : 16 | | |
| Diameter of roller | : 22 | | |
| Speed of Spindle | : 3,000 Rpm | Delivery | : 6.7 mpm. |
| Twist | : 450 Tpi (depend on count of yarn production) | | |
| Capacity | : 12 g/spindle per hour | | |
| power | : padel driven | | |
| Dimension (m.m.) | : 1400 * 500 * 800 | | |
| Weight | : 75 kg. | | |

3. Bottom roller housing should be fitted with nylon or brass bushes.
4. To improve the production of spining frame. Number of spindles per frame may be increased ( 12 spindle treadle operated charkha is recommended which is more suitable than 6 spindle charkha)
5. New rings and drafting material should be fitted in order to improve the quality of the varn .

Analysis of test :

Machines developed by TRI will give better results as it will increase the production of the operators and will improve the quality of varn. but it is only possible when the machines are modified as suggested above because the present condition of machines does not allow to operate them continuously for long time commercially. Modifications and changes can be taken up step by step as the financial conditions permit.

### 5.3 Participation in development of entirely new hand operated machine

Discussions with National Project Director (NPD) and other research staff members were held several times in detaials about the working of the machine and problem faced during trial. Ideas for development of new machine for improving production and quality of yarn were given to them . Some rough drawings and sketches to explain about technical aspects of machine, were prepared during the discussions. The principle and mechanism of each machine were explained to the R & D staff. Ideas for developing a new ginning machine with double roller and preopener to improve the cleaning efficiency of machine were offered to them. New opening machine on principle of three bladed beater or krishner beater was suggested which will give smooth beating action to fibres and will open more cotton. Development of grid bars under the opening roller instead of a thin sheet's existing undercasing were recommended. To improve production capacity of machine some changes in mainframe and various parts of machines were also suggested. Actual specifications could not be worked out due to non availability of mechanical datas and shortage of time.

Development of new carding machine,with revolving flats, proper undercasing ( Licker in and cylinder undercasing ) , small size coiler and simple comb box,was suggested. To develop a carding machine economically,use of some old parts was suggested It was informed to NPD that existing card is not suitable for a cotton processing centre and the development of new card is essential to make the programme successful.

Some modifications in drawing machines were suggested to improve its working and to raise production capacity of the machine .

Development of a new roving frame was suggested. Principle of drafting, twisting and winding were explained to the concerned staff. Appropriate size of the machine i.e. 4 spindle per roving frame was recommended. The roving m/c will work on principle of ring spinning with larger ring (54 to 60 mm) dia and smaller lift (125 mm to 150 mm). 3/3 roller apron drafting system was suggested. This machine was recommended to increase the production of drawing frame and to improve the quality of sliver.

Development of 12 spindle treadle operated and 24 spindle power operated spinning frames were suggested as these frames will improve earning of the operator. Drawings of both spinning frames were handed over to the concerned staff.

To make rural artisans independent for making double yarn in their houses for manufacturing coarse fabric, introduction of a doubling frame was suggested. Drawing of 24 spindle doubling frame were prepared and handed over to their staff.

To increase production of the handloom weaver and to improve the fabrics quality, it was suggested that the looms running in cottages should be replaced with a modified loom.

Besides above, the development of a new willow machine was discussed at length with research and development staff. The principles of working of the machine and its functioning were explained to them. The production capacity of m/c was worked out during the discussions. Approx. cost involved in the development of new machines was also calculated. The preparation of drawing and the development of machines - could not be undertaken because of short time with the expert.

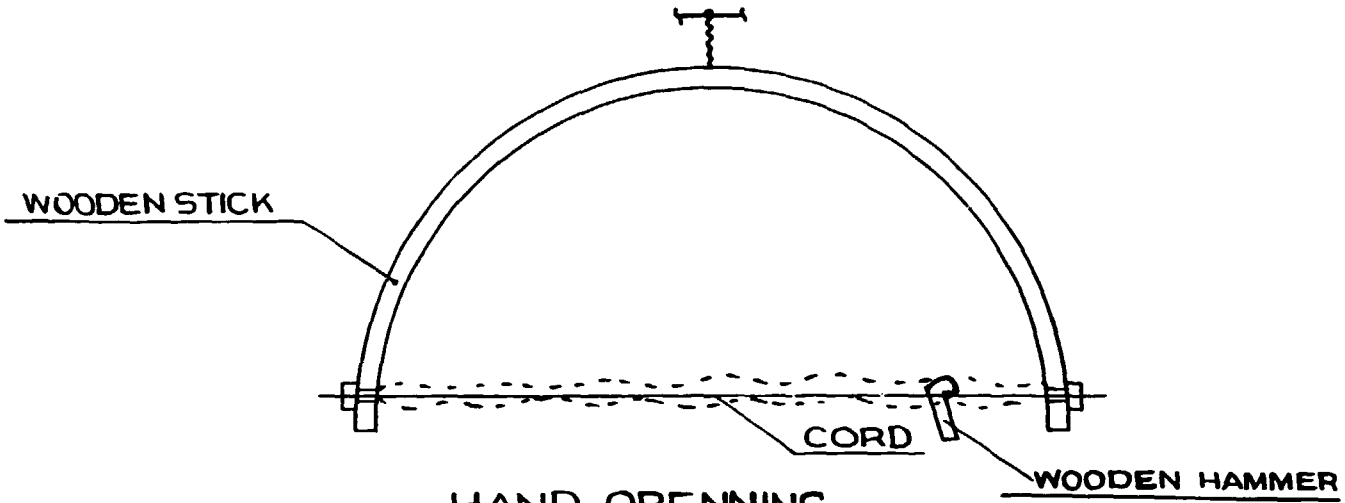
5.4 To assist in drawing up specification and design

Active participation in discussion was initiated for development of new machines. Information about specifications and design, were also explained to the technical staff to help them in laying down the final specifications .But due to shortage of time and lack of fund, it was not possible to draw the specification and design of a new machine finally.

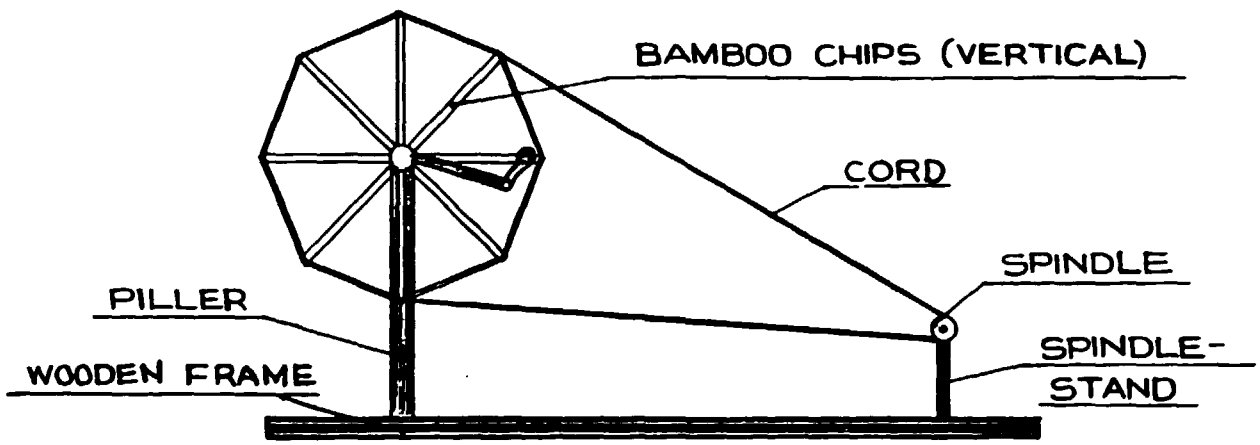
5.5 To assist in manufacturing and testing of prototypes

Ideas for developing the new machines were given to TRI staff with which they were fully satisfied. The importance of new machines was also highlighted to NPD. The development and manufacturing of a machine need funds and time. TRI is trying to seek financial help from Government or UNIDO for this work which is purely in the interest of poor artisans. Fund could not

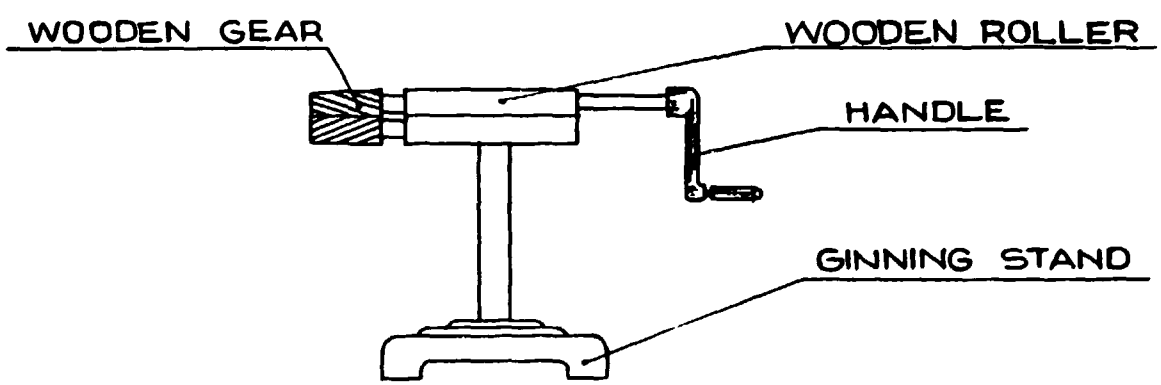
# TRADITIONAL EQUIPMENT




HAND OPENNING




SPINNING WHEEL




GINNING MACHINE

FIG.- 13

be made available so far. Therefore, machine manufacturing work could not be undertaken during the mission.

## 5.6 Spot studies of traditional spinning equipment used in villages

A very old and crude technology is being used in villages. They are using equipment made of local indigenous wood. The productivity of the equipment is very low. Quality of yarn manufactured in cottages is very poor. About 60 % population of hill area is tribal. In each house, spinning and weaving is a traditional profession since long time. These artisans do not have proper cotton processing machine they attend to this work manually and do not get clean & uniform sliver for spinning. They manufacture only coarse fabric like bed covers, towels, curtains and blankets. From ginning to finishing of fabric is carried out in cottages. Following equipment are used by villagers for making a cloth.

### 1. Ginning

A Small ginning machine made of wood is used in cottages. The m/c has two small rollers which are mounted on a wooden frame in bearing housing in such a manner that cotton seed can not pass between the rollers. The rollers are rotated by means of cranked handle and seed cotton is fed in them. The lint fibre is caught up by the rollers and drawn forward so that seeds are separated from fibre. Seed can not pass between the rollers and it falls down when they are detached from fibre.Only 8" to 10" width roller ginnig machines are seen in villages. The production of this machine is only 2-3 lbs seed cotton per day. Ginning of cotton is very difficult in raining season as atmosphere becomes humid and cotton gets moistured due to which fibres can not be separated from seed easily. Therefore, machine is used only in summer season.

### 2. Opening

Villagers do not have any opening machine. Most of them open the cotton by hand or by means of special cord mounted on a wood stick, which forms a bow shape. The bow is hanged in roof by means of rope. Operator holds the bow in one hand and pushes the cord into cotton, he beats the cord by wood hammer from his other hand. Cord gets vibrated on a high frequency, and the fibres in contact with the cord also gets vibrated and thus opens the cotton. This is slow process, only 4-5 kg cotton is opened in a whole day.It does not clean cotton properly. A large quantity of leaves and dust are seen in open cotton.

### 3. Carding and drawing

Artisans do not use any carding or drawing equipment except above arrangements for opening of cotton.

**4. Sliver making :**

Small quality of opened cotton is laid on a wooden plank. a thin wooden stick is put on the cotton. and is rolled on the plank. The cotton is first wrapped on the stick and later on removed from the stick to be used as sliver for spinning on charkha

**5. Spinning**

A single spindle bamboo spinning frame made by local carpenter is popular in the hills . It consists a big manually rotated wheel, which is arranged to drive spindle by means of a cord which passes over spindle and wheel. The spindle is fitted in fixed wooden housing. The spinner sits on the ground and rotates the wheel by means of cranked handle from his right hand and he draws out the fibre from his left hand to extend the length. which he can control. The twisting is continued until the spinner judges that the yarn is sufficiently twisted and then with his right hand , he stops the wheel and turns it backwards a little, to unwind the few coils of yarn on spindle blade and then he proceeds to wind yarn just spun on the lower part of the spindle before beginning its cycle again. The frame has a very low production ( only 200 to 250 gm coarse yarn is spun in whole day on a spinning wheel) capacity.

**6. Pirn winder**

Single spindle pirn winder based on the principle of bamboo charkha is popular. A spindle is fixed on wooden frame which is driven manually by means of a cord passed over wooden wheel and spindle. A small wooden bobbin is mounted on charkha spindle. The spindle is rotated by right hand and yarn wound on the bobbin is guided by the left hand. This bobbin full of yarn is called as "pirn".

**7. Loom**

Narrow width looms (less than 1/2 m width) are common among tribals. These are made on wooden frame. The healds and reed of loom are made locally. Loom has two foot operated tappets to move healds up and down. The looms are not attached with picking device. A small wooden shuttle made by village carpenter is passed by hand from one end to other end of cloth. To make a long design with various colours. many shuttles with different colour yarns are used. Some round wooden rods which work as lease rods are passed through the yarn.

Weavers in villages are skilled. they have art to make long design fabric such as flower, animal or bird etc. They know how to select number of wrap and weft ends to form a design in the fabric. Various type of fabric varieties like plain , twill, satin etc are manufactured in cottages. Some samples of cloth collected during visit are attached here.

For making medium and fine cloth, weavers use mills varn in both warp and weft.But for making coarse and heavy cloth, warp and weft varn are made on charkha.

Weavers also make natural dyes from the skin of trees for dyeing the varns. Weavers dissolve the dye in hot water and dip varn into water and get it dyed. In Fig 13 some traditional equipment are shown.

### 5.7 Visits

During mission at Hanoi, following four visits were undertaken by expert

#### 5.7.1 Textile mills visits

On 14/8/90 and 15/8/90 Hanoi spinning mill and m/s 8 th March Textile mill were visited to have an idea of their working conditions and to know price of lint cotton, price of varn and cotton conversion cost upto varn to enable to assess the feasibility of appropriate spinning technology equipment. Discussions were held about working of textile mills in Vietnam. Many queries were raised to the mills. Some discussions about textile industry in India on large scale were also held as the mill people were eager to know about running of a textile mill in India. Information about Indian Textile Industry as desired by the mills were furnished to them.

During course of discussion held in mills, it was informed that mills are using 100% imported Russian cotton as there is a little cotton production in the country. The local cotton is a short staple cotton .the cotton grown in Vietnam is consumed by farmers for their own use. The cotton prices in mills were not available.They informed that cotton is being supplied to the mills by the Government which has an agreement with USSR Govt. to support their textile industry. Vietnam Govt. is getting cotton on subsidised rate from Russia which is lower than open market cotton price. About sale of varn it was informed.that all mills equipped with latest machinery are exporting their varn and only 10 - 20 % varn is sold in domestic market against cash payment. The varn is being purchased either by the cooperative society or private powerloom factories. Mostly composite mills are making fabric and exporting to USSR against their cotton supply. They also export the cloth to other countries like Japan, China, Singapore etc. Only 10% of their production is sold in home market through private parties or Government stores etc. All new mills are earning profit whereas old mills are running at par because they are having old machines and their efficiency has gone down .The mills with their own saving have plan to renovate their machines in phased manner.

Now, mills are worried about the availability of cotton as the agreement between Vietnam and Russian Governments to support Vietnam textile industry is going to end this year. Further, mills do not have a hope to get cotton on subsidised rate from USSR. Hence every mill is planing to overcome this problem from their own re-sources as Vietnamese Govt. has warned each mill to run on self sufficient basis.

Appropriate spinning technology equipment development programme has been appreciated by the mills as it will encourage the cotton growings and will improve earning of rural artisans in the country.

5.7.2 **Village visit**

To see the equipment used in cottages and to assess their productivity, a visit was undertaken to a village of district Kim Boi on 24/8/90 where the expert met the Vice President of district committee who furnished the following information.

Kim boi has a population of about 120000 persons, 90% of ofthe population are tribals and only 10% are of other castes called as Kinq caste. It has 35 villages, each village with population of 4 - 5 thousand persons. Kim Boi has 14000 ha agriculture plain area, out of which 9000 ha is used for growing rice crop and rest of the plain area grows other cash crops. Kim Boi has 15000 ha forest. The cotton crop is grown on 400 ha land of hill area. The cotton yield is only 200 - 300 kg seed cotton per ha. He also informed that cotton growing is a traditional profession among the tribals. They grow the cotton for their own use. Quality of the cotton is very inferior. It is of short staple length, having a higher percentage of immature fibres. Villagers are willing to increase cotton growing area if they are paid for their efforts reasonably.

Under a Govt. scheme to raise cotton production in the country, a new variety of the cotton like TH- 2 has been introduced in hills. The results of this cotton are encouraging Cotton is of medium staple length and its yield is higher as compared to old variety of cotton. It is hoped that in the near future the cotton growers will raise the production and will be able to supply the cotton to the textile mills after meeting their own requirements. The increased production of cotton will also help in providing the employment opportunity to the increasing population in rural area. A large number of persons will be employed in cotton growings and its marketing, transportation etc.

Mr. Bang, Vice President of Distt. committee informed that last year TRI supplied them an opening machine which was installed in their premises and was operated through out the

cotton season. Villagers used to bring their cotton and get it opened there. They were satisfied with the quality of the cotton and prices charged for opening of cotton. It was cheap and convenient to them. The quality of the cotton was also superior as compared to the cotton opened by traditional method.

He informed that Govt. has a plan to improve the economic condition of hill's people by giving them loan on low rate of interest for purchasing income generating equipment such as spinning wheels, weaving looms or agricultural tools.

Similar to Kim Boi there are many other Districts in North Vietnam which are having a large hill area and need immediate help for improving their living conditions .

### 5.7.3 A visit to weaving centre :

Expert had been to a cooperative weaving society which is running in Hanoi for the last 25 years. The visit was undertaken to know about the availability of yarn and its rates in a weaving centre. The Weaving centre is procuring yarn from Govt. spinning mills and manufacturing only towels of different sizes. Weaving centre is always in short of cotton yarn due to which their production can not increase. Society is willing to procure yarn manufactured on AT equipment by villagers for making their coarse fabric.

### 5.8 Counterpart

CTA Dr. Roy Nield is counter part of expert. In the beginning of mission CTA was at Hoch. minh city and from there he proceeded on leave. Expert wished to see him and to discuss technical matters but due to his pre engagement no discussion could take place.

The NPD. Dr. Nguen Thi Bau, Director of TRI was available there to guide about the programme and to discuss. She acted as counter-part during mission in the absence of Dr. Roy Nield

### 5.9 Communications

Discussions were held with NPD in English through an interpreter. Discussions took place several times with the NPD, head of spinning dept . and research and development staffs of the institute. The main point of discussions were -

1. Research and development programme carried by TRI
2. Performance of equipment developed by TRI
3. Setting up a service centre with the help of AI equipment
4. Future programme of TRI with regard to development and manufacturing a modified machine.
5. Government policy about Appropriate Spinning technology.

## 5.10 Seminar Discussions

The discussions on Indian Textile Industry were held on 16/8/90 in a seminar in which all TAI staff members and one representative of MOEI participated.

General information about Indian Textile Industry was given to them. Indian governments policy about textile industry was explained to them. They were appraised of the type of fibres used in Indian textile, different varieties of cotton grown, consumption of various fibres and total outputs of textile industry. The growth of small scale textile industry in India and their employment potential were highlighted during the discussions. The Appropriate spinning Technology developed by A.T.D.A. Gandhi Bhawan, Lucknow was discussed in length.

In brief, Appropriate spinning Technology developed by A.T.D.A. consists of the following two stages.

1. Processing of cotton upto roving stage
2. Development of 12 / 24 spindle charkha

After studying many researches being carried out in India by reputed private and Government organizations in spinning technology working condition of textile industry and demand of processed material from decentralised spinning wheel operators. ATDA drew conclusion that small hand operated cotton processing machine will not suit in India because their productivity is lower as compared to the demands of processed cotton from users and manpower input is high, therefore it is uneconomical. New machines used in textile mills are highly expensive which can not be afforded by poor artisans . It was also difficult to maintain these machines at village level by unskilled labour. ATDA with its experience evolved a new way to overcome these difficulties. ATDA designed and set up a cotton processing centre with a capacity of 250 kg roving production per 8 hour per day by using the textile mills' discarded machines after making some modifications and changes in them to meet the operators' requirements.

The centre established by ATDA in 1980 is running smoothly and is economically viable. The design of the centre became so popular that within 2 years about 40 such centres were set up in India to feed charkhas with improved quality of roving. By using roving of these plants, charkha operators produce yarn of better quality & the production of charkha has also increased.

In the second stage, ATDA developed 12 spindle treadle operated and 24 spindle power operated charkhas. both the charkhas are capable of producing Ne 10-40 yarn. Quality of the yarn manufactured on charkha is so good that it is consumed by handloom weavers to their entire satisfaction. The maintenance of charkha is so simple that it is operated in the remote area

satisfactorily in the hands of unskilled operator. The charkhas are in operation for the last 10 years in rural areas and providing livelihood to a large no. of operator family. The charkhas can be run by men,women or grown up children.

12 spindle charkha produces 1.25 kg yarn of 20 Ne in 8 hours working and give earning of 1 - 1.3 US dollar per day to the operator.

24 spindle charkha is run by 1kw electric motor and makes 3-3.5 kg yarn of 20 Ne in 8 hour working . 24 spindle charkha operator earns 1.5 - 2 US dollar per day in 8 hours working after meeting out his all expenses.

## 5.11 Model of Project proposal with its cost ratio with AT equipment

A project proposal for setting up a cotton processing centre with the machines developed by TRI has been prepared .The cost of the machine and the building has been taken in the proposal on the basis of the information furnished by the TRI officials, Mr. Dev, head of the spinning department and other research and development staff.

On the basis of the survey conducted by TRI of cotton growing area, it is understood that in each hill province about 400 ha land is under cotton cultivation. Cotton yield per ha is approximately 200 kg seed cotton. To run a centre economically viable and to give more efficient services to the users, it is suggested that two centres in each province may be established . A proposal for one centre has been worked out as below :

| | |
|---|---|
| Total of seed cotton in a province per year (kg) | 80.000 |
| Cotton for one centre (kg) | 40.000 |
| Production of ginning machine per 8 hours (kg) | 80 |
| Working day per year | 150 |
| ( Because farmers attend spinning and weaving only when they are free from their farm work ) | |
| production of ginning machine per year ( on the basis of 2 shifts running per day) (kg) | 24.000 |
| No of ginning machines required for one centre say machine | 1.5<br>2 |
| Lint cotton received after ginning (34.8% lint cotton recovery) (kg) | 27840 |
| Production of the opening machine per year (kg) | 24.000 |
| No of opening machines required for one centre say machine | 1.16<br>1 |
| Cotton received after opening ( less 3% waste extracted in opening process) (kg) | 27005 |

It is proposed that 50% of opened cotton will be consumed by farmers on their traditional equipment for making cotton blankets etc. Balance 50% cotton will be used for spinning a fine varn. Therefore, 50 % cotton will be processed up to the stage of sliver at the cotton processing centre.

| | |
|---|---|
| Cotton for carding (kg) | 13502 |
| Production of carding machine per 8 hours (kg) | 20 |
| ( After making modification in carding machine) | |
| Production per year (kg) | 6000 |
| ( On the basis of 2 shifts per day running) | |
| No of the carding machine required | 2.25 |
| say machine | 3 |
| Cotton forwarded to drawing machine (kg) | 12962 |
| ( After deducting 4% carding waste) | |
| No of draw frame required | 2 |
| ( only after making the modification and using breaker and finisher D/F separately) | |
| Drawn sliver available for roving machine (kg) | 12833 |
| ( after deducting 1% D/F waste) | |
| Four spindle roving machine will feed 6 charkhas. | |
| production of roving machine per 8 hours (kg) | 6 |
| Production per year (kg) | 900 |
| No of roving machineS required | 14.25 |
| say machine | 16 |
| Production per charkha per day ( 14Nm) (kg) | 1 |
| Production per charkha per year ( kg) | 150 |
| No of charkha required for the centre | 84./ |
| say machine | 85 |
| If average count of yarn is24 Nm, the spinning wheels will be required (Nos) | 150 |

Summary of machines required for a centre

| | |
|---|---|
| Ginning machine | 2 |
| opening machine | 1 |
| carding machine | 3 |
| drawing machine | 2 |
| roving machine | 16 |
| Charkha | 150 |

Roving machine and charkha will be operated in spinner's house. They will be owned by the spinners by making payment through the bank loan obtained at subsidized rate of interest under Government's policy regarding the promotion of cotton growing in the hill area. Therefore the cost of these machines is not included in the economics of the centre.

**Cost inputs for setting up a cotton processing centre**

( Value in Vietnamese millions dongs)

| | | | |
|---|---|---|---|
| a. | Land | 1/2 acare | 1.5 |
| b. | Building | | |

| | | | |
|---|---|---|---|
| Workshed 60 square meters @ 50.000 dongs per square meter) | | | 4.0 |
| office | 8 | square meter | 0.5 |
| Cotton godown | 30 | -do- | 1.8 |
| Sliver godown | 30 | -do- | 1.8 |
| Store | 8 | -do- | 0.4 |
| Residence | 15 | -do- | 0.75 |
| Training shed | 20 | -do- | 1.00 |
| | | | 10.05 |
| | | say | 11.00 |

c.**Plant and machinery**

| | | |
|---|---|---|
| Ginning machine | (2) | 2.4 |
| Opening | (1) | 1.5 |
| Carding | (3) | 18.0 |
| Drawing | (2) | 4.0 |
| Accessories | | 2.0 |
| Training equipment | | 2.0 |
| Electrical fitting | | 2.0 |
| | | 33.4 |
| | say | 34.0 |

d.**Other expenses**

| | |
|---|---|
| Transportation of machine | 2.0 |
| Machine foundation and installation | 3.0 |
| Travel expenses | 2.5 |
| Office furniture and fixture | 2.5 |
| Stationery and postage | 1.0 |
| Miscellaneous expenses | 3.0 |
| | 14.0 |
| Total fixed capital | 59.00 |

e. **Working capital**

| Salary and wages | | | Dongs per month |
|---|---|---|---|
| Manager | | | 100.000 |
| Technician | | | 80.000 |
| Security guard (2) | | | 120.000 |
| Production ancillary | | | |
| Carding | 6*2 shifts | 12 operator | |
| Drawing | 2*2 " | 4 " | |
| Ginning | 2*2 " | 4 " | |
| Opening | 1*2 " | 2 " | |
| Supervisor | 1*2 " | 2 " | |
| Packers | 2*1 " | 2 " | |
| | | 26 | 1.500.000 |
| | | say | 2.000.000 |

All workers will be employed temporarily as the centre will function only 150 days in a year during the period when farmers are free from their agriculture work.

Total expenses per year (only for running days)

| | millions dongs |
|---|---|
| Salary and wages | 10. |
| Maintenance | 4.0 |
| Electricity | 2.8 |
| Misc. | 2.0 |
| | 8.8 |
| Working capital on the basis of 5 months supply | 18.6 |
| -do- 1 month supply | 3.76 |

In the above calculation of working capital, no raw material cost has been included because centre will attend to job work only i.e. farmers will bring their seed cotton and will get it converted into sliver against payment of processing charges

| | | |
|---|---|---|
| Hence, fixed capital | 59.00 | millions dongs |
| working capital | 3.76 | -do- |
| Total cost | 62.76 | -do- |

**Cost benefits of the centre**

| | millions dong |
|---|---|
| **Expenses** (yearly) | |
| Salary, wages and other expenses | 18.0 |
| Intrest @ 5% on fixed capital | 2.95 |
| Intrest @ 5% on working capital | 0.18 |
| **Depreciation** | |
| Building @ 5% | 0.08 |
| Machinery @ 10% | 1.7 |
| Total expenses | 23.71 |
| say | 24.00 |
| **Income** | |
| Ginning and opening of cotton (40000kg) @ 400 dongs for kg | 16.00 |
| Cotton processing from carding to drawing 12.705 kg * @ 750 dong per kg | 9.53 |
| total earning | 25.53 |
| say | 26.00 |
| Net profit per year | 2.00 |

The processing charges have been taken into accounts on the basis of prevailing rates in the market. The rates are acceptable to farmers. It reduces a lot of hardships on the villagers and saves their time to work on charkha or in the fields. It is expected that more and more farmers of the area will come forward to take advantage of the centre. Thus the programme will improve the earning of the cottage artisans and will encourage farmers to grow more cotton in their fields.

**Economics of cottage spinner (monthly basis)**

| | |
|---|---|
| Machine in used | 6 spindle charkha |
| Yarn count (Nm) | 14 |
| | Dong |
| Cost of charkha | 1,100.000 |
| Yarn produced on one charkha per day (kg) | 1.2 |
| Working day per month | 25 |
| Sliver consumed by an operator per month 1.2 kg * 1.01 (including spg waste)* 25 working days * @ 5800dongs per kg | 175.740 |
| Interest @ 5% | 4,5[illegible]0 |
| Depreciation @ 10% | 9.170 |
| Roving manufacturing charges to be paid to roving operator | 6.000 |
| | 196.500 |
| Sale of varn @ 7.500 dong per kg | 225.000 |
| Net earning of a charkha operator per month | 28.500 |

If charkha is operated more than 8 hours in a day, the earning of the spinners will increase proportionately.

**Economics of 12 spindle charkha**

| | |
|---|---|
| Yarn count Nm | 14 |
| Cost of machine | 1500000 dongs |
| No of working days per month | 25 |
| Average production per day kg | 2.2 |

**Monthly expenses**

| | |
|---|---|
| Raw material 2.2 kg * 25 * 1.01 (spg waste) @ 5800 d per kg | 332.140 |
| Maintenance and transportation | 3.500 |
| Interest @ 5% | 6.250 |
| Depreciation @ 10% | 12.500 |
| | 353.440 |

Monthly income

| | | |
|---|---|---|
| Sale of yarn | 55 kg @ 7500 d per kg | 412.500 |
| Net earning per month | | 59.060 |
| sav | | 60.000 |

This saving will boost up moral of the artisans. They will start running charkha for more than 8 hrs. in their houses and will increase their earnings.

**Social benefits of the project**

A farmer, who does not have any means of living except a small piece of land, will start earning about 30.000 - 40.000 dongs per month. This earning will be very helpful to him in meeting out of his needs.

1. He will afford reasonable clothes for his family
2. He will provide food to his children
3. He will think of sending his children to school
4. He will be able to take care of the sick within family.
5. He will afford maintenance of his house
6. He will have a place in society

Besides the direct benefits to the operator, a chain of people will also be benefitting indirectly such as in manufacturing machines and their spare parts, supplying machines spare parts, manufacturing of yarn and cloth, stitching of cloth, teaching of children and various other works related to the programme.

## 5.12 REQUIREMENT OF INFRASTRUCTURE AND ORGANISATIONAL PATTERN FOR SETTING UP A COTTON PROCESSING CENTRE

A suitable infrastructure is as important for any industrial production as the proper product selection and efficient technology. The infrastructure fulfils in general following needs :

1. Supply of raw material
2. Makerting of goods
3. Provision of finances

The traditional and indigenous technology was having its own infrastructure in rural area but due to the gradual development of mechanised large scale technology, it broke down . The rural entrepreneur, engaged in providing the infrastructure facilities to the traditional technology got better and expanding opportunities in working for large scale technology. The policies of the country were changed gradually so as to draw the capital to

urban areas to meet the growing demand of large scale industry. As a result, large scale industries were set up in urban area. Raw material from the rural met the increasing demand of urban industries resulting the rural artisan's fall at the level of starvation .

At present, so as to say, there is hardly any infrastructural facilities available for rural artisans. The infrastructure capital cost is high . All the material is supplied from urban areas mostly on credit at high rate of interest and the profit charged by the supplier. This has led many artisans of different trade like leather (engaged in tanning, shoe making),blacksmith and carpentry to shift to the urban area in search of a suitable job or to start the production activities under slum conditions in cities. Further due to decline of the condition of the artisans to starvation level, their in-built skill and ability for new innovation both technological and product developmental has been lost . The technology and product became static, resulting in further decline in the economics and in market acceptability of the product. So, in any rural industrial development programme, the following needs will have to be met with by the organisational pattern .

1. Initiation of suitable technology and the expansion of the technological know how and operational advice.
2. Carrying out part of the prodution activities which cannot be scaled down to the cottage and individual artisan level
3. Product development and diversification
4. Training and demonstration programme
5. Research and development

A review of the schemes and programmes being executed for rural industrialisation by Government, semi Government or voluntary organisation bring out that there is lack of comprehensive coverage of all the above infrastructural needs in these programmes. The needs are provided in isolated manner and not as an integrated packages.The Government schemes are mostly for providing financial and marketing facilities and that too on cooperative basis. Recently, Government has come out with a particular programme to help cotton growers in hill area, to encourage them to improve the cotton yield, for which a new variety of cotton seeds on subsidized rate are made available to farmers. Technical know how to grow the cotton are also given to the farmers through the staff of cooperative society working in the fields. The cotton marketing facilities are also given to them. Government has a scheme to provide loan to the villagers on subsidized rate of interest for their agriculture work and to purchase income generating equipment. But the resources are not as useful as they are in urban areas because of poor management and lack of sufficient expert advices to a rural artisan where as it is available in urban or semi urban areas. The

technological research, product development and readily available technical advice etc. do not get sufficient acceptance in rural area because of lack of finances. The impact of programme therefore becomes very limited and so the condition of rural artisans has not improved to any marked degree.

To make any developed technology successful and fruitful to rurals, it is necessary to provide comprehensive coverage of all infrastructural needs on a suitable organisational pattern. Example of such success are seen in India, where Gandhi Ashrams (Institutions producing hand spun and woven fabric in rural areas) have been providing an organisational pattern with comprehensive coverage of needs. These institutions are having a low cost technology and producing only 1 % of total cloth production in very widely dispersed rural cottages. They have become successful to revive the old technology and to provide employment in rural areas by means of giving some improved tools and technology for manufacturing fabrics, which give them suitable earning for their livelihood.

Organisational set up may be devided into two parts :

1. Service centre
2. Cottage units

The infrastructual needs are organised under the service centre and the production work is carried out in cottages.

IRI should adopt the same organisational pattern for the decentralised appropriate cottage spinning technology through cooperative society or a private organization who seems to be dedicated for rural development work.

The service centre will have two sections, one for looking after supply of raw material from a cotton processing unit and the other for looking after marketing and finances through a cooperative organisation of the artisans. Centre will also be equipped with the training equipment so that willing candidates are imparted training about working and maintenance of equipment During training period, trainees will also be acquainted with the economics of a spinning wheel. They will be appraised about getting the loan from banks so that when they go out after training, they can avail loaning facilities of Government and buy spinning wheel and start spinning in their house and start earning their livelihood.

This organisational pattern will prove its effectiveness for initiating and establishing a new technology but some few issues will arise when the extension stage is considered. For extension propose of technology, a large number of cotton service centers will have to be put up at various locations in the country. For such a programme following issues are likely to crop up :-

1. Who is going to own and operate them ?
2. From where financial resources would come ?
3. Willit require some Government or statutory body or non Government or voluntary institutions like (Gandhi Ashram in India) to carry out the extension work and later on to look after operations by organising a large no. of service centres ?
4. Could the extension be taken up by rural artisans of the unit under cooperative movement or small private entrepreneurs will take it over at the extension stage ?

All possibilities appear to be workable but when each has been examined deeply, it appears that each has some lacunae. Government and statutory bodies, because of their organisational structure, gradually overlook the interest of artisans. Voluntary organisation needs a team of dedicated workers with strong ideological background which may not be available in many cases.

The cooperative movement, as at present organised , has failed to prove to be an effective media for improving the condition of artisans. The cooperative societies are formed in such a manner so as to make a meaningful increase in the income of the artisans. Lack of resources many times create problem. Even the share money is also paid by the organiser by loaning to them due to their poor condition and to raise enough share money so as to get sufficient Government loan, the membership is increased to such an extent that only a very small number of persons may be made members and they too do not remain interested in the society. Small cooperative society cannot afford the right type of managerial skill needs for its efficient organisation. The artisan members being themselves weak and dependent , are not in a position to exercise any control on the management.

Mostly outsiders take control and work in their own interest. Lastly, the loan obtained by society has to be paid back at high rate of interest within the short repayment time. No thought about repayment capacity of the society from its own earning is given at the time of fixing repayment period. The management of society tries to squeeze the artisan by increasing the service charges and artisan finds himself in a worse position from the net income point of view than he would have otherwise

Once a production activity is well established and its economic viability proved under the actual field condition then private entrepreneurship gets interested in it and takes it up. But it brings an element of exploitation. The entrepreneur works in such a way that he keeps most of the surplus with himself.

The reason for exploitation in both cases i.e. with cooperative society as well as with private entrepreneur appears to be due to the big difference of the financial condition between the artisans and managing agencies and consequently it makes the artisans dependent on the agencies for their daily needs.

An entrepreneur with efficient financial backing can continue his activity for sufficient time and still have resources for his daily needs . The artisans are not in such a position and even one week 's closure brings them at starvation level. This weakness is exploited by private entrepreneurs as well as by cooperative management. Hence it is very necessary to think about this aspect deeply before setting up the cotton processing centre. so that centre may prove fruitful for the artisans .A survey to find out ways for setting up a suitable centre may be carried out so that centre may be set up in a manner which fulfills its aim to raise income of the artisans to a level where beside providing decent wages to meet daily living expenses. some reserves might be built up with artisans to back them while they are facing the private entrepreneur or to exercise and share some control on cooperative organisation.

The analysis made in this regard. indicates that by working on a 6 spindle spinning frame . the artisan will be able to earn just a subsistence level of wage rate say 1000 dong to 1500 dong per day or may be 1500 dong to 2000 dong per day if he operates spg wheel for more than 8 hours ( after deducting maintenance cost and installment for the share capital). By operating the 12 spindle spinning frame earning will be 2500 dong per day and on working 24 or 36 spindle power operated spg frame the earning rate will be about 10,000 dong per day after paying out the installment of loan for spinning frame as well as other misc. expenses and electricity expenses. The earnings will give the artisans enough backing to become financially strong and be able to fight against the bad management and their exploitation by a cooperative society or the private entrepreneur. If this could be achieved. it will definitely create conditions where the extension can be carried out both by a cooperative organisation and private entrepreneur. On account of financial limitations and also keeping in view the initial teething trouble in the beginning 6 spindle frame is proposed to be operated in the cottages but gradually with the success in spinning there may be introduced 12. 24 & 36 spindle frames in cottages. This will give very high push to the extension programme of spinning frame and encourage the farmers to grow more cotton on their land as it will give them good return like other cash crops.

On the basis of survey report and from the figures available. it appears that present level of cotton production and its consumption by farmers in mountain areas is very low.

hence it will not be a wise step to have centre with large scale machines. The capital investment for setting up the centre with large heavy machines will be too high to be afforded by a cooperative society or an entrepreneur. With skill available in villages, it will also be difficult to maintain these machines and the centre will run uneconomically. Hence it is advised that centre may be started with appropriate spinning technology equipment developed by IRI after making modifications and changes as suggested earlier. IRI should also continue its development work to remain ready to meet the rising demand of sliver from users. They should improve machines for better quality of sliver and higher production. Beside this, if extension work gets momentum on a large scale, working days of the centre will be increased to meet the demand. To save transport and to give efficient and prompt service in the villages more centres, on the basis of the demand/requirement of the farmers, will be set up. The centre will cover small area where each beneficiary would approach it without any trouble and get its success himself easily.

Training department will also be active in its duties. Every year about 50 willing candidates will be selected and trained at the centre.

Their loaning formalities will also be followed up with Government and bank authorities. It is hoped that the centre will run smoothly and will serve the poor farmers in a big way.

6. Constraints in the development of AT equipment are as follows:

a. Shortage of spare parts

There are very few textile ancillaries in Vietnam, who are manufacturing only some casted parts like gears, pulleys and brackets etc. No manufacturer is making machines or their critical parts like drafting material, card clothing etc. All these items are imported from other countries. Textile mills being big consumers, they import spare parts in bulk which involves heavy expenditure. TRI is a research and development oriented organisation and does not maintain stock of spares and machines whenever they need spares or machines they approach the mills, from where they can procure used part discarded by the mills after its long use in the mills.

b. Insufficient facility of workshop

Only a few big Govt. workshops are engaged in manufacturing of textile spare parts in the country. TRI workshop is small and always overburdened with many research and development work, few parts can be manufactured there. All the big workshops existing in the country do not take interest in manufacturing and supplying small machinery like AT equipment. Even if a manufacturer is ready for undertaking the manufacturing, his

rates are so high that TRI can not afford it. The private workshops are always heavily booked and engaged in mass production and they do not take small orders as manufacturing of small scale machines is not profitable to them.

c. Insufficient training

(i) Training in Machine design :-

The persons working on designing AI equipment do not have enough experience in designing spinning machines. They need expert advice and guidance to carry out their work .

(ii) Training of engaged staff in manufacturing:-

TRI staff engaged in manufacturing the small scale cotton processing and spinning machine do not have enough experience of manufacturing a spinning machine. they also need the training, expert advice for accomplishing their work satisfactory.

Both the staff teams may be trained in a textile machinery manufacturer's workshop.

d. Insufficient advice from textile mills expert

Textile mills are busy with their mass production. They have little concern with the development of small machinery. They do not have spare time to devote in the development of small machines and also do not advise TRI to remove the working difficulties in the development of AI equipment .

e. Non availability of field trial centre near Hanoi

Machines have been designed and manufactured according to the need of hill area farmers who grow cotton and process it in their houses for making their own clothes . Such areas are quite far from Hanoi. Hence it is difficult and uneconomical for TRI to take these machines for the field trial and bring them back to Hanoi for modification on the basis of the field trial.

7. Findings :

On the basis of the discussions, meetings, visits, observations and various other studies undertaken, the conclusions are as follows :

a. Vietnamese Govt. is very keen to increase the cotton production in the country. They have a plan to promote the growth of long and medium staple cotton in southern province and short & medium staple cotton in hill area of northern province.
b. Northern hills farmers grow cotton for their own use on a small piece of land. These people have their old age

tradition of spinning and weaving for making heavy cloths like cotton blankets, pillows and bed covers etc. Farmers use their traditional equipment which are primitive and do not produce a good quality product. The production of the equipment is also very low.

c. Hill area people are eager to adopt any low cost technology which may give them some relief from their tiring and boring job of cotton processing and increase their production. They are so poor that they are unable to adopt any high cost technology in absence of finances.

d. To meet the demand of the artisans TRI has developed a set of the machine which includes ginning, opening, carding, drawing and spinning frames.

(i) Machines developed by TRI are simple and of low cost.

(ii) In most of the machines old parts obtained from textile mills have been used . to reduce the manufacturing cost of machine

(iii) Due to the use of old parts and insufficient services of an Engineering workshop available to TRI. the workmanship of machine is poor and their parts do not maintain accuracy as in case of standard textile machines .

(iv) Machine needs changes and modifications ( as suggested earlier) before they are standardized for continuous commercial use in villages .

(v) Production of machines and the quality of the yarn produced on them are better as compared to traditional equipment.

(vi) Once machines are incorporated with the changes and modifications as suggested earlier they will be proved very useful to the rural artisans, as their production will increase ten times more than their present production of traditional equipment.

(vii) As regards the technical specifications of machines. they are suitable for processing short and medium staple cotton.

(viii) In comparison to large scale textile mill machines, TRI machines are lacking in production. quality and earning. But since the large scale machines need heavy initial investment the village artisans can not afford.

(ix) TRI is planning to install these machine in SUNLA province for taking their field trial. These machines will be put up in continuous operations and their close study will be conducted to assess their performances and to know the difficulties in their running. Machines will be modified accordingly and will be extended to the hill area of the country later.

It appears that the work carried out by TRI will prove fruitful to the poor rural artisans. It will increase their income It will create new source to the Govt. for providing employment to the growing population of the villages. TRI has also a plan in future to make modification/changes and to design new machine on the basis of the recommendations from experts and the information collected from field trial. to make machine more fruitful to the rural folk. TRI is in search of the funds to undertake modifications and to manufacture few more machines to set up a model cotton processing centre.

## 8.Recommendations

8.1 Research and development work -
It is classified in two parts as follows :

(A) **Items require immediate attention (action to be taken - by TRI) -**

(1) To evaluate the performance of machines in the field in terms of technical, economical and organisational aspects, and to make the close and scientific study of the machine under field trial.
(2) Modifications and changes as suggested earlier, and some in addition on the basis of the field trial should be incorporated to improve the working of the machine and to make its services fool - proof for commercial use in a cotton processing centre .
(3) Manually operated 4-spindle roving machine should be developed to ease the working of the drawingframe and to promote its production capacity.

(B) Items which can be developed at the later stage (action to be taken by TRI)-

(1) Development of machine accessories - like card machines stripping, burnishing & grinding rolls etc
(2) Development of small scale doubling machine to make artisans independent for making double yarn in their houses for the use of manufacturing heavy fabric.
(3) Development of 12/24 spindle charkhas - The field trial of the charkha should be arranged at different places and statistical datas of the performances of the charkhas should be collected.
(4) The condition of existing weaving equipment like loom , warping machine and pirn winder is also very poor, these machine should be replaced by developing an AT weaving equipment.
(5) Some regular consuming items like spindles, rings, bobbins etc should be developed in indigenous market

8.2 Training to TRI staff :
( Action to be taken by TRI/ Govt.)

i) Few staff members engaged in research and development programme should be sent for training of designing a new spinning machine as the persons working in programme have not enough experience of designing a spinning machine.

ii) Few staff members should also be imparted training in manufacturing of a machine to make them able to know about the various machines used in manufacturing of spinning machines and their parts.

b) Some managerial person should also visit , study about setting up a cotton processing centre and to run it smoothly and efficiently.

8.3 Infra structure

Items which require immediate action ( Action to be taken by TRI )

a) A model cotton processing centre with the following machines should be set up in hill area.

| Name of the machines | No. of the machine |
|---|---|
| Ginning machine | 2 |
| Opening machine | 1 |
| Carding machine | 3 |
| Drawing machine | 2 |
| Roving machine | 3 |
| Spinning wheel ( charkha ) | 12 |

The centre will prove its usefulness and satisfy the interested persons about its utility.

A well equipped workshop should be identified or developed who can undertake manufacturing of Al spinning machines to be supplied to villages. The manufacturing of these machine need to be undertaken under direct control of T.R.I. in such a manner that the machine manufacture charges the fair prices of machines and at the same time the workshop is not uneconomical to that it is self sustained.

Besides the manufacturing of these machines, at least 10 modified charkhas should be manufactured so that their trial at different places is undertaken for observing their performance in all respects in order to analyse their utility to the operators.

b)Facilities which should be provided at a later stage:-

i) Government should create facility of disposing the yarn and fabric through its cooperative society, when it is produced more than villagers requirement
ii) Few training centres should be established in the villages for imparting training to the willing candidates.
iii) Voluntary organisations should be promoted through some dedicated persons who are willing to work in the villages for the benefit of rural poor.

8.4 Financial :

a) Funds for modification/ changes for improving the working of the machines and their productions should be made available immediately.

b) Funds for manufacturing and supplying equipment for setting up a model cotton processing centre should be arranged for T.R.I.

c) Funds for manufacturing few more charkhas are also to be arranged.

d) Some reserve funds may be generated for providing subsidy on the equipment.

e) To give initial push to the programme some funds for stipend to rural artisans during training should also be arranged to compensate them for the period of training.