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TECHNOLOGIES FROM DEVELOPING COUNTRIES
(A Preliminary Compilation)
Background Paper

id. 78-6849

TECHNOLOGIES FROM DEVELOPING COUNTRIES

Volume II

A Preliminary Compilation

prepared by the UNIDO secretariat

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TECHNOLOGIES FROM DEVELOPING COUNTRIES

(A Preliminary Compilation)

Contents

PREFACE

I. Introduction

1. The collection and dissemination of information on alternative technologies are essential prerequisites for the selection of alternative techniques and processes for production operations. This assumes particular significance in the context of technological absorption, adaptation and innovation in the developing countries and the use of techniques and processes more appropriate to socio-economic objectives and circumstances in these countries.

2. Compiling information on alternative technologies in industrial sectors is undoubtedly a complex task. The great number of industrial activities, enterprises and institutions make it difficult to compile a comprehensive listing of alternative techniques, particularly of those available in developing countries. At the same time, for want of such a listing, entrepreneurs in developing countries have had to acquire technologies from industrialized countries, often perpetuating technological dependence even in sectors where more appropriate techniques would have been available locally or from another developing country.

3. An attempt has been made in this document to compile information on technologies which have been developed in certain sectors in developing countries and which can be acquired from sources in these countries. The sectors selected for this compilation are the industrial branches chosen for detailed discussion at the International Forum on Appropriate Industrial Technology in India, 20-30 November 1978.*

4. It must be emphasized that the inventory of technologies described in this document is by no means exhaustive even with regard to alternative techniques and processes available in these sectors in developing countries. There is little doubt that, apart from technologies developed in the R and D institutes, significant technological development has also taken place in a number of enterprises in these sectors. It has not been practicable for UNIDO to collect and compile information relating to technological developments in such enterprises. The information contained in the document should therefore be treated as only illustrative of the technological trends and developments in selected R and D institutes.

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* with the exception of sugar for which no completed questionnaires were received.

II. Compilation of information on technologies in developing countries

5. In preparing this compilation, UNIDO undertook a survey of selected R and D institutes in developing countries through a questionnaire. The information presented in the following sections is mainly based on the completed questionnaires or on additional material which arrived at UNIDO headquarters before 31 August 1978. In most cases all information received on a given technology or institute has been reproduced without selection. In a few cases a selection had to be made because of the large amount of information received not always pertinent to the subject. Some technologies have been included in the documentation on the basis of other sources, especially in two sectors, where no or not enough information on technologies had been received on the basis of the UNIDO survey.

6. The listing is divided into two sections: section 1 describes the technologies, and section 2 the R and D institutes where the products and processes were developed.

7. In section 1, each technology is presented on a separate page providing information on the following items:

(a) Title of the product/process
(b) Short description and advantages of the product/process
(c) Technical and economic details (with diagrams/photos, if available)
(d) Status of commercialization
(e) Contact address for further information

Only those products or processes have been included that are available for introduction on a commercial scale. The heading "status of commercialization" indicates how to obtain the technology and to what extent it is available. Approximate monetary values are given in the currency of the country.

8. In the listing no attempt has been made to evaluate the appropriateness of the techniques and processes to conditions in developing countries. It is considered that the suitability or otherwise of any of the techniques and processes listed should be considered in the context of specific factor circumstances and conditions of particular countries.

9. In section 2, the institutes are given which developed the technologies described in section 1, provided that the information was received by UNIDO before 31 August 1978. Finally some selected information has been provided on publications on technologies and R and D institutes. These represent the most recent and comprehensive guides to more detailed information on R and D institutes and technologies for use in developing countries.

III. Further action

10. It is intended to update this listing and it is hoped that the developing countries will continue to provide information to UNIDO. Information received will be disseminated through the "Interlink" column in the UNIDO Newsletter as well as through UNIDO publications.

11. It is hoped that the consideration of the material contained in this document by the International Forum on Appropriate Industrial Technology will stress the need for such collection and compilation of information regarding alternative technologies utilized and developed in various developing countries and comment on the format for this purpose. It is hoped that this document will focus attention on the need for similar compilations at a national level in each country which could thereafter be compiled on a regional or international basis by UNIDO.

08466

1 TECHNOLOGIES

1.1 Chemicals and metalworking

THERMOPHOSPHATE PRODUCTION IN MACE ROASTING FURNACE

Description: Low cost thermophosphate production for perennial plantation.

Technical and Economic Details: Apatite concentrate is submitted to a heat treatment in order to be transformed into a partial soluble product when exposed to humic acids. The process is essentially a partial smelting of Apatite concentrate mixed with special slag-forming materials, in the form of pellets using charcoal as fuel. The final product keeps the same amount of P_2O_5 and 50% of this P_2O_5 become soluble.

Status of Commercialization: A plant for 100.000 tons is under construction in the State of Goiás, Brazil, and is expected to be in operation in December 1979. The process is covered by a Brazilian patent.

Contact Address: Eng. Silvio Benedicto Alvarinho
Instituto de Pesquisas Tecnológicas do Estado de São Paulo S/A - IPT
P.O. Box 7141
01000 São Paulo - SP
BRAZIL

08467

INTEGRAL USE OF CELLULOSIC RESIDUES BY ACID HYDROLYSIS PROCESS

Description: Production technology of ethanol, lignin and other by-products from cellulose contained in renewable natural resources such as wood, agricultural wastes etc.

Technical and Economic Details: The process is a modified version of the Scholler process. Apart from contributing to the National Alcohol Programme, the utilization of this technology will have a major impact in the Brazilian steel making industry, since Brazilian low quality mineral coal renders the country dependant on heavy imports to satisfy industrial needs. Furthermore, the adoption of this technology will also generate income and employment benefits for rural and semi-urban communities throughout the country.

Status of Commercialization: No patents applied for so far. An industrial plant joint development and construction contract between a major steel making company in Brazil and this institute is currently under negotiation.

Contact Address: Fernando Magalhães Machado
Instituto Nacional de Tecnologia (INT)
Avenida Venequela No. 82 - 7° Andar
Rio de Janeiro - 20.081
BRAZIL

08468

ALUMINA FROM COAL ASH

Description: Process for extraction of high purity alumina from the ash of coal briquettes.

Technical and Economic Details: The process developed is called the "Lime-Soda-Coal Sinter (LSC) Process". The composition of the ash of a typical coal briquette (used in Seoul) is 45% SiO_2, 30% Al_2O_3, and 10% C. The LSC Process is a new way of utilizing all these major components. The carbon content originating from incomplete combustion is used as part of the sintering fuel. About 80% of the alumina content is converted to metallurgical alumina (99% Al_2O_3), and the rest to a lime silicate residue (85% Ca_2SiO_4), an excellent feed material for Portland cement plants.

The main chemical reactions occurring in the rotary kiln are the calcination of added limestone, the gasification of coal, and the lime-silica bonding by way of sintering at about 1 200°C. Part of the heat needed for the sintering comes from the combustion of coal in the feed, and the rest from that of oil or gas at the burner. The fuel ratio of coal/oil here is the most critical factor that determines the economic feasibility of the whole process.

Substitution of fuel oil by coal is possible because of the rapid combustion of the gasified products, and because of the high alumina content in the ash, which becomes part of the raw material for the process. The focus of the current rotary kiln test is on finding the upper limit of possible oil-saving that allows reasonable control of the sintering temperature and atmosphere. With 60% of the oil substituted by coal as targeted, the production cost is estimated to be $140 per ton of alumina, which is $20 less than the present import price (c.i.f.)

In the meantime, a process has been developed for extraction of alumina from domestic anorthosites. The LSC

Process is a combination of the rotary kiln operation with this. The potential feeds for the LSC Process include not only coal briquette ash and anorthosite, but also coal ash from power plants, coal shale and various kinds of clays. These materials have similar constitutions and all lead to satisfactory results in the laboratory. Especially the fact that low-grade anthracites can be used as additional fuel indicates the emergence of potentially rich resources for heat and alumina. When commercialized, the greatest advantage of the process will be in the diversity of raw materials it can use.

Status of Commercialization: Ready for commercialization. A patent has been filed.

Contact Address: The Korea Institute of Science and Technology
P.O. Box 131
Dongdaemoon
Seoul
KOREA

08469

COPPER-PLATED STEEL WIRE

Description: Process for the production of copper-plated steel wire for utilization as lead wire, especially as telephone cable, messenger wire and transmission cable.

Technical and Economic Details: Copper-plated steel wire is characterized by a combination of the electrical conductivity of copper and the mechanical strength of steel. In this project, suitable steel wire was continuously electroplated and then the wire was drawn and heat-treated. The copper-plated steel wire produced by the pilot plant has all the required characteristics to be used as lead wire and also as various forms of cable. The production will have an import substitution effect of over three million US dollars on the Korean economy.

Status of Commercialization: The process is applied in commercial production.

Contact Address: The Korea Institute of Science and Technology
P.O. Box 131
Dongdaemoon
Seoul
KOREA

08470

MANGROVE EXTRACT

Description: Manufacture of mangrove extract for various uses.

Technical and Economic Details: The process yields a modified mangrove extract which can be utilized for the manufacture of different types of leather particularly heavy, industrial and chrome retan leather in place of imported wattle and quebracho extract. The product can also be used for the preservation of fishing nets, oil drilling operation, for the prevention of corrosion in boiler, in textile industries, etc.

The raw material required annually are 6000 tons of bark. The fixed capital necessary for a plant of 1500 tons/year capacity would amount to 2 million Rs.

Status of Commercialization: The process is covered by the Indian Patent No. 99768

Contact Address: Dr. T.S. Ranganathan
Central Leather Research Institute
Sardar Patel Road
Adyar, Madras - 600020
INDIA

08471

BLEND EXTRACT FROM MYROBALAN AND BABUL/KONNAN

Description: Manufacture of blend extract from myroballan and babul/konnam (rella) as a partial substitute for wattle extract in the manufacture of a variety of leathers.

Technical and Economic Details: The process consists of judicious blending of myrobalans, babul and konnam, and of water extraction, concentration and finishing. For one ton of finished extract the raw materials required are:

Myrobalan nuts - 1½ tons

Babul bark/konnam bark - 3-3½ tons.

The following equipment is necessary: wooden leaching vats, disintegrator, toothed roller crusher, triple effect evaporator, spray drier, boiler, and miscellaneous components. The total capital investment for a plant of 3 tons/day capacity including working capital amounts to about 1.1 million Rs.

Status of Commercialization: Ready for commercialization.

Contact Address: Dr. T.S. Ranganathan
Central Leather Research Institute
Sardar Patel Road
Adyar, Madras - 600020
INDIA

08472

FERTILIZER FROM WASTE HAIR

Description: Simple process for making an indigenous fertilizer from waste tannery hair and waste human hair.

Technical and Economic Details: In the absence of enough synthetic fertilizers, products of this nature which are rich in nitrogen and are comparable to other farm yard manures will always have a demand particularly because they will be cheaper than the synthetic fertilizers and are not easily leachable.

Status of Commercialization: Pilot plant trials are being completed.

Contact Address: Dr. T.S. Ranganathan
Central Leather Research Institute
Sardar Patel Road,
Adyar, Madras - 600020
INDIA

08473

ETHANOL PRODUCTION FROM MANIOC ROOTS

Description: Technology to produce ethanol (ethylalcohol) from manioc (cassova) roots to substitute oil derivate fuels by fuels derived from renewable natural resources.

Technical and Economic Details: The steps of the process are: raw material preliminary treatment, cooking, saccharification, fermentation, distillation. Although not generally considered a very sophisticated process, it presents some special features like non-newtonian fluids, control of enzyme activities, toxic substances and so forth. The appropriate adoption of this technology - particularly in the form of smaller units (10,000 litres/day) - would certainly help to meet existing basic socio-economic needs, through the generation of income and employment benefits for rural communities. This advantage is further enhanced by the nature of by-products supplied by the process: carbon dioxide (dry-ice, freezing of perishable rural products); stillage (cattle feedstuff, fertilizers) and so forth.

The average agricultural capital investment needs are estimated at around US$ 632.00 per hectare (1US$=19 Cr.). Industrial requirements depend on plant production capacity. For a plant with a capacity of 10,000 litres ethanol/day a capital investment of US$ 900,000. would be required. If average operating costs and current ethanol prices are taken into consideration this would yield a return on investment of 14%.

Status of Commercialization: The process has been used commercially by Petrobrás in a 60,000 l/day unit. Three new plants of 120,000 l/day are now in the detailed engineering stage.

Contact Addres : Fernando Magalhães Machado
Instituto Nacional de Tecnologia (INT)
Avenida Venezuela No. 82-7° Andar
Rio de Janeiro - 20.081
BRAZIL

08474

PROTECTIVE COATING FOR METAL PARTS (PLASTIPEEL)

Description: Plastic protection for metal parts with indigenously available raw materials.

Technical and Economic Details:

The process essentially consists of making a jelly of a special grade of ethyl cellulose. This is a mixture of mineral and vegetable oils with specific antioxidants. The capital necessary for establishing a plant with a capacity of 1 ton/day is approximately Rs. 100,000. The process lends itself for small/medium-scale production.

Status of Commercialisation:

The process has been commercialized in 1960. It has been forwarded to other parties as well.

Contact Address:

M/S. National Research Development Corporation of India
61 - Ring Road
Lajpatnagar - III
New Delhi - 110024
INDIA

08475

IMPROVED PVC PRODUCTION

Description: Improved process to reduce and/or minimize the scale formation in PVC production.

Technical and Economic Details:

The process has been developed by the Shri Ram Institute for Industrial Research. It involves the addition of special ingredients in the recipe which reduce the scale formation in VC polymerization by 90%. The remaining scales can easily be cleaned by simple means.

Status of Commercialization:

The process is being commercially exploited.

Contact Address:

Shri Ram Chemical Industries
Kanchenjunga Building
Barakhamba Road
New Delhi - 110001
INDIA

08476

PRODUCTION OF PANCREATIN FOR LEATHER MANUFACTURE

Description: Production of pancreatin, a highly potent enzyme bate, which is used for bating different types of hides and skins in the process of leather manufacture. Pancreatin is also capable of replacing the imported product, which is used for the recovery of both silver and cellulose triacetate base from exposed photographic and X-ray films.

Technical and Eoonomic Details:

In the process well-minced animal pancreas is subjected to two suitable sequential treatments for the complete conversion of the inactive enzyme precursors to highly active enzyme proper and then blended with cheap, indigenously available carriers of enzyme and ammonium salts, dried and powdered for the manufacture of the pancreatin product. All the machines and raw materials are available locally. It is easy to maintain the day-to-day production of standard quality bate.

Cost estimate: Rs 60 000 investment for plant and equipment can yield 33% return with the production of 250 kg of bate per day per shift.

Status of Commeroialisation:

Indian Patent 2170/Cal/75

Contact Address:

Mr. S.C. Dhar,
Central Leather Researoh Institute
Madras
INDIA

08477

IMPROVED CATALYST SYSTEMS

Description: Improved process to enhance polymer production with the existing equipment at lower costs.

Technical and Economic Details:

The process is a low temperature polymer with increased rates of polymerization. It does not produce any residual catalyst which may effect the polymer. The process has been developed by the Shri Ram Institute for Industrial Research.

Status of Commercialization:

Some of the catalysts have been in continuous use since 1960.

Contact Address:

M/S. Shri Ram Chemical Industries
61 - Ring Road
Lajpatnagar - III
New Delhi - 110024
INDIA

08478

MANUFACTURE OF ABS PLASTICS

Description: Indigenously developed process techniques for the manufacture of acrylenitrite brutadiene styrene (ABS) plastics.

Technical and Economic Details:

The process has been developed by the Shri Ram Institute for Industrial Research. Different grades of ABS plastics have been developed at international standards. The necessary capital investment for a plant with a capacity of 10 tons/day is approximately Rs. 2 crores, the total investment would be of the order of Rs. 4 crores.

Status of Commercialisation:

A semi-commercial plant has been in operation for three years. A commercial plant started production in May 1978. The process is at present licensed to three parties.

Contact Address:

M/S National Research Development Corporation of India
61 - Ring Road
Lajpatnagar - III
New Delhi - 110024
INDIA

08479

DISSOLUTION OF COPPER FROM COPPER SULPHIDES

Description: Improved process for recovering copper from low grade sulphide ores.

Technical and Economic Details: The technologies used until now did not permit an economical treatment of low grade sulphide ores and the recovery of copper therefrom and produced far more contaminants. The adapted process makes better use of local resources. Capital investment amounts to about 0.7 of that required for the regular flotation smelting process. Also the operation costs are lower.

Status of Commercialization: The process is applied in a pilot plant. An industrial plant will take up production in 1979.

Contact Address: Comité Contratante para Decisión 87
Junta del Acuerdo de Cartagena
P.O. Box 3237
Lima
PERU

CARBOXY METHYL CELLULOSE

Description: Process for the manufacture of Carboxy Methyl Cellulose from locally available raw materials. The product is used in oil exploration.

Technical and Economic Details: The process has been developed by the Shri Ram Institute for Industrial Research and consists of suspending shredded cellulose in alcohol and then adding the requisite amounts of aqueous caustic soda and chloroacetic acid at a temperature of 50-70°C for about 3-5 hours; separating the resulting mass by centrifuging, washing and if necessary, neutralization, and finally drying and disintegration. Special features of the process are the utilization of ethyl alcohol as medium which is plentifully available in the country and the use of pulp from indigenous sources. The process is cheaper compared to the one offered by foreign countries. The approximate investment on a plant of 10 tons/day is Rs. 5 000 000.

Status of Commercialization: The process has been licensed to M/S. Dardesai Brothers in 1970. Presently, licences are given to other parties as well. The process is covered by Indian Patent No. 62751.

Contact Address: M/S. National Research Development Corporation of India
61 - Ring Road
Lajpatnagar - III
New Delhi - 110024
INDIA

08481

ETHYL ETHER

Description: Improved process for the production of Ethyl Ether.

Technical and Economic Details: The conventional sulphuric acid process for manufacture of ethyl ether presented many operational and maintenance problems. The salient feature is a simplified reactor design which permits continuous operation. The process consists of catalytic dehydration of ethyl alcohol in gaseous phase using fluidised bed system. Only the licensee, M/S. Industrial Solvents Ltd., Bombay, may forward information on capital investment.

Status of Commercialization: A plant is in operation since 1963. The process is covered by Indian Patents No. 49836 and 60921.

Contact Address: M/S. National Research Development Corporation of India
61 - Ring Road
Lajpatnagar - III
New Delhi - 110024
INDIA

08482

BISPHENOL-A

Description: Process for the local production of Bisphenol-A as a substitute for the imported product.

Technical and Economic Details: The process has been developed by the Shri Ram Institute for Industrial Research and essentially consists of reacting phenol with acetone in the presence of sulphuric acid or hydrochloric acid. Information on the amount of capital investment required is available from the licensee (see contact address).

Status of Commercialization: The process is under commercial exploitation.

Contact Address: M/S. Raghunand Chemicals Pvt. Ltd.
Mustafa Building
Feroze Shah Mehta Road
Bombay-1
INDIA

08483

PENTAERYTHRITOL

Descriptio Cheaper process for the manufacture of Pentaerythritol.

Technical and Economic Details: The process has been developed by the Shri Ram Institute for Industrial Research and involves reaction of acetaldehyde and formaldehyde under different conditions in the presence of an alkali followed by isolation of the product. The investment cost of a 10 tons/day plant is approximately Rs. 15 millions.

Status of Commercialization: The process is under commercial exploitation and the know-how will be available to other parties on a turnkey basis.

Contact Address: M/S. National Research Development Corporation of India
61. - Ring Road
Lajpatnagar - III
New Delhi - 110024
INDIA

08484

DIALLYL PHTHALATE MONOMER, PREPOLYMER AND MOULDING COMPOSITIONS

Description: Process for production of Diallyl Phthalate Monomer, Prepolymer and moulding compoeitions. The product is applied in electronic componente, dough moulding compositions and bonding and finishing agent for plywoods.

Technical and Economic Details: The process has been developed by the Shri Ram Institute for Industrial Research and is based on esterification reaction of allyl alcohol and phthalic anhydride, followed by vacuum distillation and polymerisation of the pure monomer. The product obtained has been evaluated at various consumer centres in the country and meets international standards. The processing know-how was completely developed at Shri Ram Institute and a plant capable of producing 1 ton/day was completely designed at the Institute. It has been built and erected at the factory of the sponsors and has given the desired out-put. The investment on plant and machinery is about Rs. 750 000.

Status of Commercialisation: A plant was inaugurated in 1978 and is under commercial production.

Contact Address: M/S. Western India Plywoods Ltd.,
Baliapatam,
Cannanore District
Kerala
INDIA

08485

UNSATURATED POLYESTERS

Description: Process for improved grades of resins such as glass reinforced polyesters

Technical and Economic Details: The reactions are mainly with terephthalic acid or isophthalic acid, maleic anhydride and ethylene glycol. The process falls in the medium-scale industry. The approximate capital investment for a plant of 1 ton/day would be of the order of Rs. 500 000.

Status of Commercialization: The process is commercially utilised since 1965. It is covered by Indian Patent No. 78016.

Contact Address: Shri Ram Institute for Industrial Research
19, University Road,
Delhi - 110007
INDIA

08486

1.2 Drugs and pharmaceuticals

PRODUCTION OF ETHAMBUTOL

Description: Process for synthesizing ethambutol, a raw material for an anti-tuberculosis drug.

Technical and Economic Details: KIST has developed an entirely new process. The synthetic process for ethambutol requires highly developed chemical technology, especially the technology of separating optical heterogeneities with the result that the world market price of ethambutol stood at US$ 120,000 to US$ 130,000 per ton. The domestic production thus will substitute imports.

Status of Commercialization: Patents have been applied for. Commercial production has started.

Contact Address: The Korea Institute of Science and Technology (KIST)
P.O. Box 131
Dongdaemoon
Seoul
KOREA

08487

EXTRACTION OF GLUE AND GELATINE

Description: Modified method for the extraction of glue and gelatine for various purposes.

Technical and Economic Details: Glue is used in the wood industry and gelatine in the pharmaceutical, food and photographic industry. As a by-product a proteinous material containing 10-14% nitrogen is produced which can be used as a nitrogenous fertilizer supplement.

The present method suitably treated collagenous yield from 20-30% glue concentration. When the extracts obtained are dilute, they need to be pre-concentrated by vacuum concentrators prior to becoming fit for drying further. By this process the glue obtained is concentrated enough thus avoiding or minimizing one operation process namely pre-concentration.

This has several added advantages:
1. Saves thermal and other power inputs, 2. Saves total factory working time, 3. Needs smaller extraction vats, 4. The impurities that will concentrate from added float are eliminated thus yielding a purer product, and 5. Yield of glue is slightly increased.

Status of Commercialization: Ready for commercialization. Application for a patent is under way.

Contact Address: Dr. T.S. Ranganathan
Central Leather Research Institute
Sardar Patel Road,
Adyar, Madras - 600020
INDIA

COCONUT WATER AS INTRAVENOUS FLUID

Description: Preparation of coconut water for uee in intravenous replacement therapy.

Technical and Economic Detail: After chopping off the husk at one place, coconut water was aeeptically withdrawn from the unripe fruit through a plaetic trochar from a blood administration set into a sterile bottle, using a large-bore gauge 18 needle as vent. This fluid was subcequently used for chemical analysis and in-vitro and in-vivo animal and human experiements. Fresh coconut water was analyzed for its electrolyte, sugar, protein, and fat content. Other determinations were osmolarity, sterility, toxicity, pyrogenicity and antigenicity. Coconut water was found to be rich in potaeeium, low in sodium, sterile, non-pyrogenic, non-hemolytic, and non-antigenic. Preliminary studies using mice, rats, rabbits, dogs, and monkeys indicate that coconut water is non-toxic and if given by intravenous infusion does not cause many significant changes in the electrolyte composition, osmolarity, and pH of the blood in the experiemental animals. 500-750 ml of coconut water infused intravenouely in nine human volunteers from the Philippine General Hospital did not cause any significant change in the electrolyte composition of blood. There wae also no significant change in blood pressure, pulse rate, or respiration and no untoward reactions of any type were observiced.

Status of Commercialization: No information received.

Contact Address: Dr. Vedasto R. Jose
Commissioner
National Institute of Science and Technology
P.O. Box 774
Manila
PHILIPPINES

08489

ERGOTOXINE STRAIN OF ERGOT

Description: Agro-technology for the cultivation of ergot with a higher percentage of alkaloids than the imported product.

Technical and Economic Details: Ergot alkaloids are obtained from ergot of rye, the trade name for the sclerotia of the fungus "Claviceps purpurea Tulasne" which is parasitic on rye. The Central Indian Medicinal Plants Organization developed indigenous agro-technology for the cultivation of ergot. Hitherto, the strain of ergot produced in India was primarily meant for production of ergotamine - an alkaloid specific for treatment of migraine. Recently a formulation of ergocristine, ergocryptine and ergocornine under the trade name "Hydergine" has been found to be effective for vaso-relaxation, increased blood flow and systematic lowering of blood pressure. Pilot scale cultivation of the improved strain has shown that it can be successfully cultivated with 0,725% total alkaloids and 0,4% ergotoxine. The product imported from Europe had only 0,3% alkaloids. The average yield of ergot sclerotia is 100 kg/ha. The yield is expected to be much higher in the temperate climate of Kashmir.

Status of Commercialization: Production started on pilot scale.

Contact Address: Central Indian Medicinal Plants Organisation
Lucknow
INDIA

08490

METHAQUALONE AND METHAQUALONE HYDROCHLORIDE

Description: Process for producing Methaqualone mainly from locally-available raw materials. Methaqualone is an accepted non-barbiturate sedative used in pharmaceutical preparations.

Technical and Economic Details: The process involves reaction of anthranilic acid or isatoic anhydride with acetic anhydride. The acetylated product is isolated and refluxed in a suitable solvent with o-toluidine under suitable conditions when methaqualone is formed. Methaqualone is isolated from the reaction mixture as its hydrochloride and is purified by crystallization. The free base is obtained by basification of the hydrochloride.

The process has been standardized on a scale of 1 kg/batch of methaqualone hydrochloride. A total quantity of 5 kg product has been prepared by the laboratory.

The raw materials required in the process are: isatoic anhydride or anthranilic acid, acetic anhydride, o-toluidine, and hydrochloric acid.

The equipment required for the process are: 20-litre glass assemblies, filtration unit, vacuum pump, cooling water pump, tray drier, and heating mantle.

The suggested capacity of an economically viable unit is 1 tonne of the material per annum. The total outlay required to put up such a unit has been estimated at Rs. 80 000, including a fixed capital on plant of Rs 42 000, and a working capital of Rs 36 000. It is envisaged that the product could be manufactured by an existing unit producing fine chemicals and, therefore, no fixed capital will be necessary for land and building (80 m^2 approx.). The cost of product has been worked out at Rs 137/kg.

Status of commercialisation: The process is commercially exploited.

Contact Address: The Managing Director
National Research Development Corporation of India
61 - Ring Road
Lajpat Nagar III
New Delhi 110024, INDIA

08491

SILICA GEL PRODUCTION

Description: Low-cost production of Silicia gel of high purity (99%) for chromatographic and other special purposes. Silica gel is used mainly as a desiccant in industrial appliances ranging from instruments to medicine. It is also used for separation of gases in petroleum refining, as a catalyst carrier in butadiene polymerization, and in synthetic rubber industries.

Technical and Economic Details: The process for the production of silica gel, potassium silicate, silica sol and molecular sieve zeolites. Potassium silicate solution finds use in fixing phosphor in TV tubes and screens. Molecular sieve zeolites are used in selective separation of gases and liquid mixtures, extreme drying of gases and liquid, catalyst or catalyst support. Magnesium trisilicate is used extensively in the pharmaceutical industries as antacid. Other metallic silicates, such as calcium silicate, are used as filler materials in the rubber and paint industries. Following this process all these chemicals can be manufactured, depending upon the need, using the same equipment and machines. Besides, chemicals like magnesium trisilicate and other metallic silicates can also be manufactured using silica sol. Patalia Chemicals has recently adopted the process for the production of silica sol. Silica sol itself finds extensive use in the paper, refractory and chemical industries. The process does not require elaborate arrangements like dialysis for removal of electrolytes and thus the operation cost for production is low. Production cost is about Rs. 10/kg and the gel compares well with high-grade silica gel which sells at Rs. 45/kg; water absorption capacity is 42-44% at 92-95% RH while normally water absorption is about only 36% at 90-95% RH. The capital investment for a plant of a capacity of 50 tons/annum will be about Rs. 278 000.

Status of Commercialisation:

Three Indian firms have started the commercial production of silica gel.

Contact Address:

Regional Rsearch Laboratory (RRL)
Jorhat
INDIA

08492

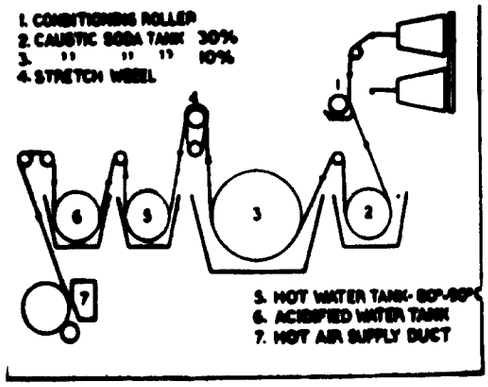
1.3 Textiles

HIGH TENACITY COTTON YARNS BY MERCERIZATION

Description: Method for improving strength and uniformity of mercerization for the production of yarns of high tenacity.

Technical and Economic Details: The yarn to be mercerized is unwound from a cone and guided round a driver roller A, rotating in a small trough of alkali containing a wetting-out agent. When the yarn is wet with alkali it is passed round a wheel immersed in a tank of caustic soda solution of 30% conc. where good penetration of alkali and intra-crystalline swelling takes place. The number of wraps on this wheel is so adjusted that the yarn is in alkali for 10 seconds. The yarn then passes another big wheel (3) immersed in a tank of 10% caustic soda solution. Here, further intra-crystalline swelling takes place and the mercerization becomes more or less complete. The yarn is in this solution for 20 seconds and the number of wraps on the wheel is adjusted accordingly. The thread then passes round a stretch wheel (H) which is a double V-type pulley with an adjustable mechanism permitting the ratio of diameter of the two groves to be altered to achieve a varying degree of stretch. Subsequently, the yarn passes round two wheels (5 and 6) immersed in hot water (80-90°C) and 2% sulphuric acid respectively to wash out and neutralize the alkali. The newly-processed thread is squeezed to remove excess water and then dried in a drying chamber by hot air directed on to the yarn while it is being wound on the tak-up package. Capital investment is approximately Rs. 150 000.

The yarn mercerized yarns. It has been estimated that the yarn will cost about Rs. 1.25 more than the commercially mercerized sample, but the improvements in quality will compensate for the increase in cost.



Single end mercerisation process.

Status of Commercialization: Ready for commercialization.

Contact Address: Director
The South India Textile Research Association
P.B. No. 3205
Coimbatore Aerodrome Post
Coimbatore - 641 014
INDIA

08493

HIGH DOME LICKER-IN COVER FOR CARDING ENGINE

Description: Modified cover to minimise loss of fibres in carding engines.

Technical and Economic Details: The aim is to minimise the loss of good fibres which are wastes produced by the licker-in of a cotton carding engine. This helps in better utilization of raw material resulting in a reduction of cost of production. The modified cover follows a contour different from the conventional cover to create a low pressure area above the licker-in. This modified cover can be fitted, with minor modifications, to an existing cover-bracket.

Status of Commercialization: A license has been issued. Application for patenting has been presented to the authorities.

Contact Address: Director
The South India Textile Research Association
P.B. No. 3205,
Coimbatore Aerodrome Post
Coimbatore - 641 014
INDIA

08494

DOUBLE CARDING

Description: System to improve the quality of spun cotton and blended yarns by double carding. Simpler and cheaper substitute for the commercial "Tandem card".

Technical and Economic Details: Two cards - a semi-high production card and a high production card with crush rolls - have been brought together. The carded material from the first card is passed over a highly polished plate of about 11" long and inclined at an appropriate angle to the feed roller of the second card. Both the cards are synchronized by a simple drive system. The material is carded twice in this set-up, which results in cleaner and more uniform card slivers. The yarns produced are more uniform, stronger and cleaner than the corresponding single carded yarns. Investment requirements are:

- conversion of two semi high production cards to the SITRA double card set-up would cost Rs. 60,000.

Status of Commercialization: A patent has been applied for. Negotiations are in progress with a prominent machinery manufacturer in India for commercialization.

Contact Address: Director
The South India Textile Research Association (SITRA)
P.B. No. 3205,
Coimbatore Aerodrome Post
Coimbatore - 641 014
INDIA

08495

SINGLE YARN MERCERIZATION

Description: Process to optimize the parameters for the production of mercerized single yarns as cheaper substitutes for mercerized doubled yarns.

Technical and Economic Details: Mercerization is normally carried out for doubled yarns, the main reason being that they are much stronger than their equivalent single yarns and can stand up to the stretch that imparts improved lustre and strength to these yarns. But these doubled yarns are quite expensive and this puts them out of the reach of local knitting industries. In this process it has been shown that by selecting the right type of cotton, and by manipulating the various mercerizing parameters, it is possible to produce mercerized single yarns with good lustre and other improved properties at a much reduced cost.

Status of Commercialization: The technical know-how has been passed on to the industry.

Contact Address: Director
The South India Textile Research Association (SITRA)
P.B. No. 3205
Coimbatore Aerodrome Post
Coimbatore - 641 -014
INDIA

08496

USE OF UNCONVENTIONAL FIBRES

Description: Method for processing of unconventional fibres on existing cotton spinning machinery with appropriate adjustments.

Technical and Economic Details: A method has been developed for processing and spinning fibres like Ramie, Jute, etc. in the cotton family either in pure form or in blends with other natural and man-made fibres. No high capital expenses are necessary to implement this method.

Status of Commercialization: The technology was transferred to village industrial organizations and a project for the construction of a mini-mill has been submitted to the Ministry of Commerce.

Contact Address: The South India Textile Research Association (SITRA)
P.B. No. 3205
Coimbatore Aerodrome Post
Coimbatore - 641 014
INDIA

08497

CREASE-RESISTANT RAW SILK FABRICS

Description: Technology to produce crease-resistant raw silk fabrics.

Technical and Economic Details: The method was developed to make the very popular all silk 'raw silk' fabric woven on handlooms crease-resistant so that it can meet the requirement of consumers regarding easy-care characteristics. The method mainly involves the blending of silk with polyester fibre after cutting the silk to suitable lengths to match the length of polyester fibre with which it is blended.

Status of Commercialization: The know-how developed has been communicated to sponsors. Some organizations have already started making use of this technique in the organized mill sector.

Contact Address: Director
The South India Textile Research Association (SITRA)
P.B. No. 3205
Coimbatore Aerodrome Post
Coimbatore - 641 014
INDIA

08498

TRASH ANALYSER

Description: Instrument for estimating the trash content.

Technical and Economic Details: The trash analyser can be used for the following purposes:

- estimation of trash content in sample of raw cotton
- sstimation of trash content in lap or card sliver or process stock from diffsrent points in the blowroom line.
- estimation of lint content or spinnable fibre in the waste from any machine.

The instrument has been developed by the South India Textile Research Association (SITRA).

Status of Commercialisation: A license has been issued.

Contact Address: M/S. The Kasturi Engineers Pvt Ltd.
218, Avanashi Road
Coimbatore - 641 018
INDIA

08499

SRIFIRSET RESINS FOR TEXTILES

Description: Process for giving better anti-shrink wash and wear properties in textile finishing.

Technical and Economic Details: The process has been developed by the Shri Ram Institute for Industrial Research. The special features of the process are better wash fastness, chlorine resistant and "delayed cure" technique for producing durable press materials. The product developed is cheap and easy to manufacture, and does not deteriorate on storage.
Information on capital investment may be obtained from the licencee, M/S. Sardesai Brothers, Bombay.

Status of Commercialisation: The process was commercially exploited from 1961 onwards. The process is covered by Indian Patents No. 65282, 52325 and 59835.

Contact Address: M/S. Sardesai Brothers
82, Advent, 8th Floor, 12-A
Gen. J. Bhonsle Marg,
Fort
Bombay - 400001
INDIA

08500

SRIFIRCIDES FOR ROT-PROOFING AGENTS FOR TEXTILES

Description — Process for the development of improved types of rot-proofing agents for the textile industry.

Technical and Economic Details: The process has been developed by the Shri Ram Institute for Industrial Research and involves condensation of carboxylic acids with organic anilides in the presence of phosphorous pentoxides. Unlike conventional copper napthanate-based compounds, SRIFIRCIDES do not adversely affect the treated materials being handled. Because of their less corrosive nature of reaction, the same can be carried out in stainless steel vessels instead of costly glass-lined equipments. The product is of comparatively low tonnage.

Status of Commercialization: Production started in 1963. The process is covered by Indian Patents No. 66794, 66795 and 83567.

Contact Address: Shri Ram Institute for Industrial Research
19, University Road
Delhi - 110007
INDIA

08501

ORGANDIE FINISH

Description: Improved process for finishing organdie.

Technical and Economic Details: The process has been developed by the Shri Ram Institute for Industrial Research and briefly consists in treating textile fabrics with concentrated sulphuric acid in the presence of retardents/catalysts at controlled temperature and time. The process is cheaper and equivalent to the one offered by foreign countries. Inquiries about capital investment should be addressed to the contact address.

Status of Commercialisation: The process has been successfully utilized since 1963 and most of the product has been exported. The process is covered by Indian Patent No. 44808 and 52344.

Contact Address: M/S. Finlay Mills Ltd.,
Chartered Bank Building
Mahatma Gandhi Road
Bombay
INDIA

08502

TWO-FOR-ONE TWISTING MACHINE

Description: Machine which introduces into the yarn two turns of twist for every revolution of the spindle. The machine substitutes for very expensive imported ones.

Technical and Economic Details: The machine has been developed by the South India Textile Research Association in Coimbatore. The advantages of the two-for-one twist process are as follows:

1) For a given spindle speed, the production per spindle is double that of a ring twister. Also, the limiting spindle speeds are around 13,000 rpm and, therefore, the production per spindle on the two-for-one twisting system are 2½ to 3 times that of a ring twisting system.

2) Larger yarn packages (about 1 kg) are produced This results in fewer knots in the doubled yarn, which is an added advantage in further processing. Also, owing to the large package produced, a lower doffing cycle results so that fewer operators are required for a given rewinding number of spindles.

3) Rewinding is eliminated and, hence, the cost of rewinding (machines and operators) is saved.

Status of Commercialisation: Licence issued for commercial manufacture.

Contact Address: K. Sreenivasan and N. Govindarajan
South India Textile Research Association (SITRA)
Coimbatore
INDIA

08503

STAGGERING TAPPETS

Description: Mechanism to reduce damages during weaving.

Technical and Economic Details: In normal plain weaving all the yarns of one shed line cross all the yarns of the other shed line simultaneously, thus causing maximum yarn-to-yarn abrasion. If the yarns forming a shed line can be split into 2 or more layers while crossing the other set of yarns and also separated in two layers, the yarn abrasion during shedding can be reduced considerably. The abrasion of yarns in the reed dent and entanglements between yarns during shedding can also be reduced. This reduces the possibility of warp yarn breaks and hence better efficiency and less damage during weaving. For effective staggering, it is necessary to move the 4 heald shafts independently by specially designed tappets which provide variable heald staggering achieved by moving the 2 heald shafts of the same shed line through different distances in a given time. Results of a number of mill trials indicate that a consistent reduction is obtained in the endbbreakage rates (20-25%). The mechanism has been developed by the Ahmedabad Textile Industry's Research Association.

Status of Commercialization: The device is being used in several mills for seven years. A licence is being issued.

Contact Address: Messrs. Poonjabhai Vanmali and Sons
Gheekanta
Ahmedabad 380 001
INDIA

Messrs. Chesuni Egeneering Works
C 3, Purnima Park
Near Jain Merchant Society
Paldi
Ahmedabad 380 007
INDIA

08504

USE OF FOAM PADS AT SIZING

Description: Simple and efficient means of reducing the hairiness of sized yarn using foam pads to lay the protruding fibres in the wet, sized yarn.

Technical and Economic Details: Excessive hairiness in the warp yarn is known to increase the yarn to yarn abrasion on the loom and cause increased warp breakages. This affects the productivity of the loom and the incidence of cloth damage. To avoid these negative results, foam pads are mounted between the squeezing rollers and the first drying cyclinder in a staggered fashion in such a way that they do not exert any pressure on the warp sheet. The technique can be used profitably to reduce warp yarn entanglement and yarn-to-yarn abrasion where the warp yarns used are more hairy (e.g. carded yarns and polyester/cotton blends); or conversely, when weaving fabrics of heavy construction from a given yarn. The attachment can be easily fabricated in the mill's workshop itself and results in a 15% reduction in the warp breakage rate and a consequent increase in weave loom productivity. Reduces yarn-to-yarn abrasion and warp yarn entanglement and fabric defects.

Status of Commercialization: Several mills are applying this technology.

Contact Address: The Head
Mechanical Processing Division
Ahmedabad Textile Industry's Research Association (ATIRA)
Ahmedabad 380 015
INDIA

08505

IMPROVED MECHANICAL SLUB CATCHER

Description: Mechanical slub catcher with considerably improved yarn clearing efficiency over the conventional fixed blade slub catchers for use on Rotoconer type of winding machines.

Technical and Economic Details: This slub catcher was developed by the Ahmedabad Textile Industry's Research Association. It is equipped with a suction unit to remove all the liberated fluff and to help to obtain cleaner packages. Its use on non-automatic winding machines improves the weaving efficiency in the same way as does a modern automatic winding machine and it thus has the crucial technological advantage of a modern sophisticated automatic winding machine. The slub catcher units are available as replacement to the existing units on Rotoconer type of winding machines. They are suitable for clearing both cotton and polyester blended yarns. In view of the improved clearing efficiency, the breakage rate at winding is often higher by about 50%, requiring a reallocation of spindles to a tenter.

Status of Commercialization: Several mills filled their winding machines with this slub catcher. A license has been issued.

Contact Address: Kinariwala RJK Industry
Behind Anil Starch Products, Near Nicol Octroi Naka
Ahmedabad 380 002
INDIA

08506

RAPIDRY SYSTEM FOR CYLINDER DRYERS

Description: Improved system for cylinder dryers with increased drying speeds.

Technical and Economic Details: In cylinder dryers a stagnant film of vapours forms over the drying surface and impedes evaporation. Air jets are used to disperse these vapours and increase the evaporation rate. Only ambient air is used and at the optimum velocity. The drying speed of a cylinder dryer is increased by over 25%. The Atira Rapidry System is most usefull where drying is a bottleneck. It costs less than a tenth of a new machine but increases production by more than 25%. It requires no additional heating and can be installed on almost any cylinder dryer without affecting the working of the machine. It saves energy.

Status of Commercialisation: Several mills are using this system.

Contact Address: The Head
Engineering Division
Ahmedabad Textile Industry's Research Association (ATIRA)
Ahmedabad 380 015
INDIA

08507

AUXILIARY BUFFER FOR PICKING STICK ON OVERPICK LOOMS

Description: Auxiliary buffer to reduce the consumption of accessory machinery in the weaving industry.

Technical and Economic Details: The excessive momentum of the picking stick after picking causes the stretching of the picking band, pulling up the loom spindle and the picker. The conventional buffer is ineffective in minimising these strains, which cause frequent failures of these accessories. In order to absorb this momentum an auxiliary buffer was designed which directly acts on the picking stick once picking is completed. The buffer consists of a L-bracket and a flexible cylindrical buffer made of rubberised canvas. The buffer can be fitted on any overpick loom.

Status of Commercialisation: The buffers have been installed in several mills.

Contact Address: The Head
Mechanical Processing Division
Ahmedabad Textile Industry's Research Association (ATIRA)
Ahmedabad 380 015
INDIA

08508

ROOF-COOLING SYSTEM

Description: Roof-cooling system in spinning and weaving departments as an aid to combat the excessive heat loads filtering into departments during hot summer days.

Technical and Economic Details: For roof cooling, water is sprinkled in a certain form over the roof surface so that skin temperature is brought down to about 30°C. This greatly reduces the heat transmitted through the roof. Diurnal atmospheric variations are almost completely evened out so that steady ambient conditions can be maintained in the department throughout the day. This also means that the air conditioning plants will require only very little adjustment from morning till evening. The cost of roof cooling is about a tenth of that of humidification plants (without refrigeration) of similar performance and it also means a saving of about 40 to 50 kW in installed power in an average-sized mill.

Status of Commercialization: The roof-cooling system has been introduced in several mills.

Contact Address: The Head
Engineering Division
Ahmedabad Textile Industry's Research Association (ATIRA)
Ahmedabad 380 015
INDIA

08509

MODIFIED ROPE WASHING MACHINE

Description: Modified rope washing machine with reduced water consumption.

Technical and Economic Details: Washing machines consume about 25% of total water consumption in a mill. The tight and slack rope washing machines are commonly sturdy and give troublefree service, but their washing performance is poor compared to modern machines. With the modified rope washing machines a reduction of water consumption in conventional bleaching process of about 35 to 40% has been achieved. The modified slack rope washing machines are also working satisfactorily in the continuous bleaching process of a mill in place of modern tensitrol washers. The capital cost of modified slack rope washing machines is about one-third that of tensitrol washers.

Status of Commercialization: The machine is introduced in many Indian mills.

Contact Address: The Head
Engineering Division
Ahmedabad Textile Industry's Research Association (ATIRA)
Ahmedabad 380 015
INDIA

08510

SWELL RELEASE MOTION

Description: Mechanism comprising of two simple levers fitted on non-automatic looms so as to periodically release the swell pressure on the shuttle.

Technical and Economic Details: The mechanism only works at the time of picking. At the time of checking, however, the swell pressure acts fully on the shuttle to retard it. It can be fitted on any non-automatic loom and has the following advantages:

- reduced picking force and hence smoother running of the loom
- less wear and tear of accessories and hence longer life
- reduced loom slip and hence higher production

Mills have been able to achieve of up to 30% in the replacement of loom accessories and a reduction in slip of up to 3%.

Status of Commercialization: Several mills implemented this device.

Contact Address: The Head
Mechanical Processing Division
Ahmedabad Textile Industry's Research Association (ATIRA)
Ahmedabad 380 015
INDIA

08511

FIBRE LENGTH TESTER

Description: Instrument for the measurement of the parameters of length distribution of cotton fibres.

Technical and Economic Details: An aligned tuft of fibres is scanned for optical transmission along the fibre axis. The distribution of optical density along the fibre tuft has been found to be highly correlated with the length distribution pattern obtained on comb sorters. An accessory to the instrument, the Autosampler, prepares the aligned tuft for scanning. The instrument has been developed by the Ahmedabad Textile Industry's Research Association. It is reliable, simple to operate and inexpensive. Compared to the Comb Sorter Method the testing time is reduced and operator bias largely eliminated.

Status of Commercialization: Nearly 40 instruments are in regular use at present.

Contact Address: Messrs. Mahlo-Star Electronic Equipments Private Ltd.
GIDC Plot No. 78/3, Makarpura
Baroda 390 009
INDIA

FIBRE FINENESS TESTER

Distribution: Instrument for estimating the fineness, maturity and M_c values of a fibre.

Technical and Economic Details: The instrument uses the air flow through a fibre plug to obtain a combined estimate of fineness and maturity (MH). A separate scale is also provided for the M_c values. The MH scale ranges from 1.5 to 7.0 and the M_c scale from 2.5 to 6.5, both in units of 0.1. At present refinements are being introduced to the instrument for obtaining separate indices for maturity and fineness as well as for measuring the fineness of manmade fibres. The instrument is reliable, simple to operate and inexpensive. It has been developed by the Ahmedabad Textile Industry's Research Association.

Status of Commercialisation: Nearly 200 instruments are in regular use at present.

Contact Address: M/S. Scientific and Industrial Instruments Co.
B-14, Industrial Estate
Polo Ground
Indore 3.
INDIA

SHORT PROCESS OF BLEACHING POLYESTER/COTTON BLENDS

Description: Shorter process of bleaching for polyester/cotton blend which can be completed in about five hours without the use of sodium chlorite.

Technical and Economic Details; In many mills, the daily production of polyester/cotton blends is less than 5000 metres. These mills bleach the blend cloth on jiggers which takes about 8-10 hours. Also they use expensive and imported sodium chlorite to get the required whiteness. In the process developed by Ahmedabad Textile Industry's Research Association the total time is reduced by about 3 hours and sodium chlorite can be eliminated. The process is about 30% cheaper than the conventional one.

Status of Commercialisation: Eight mills are using the process successfully.

Contact Address: The Head
Chemical Technology Division
Ahmedabad Textile Industry's Research Association (ATIRA)
P.O. Polytechnic
Ahmedabad - 380 015
INDIA

LOW TEMPERATURE-CURE CATALYST FOR WASH AND WEAR FINISHING

Description: Cheaper method for easy-care finishing.

Technical and Economic Details: A low temperature cure catalyst system viz., catalyst LCR for resin finishing was developed. In continuation of this work, two more catalyst systems viz., Catalyst LCR and Catalyst PD have been developed. With catalyst LCR, it is possible to cure the resin treated fabrics at 110° in 2-3 mirutes. Catalyst PD is meant to cure the resin during the drying stage only. Hence the process of resin finishing would be pad and dry on stenter at about 140°C for one minute. These catalysts are comparable in performance to magnesium chloride. The storage stability of resin finishing solutions of both the catalysts has been satisfactory. There is no change in the tone of fabrics dyed with reactive dyes. Catalyst LCR permits the use of a lower temperature for curing. The polymeriser can be run at a lower temperature of 125°C, leading to substantial saving in power consumption. The cost of these catalyst systems is lower than that of magnesium chloride.

Status of Commercialization: More than 20 mills have obtained the know-how of the catalyst systems.

Contact Address: The Head
Chemical Technology Division
Ahmedabad Textile Industry's Research Association (ATIRA)
P.O. Polytechnic
Ahmedabad 380 015
INDIA

008515

STAIN REMOVER FOR TEXTILES

Description: BTRANOL is a milky white liquid used for removal of oil/grease stains from textiles.

Technical and Economic Details: The manufacture of BTRANOL essentially involves mixing components (solvents and detergents) in stages with a high speed stirrer. On a pilot-plant scale, a locally-made disperser (1,5 H.P.) can produce 20 to 30 kg. of the product per hour. The advantages of the product are:

- low cost of production
- no special equipment is required for its manufacture
- better performance than other comparable products
- raw materials used are indigenous

Status of Commercialization: A license has been issued to an Indian firm. The product is being widely used in the country.

Contact Address: Mr. T.V. Ananthan
The Bombay Textile Research Association (BTRA)
Lal Bahadur Shastri Marg
Ghatkopar (West)
Bombay - 400 086
INDIA

1.4 Cement and building materials

CEMENT FROM RICE HUSK ASH

Description: Process for the manufacture of ASHMOH, a cement from rice husk ash and lime.

Technical and Economic Details: The rice husk ash -which contains 90% of silici- is mixed with dry staked lime and ground in a ball-mill to achieve a fine powder which can be utilized as cementing material.

The ideal location for setting up a ASHMOH plant is near a rice mill which uses rice-husk as fuel for par-boiling the rice. Alternatively the husk has to be field-burnt in a proper way to yield a good variety of ash.

A 500 tons/year capacity plant could be set up with an investment of Rs. 100 000.

Status of Commercialization: Patents have been obtained for the process. A 500 tons/year capacity plant is under production.

Contact Address: The Director
Indian Institute of Technology
Kanpur 208016
INDIA

FOAM CONCRETE

Description: Process for manufacturing foam concrete by incorporation of controlled amounts of stable foam in the cement mix with the help of an indigenously-developed foaming agent.

Technical and Economic Details: The foaming agent, marketed under the trade name of Balcrete, was sold in liquid form and was based on hydrolysed proteins stabilized by suitable chemicals to produce improved foam volume and foam stability. This product is comparable in performance to U.S. products like 'Mearlcrete' and 'Elasticell'.

In recent years know-how for producing foam concrete using nonproteinous composition was developed. This composition cannot be marketed as a stable product but can be easily made on the site in pots and pans.

Using a conventional concrete mixer, add the ingredients of the foam compound to the required quantity of water (4 to 8 oz/bag of cement); run the mixer for 3-5 minutes; add the cement in small portions and mix thoroughly until the batch appears homogeneous. The slurry obtained is cast into wooden moulds, which are removed after 12 to 24 hours, and the blocks are cured like conventional concrete.

For casting foam concrete *in situ* on roofs, the roof area can be divided into 6-12 feet wide strips of separate wood forms into which the foam concrete is poured to a level of 2-3 inches. Alternate stripe are poured so that as every other section sets, the foam removed and the intervening area filled. The mix is very easy to handle and presents no problem.

A special portable whisking machine was also designed for the manufacture of foam concrete. This machine costs less than the conventional cement mixers and produces one batch in 6-8 minutes.

The density can be controlled by a number of factors such as the quantity of foaming agent, the agent, the length of the mixing cycle, the type of mixer and the water/cement ratio.

Status of Commercialization: Licences have been issued (on a non-exclusive basis) and the process is commercially applied.

Contact Address: Pakistan Council of Scientific and Industrial Research
Press Centre
Shahrah-e-Kamal Ataturk
Karachi 01090
PAKISTAN

MASONRY CEMENT FROM WASTE LIME SLUDGE AND PORTLAND CEMENT

Description: Process for the manufacture of masonry cement using waste lime sludge and ordinary Portland cement.

Technical and Economic Details: The process involves intergrinding of waste lime sludge with Portland cement and the required quantity of gypsum. A small amount of an air-entraining agent may also be added, if required, for any special use. But even without such an agent the lime-sludge-based calcium carbonate sludges, possesses good workability and water retention properties. The manufacture of limestone/slag and Portland cement clinker blend masonry cements involves considerable intergrinding cost which is reduced substantially by using lime sludges. Besides, this process offers a direct utilization and useful means of disposal of these waste sludges from sugar factories and paper mills.

Manufacture of masonry cement can be taken up either on a small or large scale depending upon the quantity of lime sludge available. No large-scale plant and machinery are required except a ball mill and a set of sieves. The capital investment for a plant of 6000 tons year of 300 working days amounts to Rs. 160 000.

Status of Commercialization: The process has been licensed to three parties and commercial production is expected by the end of 1978.

Contact Address: Mr. A.C. Banerjee, Scientist
Central Building Research Institute
P.O. ROORKEE (U.P.)
INDIA

CEMENTITIOUS BINDER FROM WASTE LIME SLUDGE AND RICE HUSK

Description: Very simple process for the manufacture of a cement binder from waste lime sludge and rice husk. The production can be established in rural areas for rural development projects.

Technical and Economic Details: A new hydraulic binder possessing properties similar to Portland cement has been developed from the waste lime (by industries such as sugar, acetylene, paper and tanning etc.) and rice husk. The binder produced can be used in place of cement for certain construction applications. The process of production of the binder is quite easy and can be adopted on a small-scale industry level. The binder is consequently cheap and can also be manufactured by the rural population itself.

Method of Preparation: Dry waste lime-sludge and rice husk are mixed together thoroughly in the proportion of 1:1 by weight or 1:2 by volume respectively. The required amount of water is added to the dry mix for making balls or cakes by hand. These balls/cakes are put in the open for drying before burning. They are then fired in the open on a jalli (grating) base of a clamp or in a trench. Rice husk not only acts as integral fuel but also provides *in situ* silica for the lime produced during firing.

The fired material obtained is quite soft and is in a powdery state. Its reactivity like other hydraulic binders increases with increasing fineness. Therefore it is ground by a grinding device preferably in a ball mill to achieve sufficient fineness.

The total capital investment for a production of five tons/day shift for 200 working days/year amounts to Rs. 120 000.

Status of Commercialization: The process has been demonstrated on a large scale to some entrepreneurs. However, no commercial unit has so far been set up.

Contact Address: Mr. A.C. Banerjee, Scientist
Central Building Research Institute
P.O. ROORKEE (U.P.)
INDIA

008520

MANUFACTURE OF PLASTER OF PARIS

Description: Efficient process for continuous production of hemihydrate for calcium sulfate.

Technical and Economic Details: Powdered gypsum is charged to vertical shaft kiln wherein it meets the counter-current of hot air. The process is efficient, economical and continuous in operation and yields a product of uniform quality. The process has been developed by the Shri Ram Institute for Industrial Research.

Status of Commercialization: The process is applied in commercial production.

Contact Address: M/S. National Building Organization
Ministry of Works and Housing, Govt. of India
Nirman Bhavan, Maulana Azad Road
New Delhi
INDIA

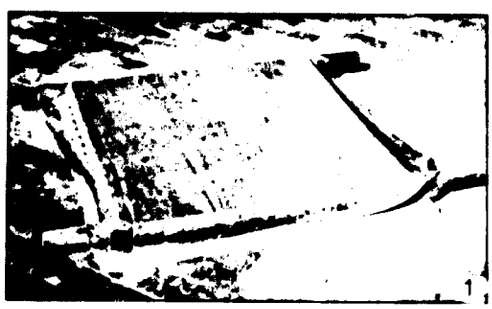
008521

FUNICULAR SHELL ROOF

Description: Low cost simple technology for roofing of residential and institutional buildings.

Technical and Economic Details: This roofing system uses a minimum of materials (cement and steel) to a maximum structural advantage with the resulting material savings (steel: up to 40%) and cost reduction (25%). The roofing element is a thin shell whose shape is chosen in such a way that it carries loads in compression. The technology can be used under rural, urban and metropolitan conditions.

The process can be reduced to a simple village level technology for the production of roofing units. The simple equipment needed consists of a wooden mould, a masonry platform and a piece of sack. These precast units, measuring about 4' x 4' weigh only 275 pounds and may be easily handled manually. The shells are just one inch thick and need no steel reinforcement.



Only the edge beams are lightly reinforced with a single 3/8" diameter bar. These precast units are put together and the top surfaces made level by an in situ layer of concrete. The units are temporarily propped up during construction. The space between the edge beams is concreted to form an intersecting system of grid beams. The roof presents a pleasing waffle-pattern.

The precast shells can also form the intermediate floor of multi-storey buildings because they are strong enough to carry 300 pounds per square foot of loading.

Status of Commercialization: The process has been patented and is available to anyone interested. It was repeatedly used in housing projects in Egypt, India, Iran and the USA.

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INDIA

LIGHT-WEIGHT AGGREGATE FROM URBAN SEWAGE SLIME

Description: Process for the production of light aggregate for civil construction using disposable urban sewage slime.

Technical and Economic Details: The sewage slime is submitted to a dehydration process in a drying operation that is followed by stages of self-synthering process with no additional fuel. The final synther is crushed and sized for final use. The cost of a pilot plant for 1 m^3/hour production is US$ 1,000,000.

Details of the process were published in the Brazilian review Revista DAE, Vol. 36, No. 104/1976.

Status of Commercialization: An industrial plant is under construction in the city of Sao Paulo. The process is covered by a Brazilian patent.

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BRAZIL

CORRUGATED ROOFING PANELS FROM AGRICULTURAL RESIDUES

Description: Process of conversion of fibrous agricultural residues, such as bagasse from sugar cane, into a corrugated fibre roofing panel providing stiffness and load-carrying properties comparable to corrugated galvanized iron sheets.

Technical and Economic Details: The process is labour-intensive and requires relatively low capital investment. The construction material produced by it is as durable as galvanized iron if protected with impregnants or coatings, such as asphalt and aluminum paint.

The process consists of 5 sets of operations:

- hammermilling and air separation of fines and pith
- soaking, beating and screening for further pith removal
- addition of chemical additives and oriented mat formation
- mat pressing
- post treatment like trimming, asphalt coating or vacuum impregnation with preservatives and painting with aluminized asphalt coating.

The capital required for a plant with a capacity of 250 panels/day amounts to US$ 56 000. Cost per sq. ft. of material: US$ 0.15 (includes the depreciation of investment over 5 years). Chemical costs are estimates based on prices in developing countries.

Status of Commercialization: No details received.

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USA

WOOD WOOL BOARDS

Description: Process for the manufacture of wood wool boards on a small scale.

Technical and Economic Details: Wood wool board is a material made from wood fibre (Wood wool) and cement. Wood wool is saturated with cement slurry and compressed in the form of a board. After giving strength the board is a sufficiently durable material. It is of medium density i.e. 300 to 500 kg/m^3 and open texture due to which it is primarily used as a thermal and acoustic insulation material. Being made with fibre the board also has good bending properties and can be used as a structural panel material. Other characteristics of wood wool board are its inherent resistance to fire and termite attack. Its surface can be plastered and all coating materials, including bitumen, can be applied over it.

Wood wool board is used in building as a cladding material for walls and roofs, in partitions, permanent shutters for concrete and in ceilings. It is also used for making flat and pitched roofs above the concrete and solid floors beneath the screen.

The Central Building Research Institute, Roorkee, has worked out a simplified method for making cement-bonded wood wool boards in which no heavy investment is involved and the boards can be made at a desired small-scale level. In this method the use of a heavy press has been totally eliminated. As regards a wood wool making machine, it is understood that a firm in Batala (Punjab) M/S. Best Wood Working Machine Makers, G.T. Road, has a prototype whose approximate cost is expected to be below Rs. 30 000.00.

The process utilises wood wool obtained by the use of a wood wool-making machine and a cement binder which could be ordinary Portland cement or magnesium oxychloride

cement. A suitable mix of wood wool and the cement binder is spread in a wooden mould by hand and compressed by hand-operated jacks. The boards thus formed are cured for 24 hours and demoulded and further cured to gain the desired strength. The boards are trimixed and finished off for market.

For a production of 75 000 boards/year (size 200 cm x 50 x 2.5) in a three shift operation on 300 working days/year, a fixed capital of Rs. 182 000 and a working capital of Rs. 70 000 is required.

Status of Commercialization: The process has been licensed to seven parties. There is no patent involved in this process. The material is already produced in India.

Contact Address: Mr. A.C. Banerjee, Scientist
Central Building Research Institute
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INDIA

CORRUGATED ROOFING SHEETS FROM COIR WASTE OR WOOD WOOL

Description: Process for the manufacture of corrugated roofing sheets using Portland cement as binder and coir waste or wood wool.

Technical and Economic Details: Coir/wood wool fibre is soaked in mineralized water for 2 hours. The remaining water is drained off the fibre and then mixed with dry cement. A mat of suitable thickness is next formed on a corrugated mould and pressed. It is held under pressure for 4 to 8 hours. After demoulding the sheet is cured and dried.

Wood wool/coir fibre corrugated sheet requires 30 per cent less cement compared to Asbestos Cement Sheet. The sheets are light but tough and can be transported over hilly and rough roads without any breakage. The sheets are strong and possess good bending strength. A man can safely walk over them. The sheets possess good thermal insulation properties and so ar expected to provide greater comfort in the tropics as compared to A.C. sheet and G.I. sheet. Their preparation needs neither heavy machinery nor high capital investment. The sheets are 50% cheaper than A.C. sheets. These can be laid on roofs like A.C. Sheets. The roofs so made do not require any further finishing or water-proofing treatments. The material is fire-resistant.

The total capital investment for a production of 45 sheets/day of 150 cm x 90 with 300 working days/year amounts to Rs. 110 000.

Status of Commercialization: The purpose has been licensed to five parties, one of whioh has started tial production.

Contact Address: Mr. A.C. Banerjee, Scientist
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INDIA

RESIN/NATURAL FIBRE COMPOSITES

Description: Process for combining natural fibres with resins yielding a construction material for buildings, bins, boats, etc.

Technical and Economic Details: It has been found that when natural fibres, such as jute, are combined with unsaturated polyester resins (thalic anhydride and malic anhydride and propelyne glycol) the resultant composite has proved to be highly suitable for use in construction of schools, clinics, houses and warehouses that can withstand cyclones, heavy monsoon, and the effects of prolonged exposure to the tropical sun.

The cost of producing is spun on a large drum, with the power of oxen, and is passed through a resin bath. Within a few hours the procut is dry and popped off the drum which is then ready for use again.

The technology has been developed by the Bangladesh Jute Mills Corporation. It allows for an application in a labour-intensive, small-scale manner.

Status of Commercialization: The process is ready for commercialization. A transfer of this technology to Tanzania is being considered.

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BANGLADESH

008527

BUILDING LIME FROM SUGAR PRESS MUD

Description: Process for the manufacture of lime for building purposes from waste lime sludge of sugar industry (carbonation process).

Technical and Economic Details: Sugar press-mud (lime sludge) is a waste material both in the carbonation and sulphitation processing sugar mills. Whereas a considerable portion of press-mud obtained in the sulphitation sugar mills finds use as a fertilizer, the press-mud obtained in the carbonation sugar mills does not find any use as it mainly contains calcium carbonate. This mud can be used as building lime after calcination.

Press-mud is available in powder form. Calcination of the powder in the commonly-used mixed type kilns is not practicable unless it is made into briquettes of suitable size. Hence, briquetting of press-mud was first taken up. It was found that about 6000 lb./sq.in. pressure was necessary to produce briquettes of a strength sufficient to withstand load in 15-20 ft. high mixed-feed kilns. The optimum firing temperature was also found to be 950-1000°C.

In large scale trials dry press-mud in powder form with 15-20 per cent water was fed to a briquetting plant. The briquettes were sun-dried and then calcined. The product obtained was analysed and usually conformed to the Indian Standards Specifications. The magnesium oxide content, rarely exceeded 5 per cent.
The cost of press-mud lime is lower than that for comparable material. The capital investment for a plant of 20 tons capacity/day is estimated at Rs. 78 000.

Status of Commercialisation: The process has not yet been utilised commercially, but several field trials have been carried out. There is no patent involved in this process.

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P.O. Roorkee (U.P.)
INDIA

MANUFACTURE OF PUZZOLANA CLAYS

Description: Process for continuous activation of clays to increase the puzzolanic efficiency.

Technical and Economic Details: Powdered clays are charged into a vertical shaft in which they flow counter-current to the upgoing system of hot air. The process is of special use and importance to developing countries, since it does not involve huge capital investment as is normally required for cement plants. Such plants can be located in close proximity to avoid costly transportation. The process has been developed by the Shri Ram Institute for Industrial Research.

Status of Commercialisation: The product is commercially manufactured.

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New Delhi
INDIA

LIME BURNT CLAY PUZZOLANA MIXTURE (LBCPM)

Description: Cost-saving process to produce LBCPM as a partial substitute for cement.

Technical and Economic Details: LBCPM is produced by intergrinding burnt clay puzzolana with dry hydrated lime. It is a ready-to-use cementing material and can be used as a strength-based economical substitute for cement for certain categories of civil engineering work, such as pavement bases, masonry mortars and plasters, foundation concretes, precast construction, airfield bases and lightweight concrete etc. The technology was developed by the Central Road Research Institute in New Delhi.

LBCPM mortar and concrete mixes are about 30% more economical compared to cement mortars and concretes of equivalent strength.

The burnt clay puzzolana and dry hydrated lime are mixed and ground in a ball mill of suitable capacity in stipulated proportions of one part of lime and two to three parts of burnt clay puzzolana by weight, and ground to fine mesh size to produce LBCPM.

Hydrated lime should be Indian Standard (IS) class "C" variety lime. Fineness: 90% passing IS 150 micron sieve.

It is estimated that for small-scale manufacture of five tons a day the outlay involved will be approximately Rs. 250 000 - 300 000 which includes the cost of land and civil engineering works, the plant, machinery and laboratory equipment and the working capital for three months.

The present-day consumer cost is expected to be around Rs. 120 per ton (controlled price of cement is Rs. 260 per ton). Studies have shown that dolomitic limestone has a much higher magnesia content than is permissible for cement manufacture and can be used successfully for making LBCPM. Since dolomitic limestone

is much cheaper than the calcitic one, considerable additional savings can be made.

Status of Commercialization: Indian Patent No. 90470 - 1960 - 65

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INDIA

008530

BURNT CLAY PUZZOLANA (REACTIVE SURKHI)

Description: Process for the production of reactive material which can be used as partial replacement of cement (up to 20 - 25% of weight) in all cement mortar and concrete works.

Technical and Economic Details: The manufacture of reactive surkhi involves a correct choice of suitable clay, its controlled calcination and its pulverization to the required fineness. The material may be used also in the manufacture of puzzolana cement.

Down draught kiln of batch type can be successfully used for small-scale manufacture. Its operation is easy and may be conducted by semi-skilled workers. As B-grade steam coal is used as a fuel well-suited for rural areas for manufacture on a small-scale.

The process has been developed by the Central Road Research Institute of New Delhi.

Although the capital investment required will vary from place to place, depending upon the cost of land, raw material, transport and labour charges, it is estimated that for small-scale manufacture of 5 tonnes per day, the outlay involved will be approximately Rs. 200 000 - 250 000, which includes the cost of land and civil engineering works plant machinery and laboratory equipment and working capital for 3 months.

The advantages of this technology are: conservation of cement in large quantities; cheaper mortars and concretes (about 10%); improvement of the physical properties of mortars and concretes, including reinforced concrete; opening up of employment through small scale industry.

Status of Commercialization: Indian Patent No. 93726-1960-65

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INDIA

LARGE-SIZE CLAY PRODUCTS WITH IMPROVED STRENGTH

Description: Process to modify the properties of ordinary brick clay with suitable admixtures so as to yield fired products such as tiles, pipes etc. having higher tensile strength.

Technical and Economic Details: The main feature of this process is that a special body mix is used in place of the ordinary clay mix for making the pipes and corrugated clay sheets he tensile strength of these products after firing is quite high. The corrugated clay sheets can be made by hand-moulding and pipes by extrusion. Sheets and pipes of quite large size can be made without any warping during drying and firing. Handling, drying and firing losses are almost negligible. The weight 30 kg/m^2 of the roof laid with clay sheets is much less compared with Mangalore pattern tiles which is 54 kg/m^2. The sheets are easy to lay and handle and can be drilled and sawn.

Corrugated clay sheets can be used as a roofing material particularly for rural housing and for low-cost housing. The pipes can be used for irrigation in rural areas.

Adoption of this process will reduce the ultimate cost of the roof as compared to the clay tile roof and a-c roof. As such, the production cost of corrugated clay sheets is quite comparable to that of the clay tiles. The clay sheets and pipes are much cheaper than the a-c sheets and pipes. In the case of clay sheets the cost of the supporting structure is much less than that for clay tiles.

Any locally-available alluvial brick clay having 25 to 40 per cent clay fraction is suitable for making clay sheets and pipes. The other raw materials are glass wool and red oxide of iron and the addition is about 3-4% by the weight of clay. Pipes can be extruded

well with the addition of wollastonite also. Clay sheets can also be made with the addition of wollastonite and glass wool. The quantity of glass wool can be reduced when wollastonite is added to the mix.

Capital investment: A fixed capital of Rs. 95 000 and a working capital of Rs. 35 000 is required. According to the laboratory and field trials the production cost of the corrugated clay sheets of 105 cm x 60 cm size and 10-12 mm thickness is about Rs. 2.16 per sheet. The production cost of clay pipes of 5 cm internal diameter, 8 mm thickness, is about Rs. 0.50 per metre.

Status of Commercialization: A patent has been taken. The process has been demonstrated on large scale with the help of existing units, but so far no license has been issued.

Contact Address: Mr. A.C. Banarjee, Scientist
Central Building Research Institute
P.O. ROORKEE (U.P.)
INDIA

CLAY FLOORING AND ROOFING TILES

Description: Process for the manufacture of improved quality clay flooring and roofing tiles from alluvial clays.

Technical and Economic Details: Clay flooring and roofing tiles are one of the cheapest building materials commonly used in South India. They can be used for flooring in rural and urban housing and light duty floors in industrial buildings, school and health buildings. The Central Building Research Institute has developed a process for the manufacture of improved quality tiles from alluvial clays possessing a flexural strength above 160 kg/cm^2 and a water absorption of less than 10 per cent.

The flooring tiles are resistant to abrasion and impact and can easily be laid or replaced from the floor or roof. Due to the scarcity and high cost of cement and steel, these tiles are a suitable alternative for low-cost construction.

Plastic alluvial clays from Indo-Gangetic plain containing illitic or the kaolinitic group of clay minerals and free from nodular lime or aggregates can be used for the manufacture of these tiles. The clay admixture containing lean and plastic clays must contain:

Clay	- 28 to 35 per cent
Total fines	- 65 to 75 per cent
Plasticity Index	- More than 20.

The admixture of lean and plastic clays in suitable proportions is weathered by alternate wetting and drying for a period varying from 2 to 3 months.

Weathered soil is pugged mechanically in a pug mill and left for a period of one or two weeks. The pugged mass is tempered, repugged and clay slabs of suitable size are hand-moulded or extruded.

The slabs are pressed to roofing or flooring tiles by a hand-driven screw press. The tiles are dried slowly under shade, and fired in a down draft kiln at a firing temperature range of 850 - 950°C.

Pilot plant work, consisting of several batches of production in a commercial kiln near Roorkee, was carried out. One 6.09 metre dia down draft kiln with a capacity of 25 000 tiles per batch is required to manufacture 750 000 tiles per year (300 working days) at a capital expenditure of Rs. 212 000.

Status of Commercialization: The process has not yet been utilized commercially, but several large scale field trials have been conducted in collaboration with the tile industry. There is no patent involved in this process.

Contact Address: Mr. A.C. Banerjee, Scientific
Central Building Research Institute
P.O. ROORKEE (U.P.)
INDIA

MANUFACTURE OF CERAMIC FLOOR TILES

Description Process for the manufacture of ceramic floor tiles.

Technical and Economic Details: The process developed 10 substitutes for improved tiles using 100% local raw materials; only feasible as part of a ceramic factory.

Status of Commercialisation: It is being negotiated with the State Ceramic Corporation.

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SRI LANKA

008534

PRODUCTION OF WALL TILES FROM UNREFINED CHINA CLAY

Description: Bench scale production of wall tiles utilizing unrefined China clay.

Technical and Economic Details:

By using unrefined China clay (containing mainly Quarts and Felspar as impuritiss) the cost of the tiles may considerably be reduced. The tiles are covered with an opaque glaze.

Status of Commercialization:

A pilot plant is being established.

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ZAMBIA

008535

PRODUCTION OF FLOOR TILES FROM RED BURNING CLAY

Description: Bench scale production of floor tiles utilising a red burning clay.

Technical and Economic Details:

Floor tiles were manufactured on a bench scale utilising a red burning clay and feldspar. The tiles were fired at 1200°C and the porosity was less than 2%.

Status of Commercialisation:

A pilot plant is in the planning stage.

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ZAMBIA

008536

PRODUCTION OF ACID-RESISTANT BRICKS FROM RED BURNING CLAYS

Description: Bench scale production of acid resistant bricks using red burning clays.

Technical and Economic Details:

Acid-resistant bricks which are used in the copper refining industry are manufactured on a bench scale with red burning clay and grog by an extrusion process.

Statue of Commercialization:

It is hoped that the Zambia Clay Industries will take up the technology and produce the bricks on commercial basis.

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SOIL-CEMENT BRICK MAKING MACHINE

Description: Hand-operated press for making soil-cement building blocks (modified CINVA Ram).

Technical and Economic Details: In the early 1950's the Inter-American Housing and Planning Centre (CINVA) in Bogota Columbia developed a simple hand-operated press for the production of building blocks from soil cement. This CINVA Ram has been modified in Zambia to eliminate some deficiencies. The bricks can be produced at low cost and withstand high temperatures and most weathers.

Status of Commercialization: About 50 machines are in use in Zambia.

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008538

COCONUT-PITH EXPANSION JOINT FILLER AND BUILDING BOARD

Description: Process to produce an expansion joint filler for road pavements and for building and packing material from the non-fibrous tissue of the coconut husk.

Technical and Economic Details: Cement concrete slabs in road pavements, runways and taxiways, bridge decks, etc. expand and contract due according to the rise and fall of temperature. In order to adapt to these changes, joints with filler material are necessary which have: a) good compressibility, b) high recovery after compression, c) adequate resistance to water, d) resistance to weathering, e) stability, and f) adequate strength against handling. Coconut-pith is the elastic corklike material forming the non-fibrous tissue of the coconut husk which, in combination with a few indigenous products, are the basis for the manufactured low-cost expansion joint filler boards.

It is estimated that at present 350 000 tons of coconut-pith are available as a waste product of the coir industry (this quantity will increase and the disposal problem intensify). On account of its poor cellulose content (35%) this material has no place in the pulp industry.

Raw coconut-pith is cleaned of sand and grit by sieving and washing with water, then mixed with an animal glue solution (3% animal glue on the weight of the pith, made into a 4% solution in hot water) in a non-staining tray. Compounded rubber latex is used as a binder (mixture of 28% rubber latex and 0.25% of vulcanizing paste comprised of Z.D.C. sulphur and zinc oxide, both by weight of the pith). The vulcanizing paste is prepared in an 0.12% ammonical solution of 3.5% casein by weight of the volcanising agents. The mixing process is completed as

quickly as possible in order to avoid the clogging of the material. It is then kept in the oven at 50-60°C for 24 hours for curing. Cured material is pressed in a pre-heated press (80 + 5°C) at a pressing load of 75 psi for 15 minutes. The prepared board is allowed to dry slowly to avoid warping and is then treated with a solution of bitumen in kerosine oil, as a protection against microbial attack.

Cost of production of the board: Rs.13.50 and Rs. 21 per square meter for ½" and 3/4" thickness respectively.

Besides their use as an expansion joint filler, coconut-pith boards prepared and suitably modified in the process may also be utilized as insulation boards, building boards, packing material, sealing caps etc. The process was developed by the Central Road Research Institute.

Status of Commercialization: Indian Patent No. 87958

Contact Address: National Research Development Corporation of India
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INDIA

UTILIZATION OF FLY-ASH

Description: Techniques for the use of fly-ash in pavement construction.

Technical and Economic Details: Fly-ash is a waste material and about 4.5 million tonnes are being produced in Indian power plants. This quantity costs about 10 million Rupees merely for its disposal.

A semi-rigid behavior is observed when lime and fly-ash mixture is used as a bonding medium in different techniques which can be used as alternatives to conventional bases, especially in areas of adverse subgrade, climatic and draining conditions.

Lime-fly ash concrete

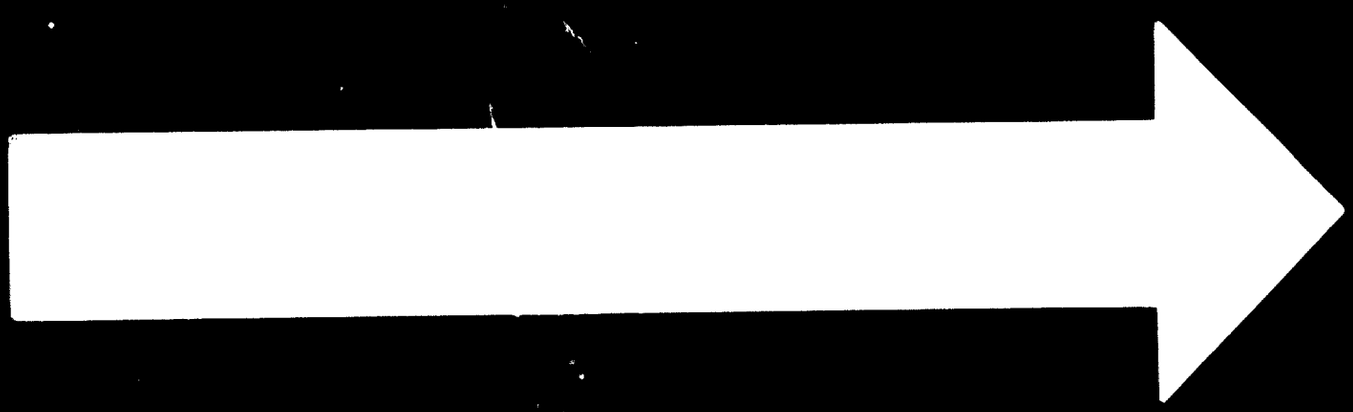
a. as sub-base or base course in pavements: spreads load over larger areas; due to greater resistance to penetration of water than granular bases, the performance of such pavements is better compared to other conventional materials. Initial cost is at par with conventional base construction; savings will result due to better long-term performance;

b. as precast blocks: they have been found suitable for construction of footpaths. The blocks are topped with a thin layer of cement sand mortar for better resistance to abrasion.

Lime-fly ash-sand bound macadam as base course: initial cost of this technique is about 5-8% more than conventional base construction; in view of its superior performance and expected long life, there is a saving in maintenance costs in the long run.

Lime-fly ash stabilised soil as sub-course in pavements: gives superior performance and long service life; economical wherever stones are costly.

G-12



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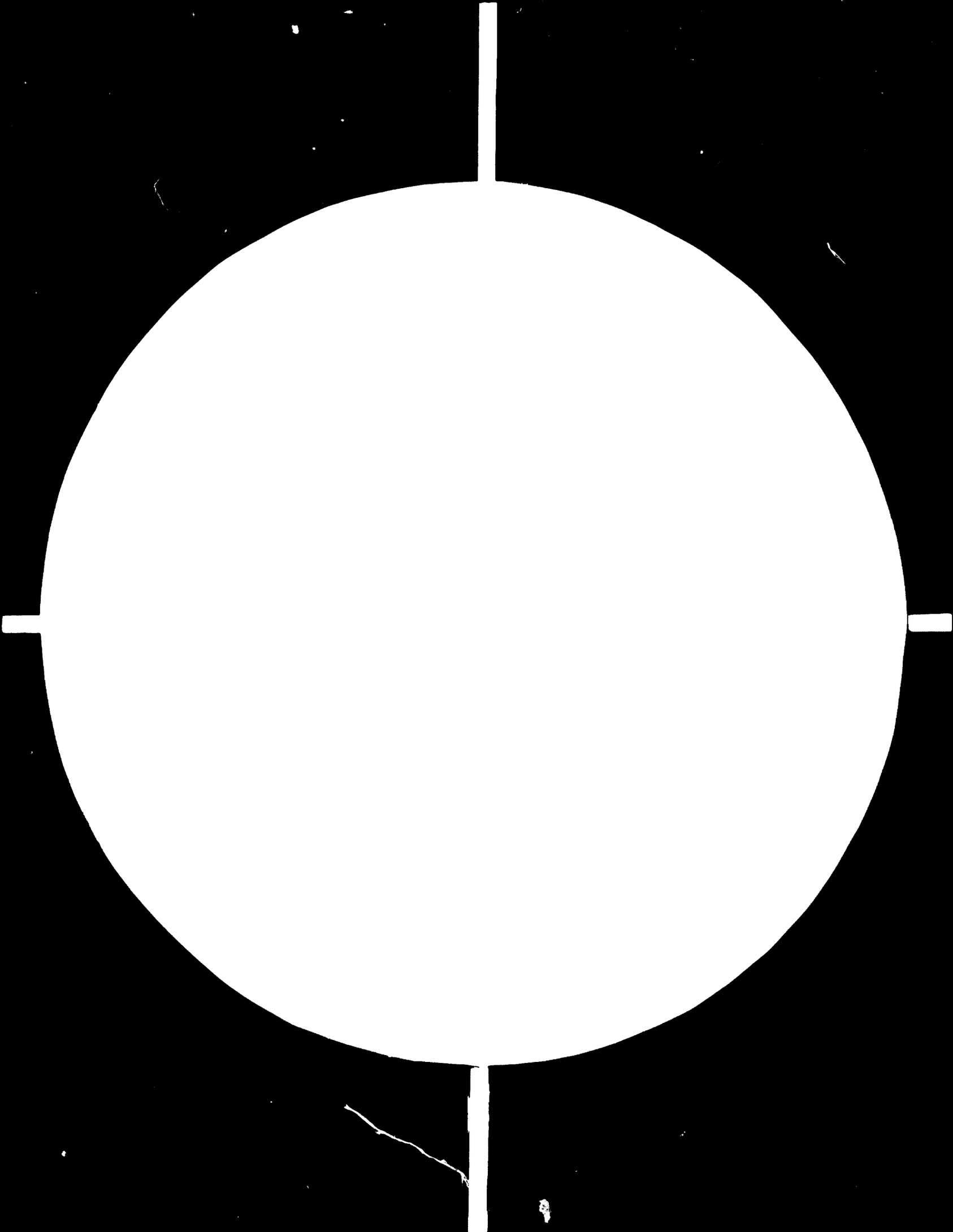

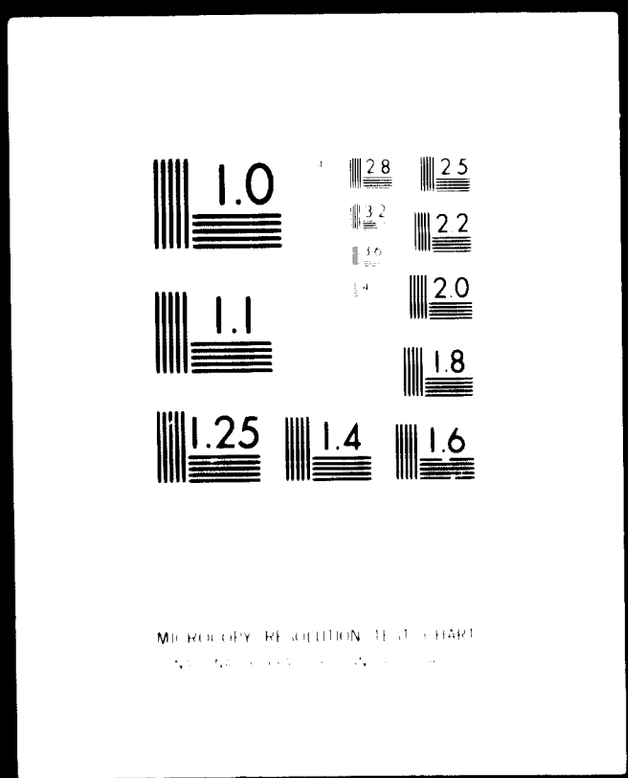

Status of Commercialization: Ready for commercialization.

Contact Address: Central Road Research Institute
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INDIA

LOCALLY AVAILABLE LOW-GRADE MATERIALS FOR THE CONSTRUCTION OF RURAL ROADS

Description: New techniques for construction of low-traffic roads with low-grade materials, such as kankar, moorum, laterite, gravel, coral etc. in areas where conventional hard stone is not available.

Technical and Economic Details: Low-grade materials had not been considerod acceptable for road construction, since, compared to stone, these usually have a low crushing strength or are found to be mixed with other materials. Considerable research work has been carried out to investigate the possibility of their scientific use in the construction of road pavements either in their natural state or in combination with other stabilizing material. The engineering properties and other physico-chemical characteristics of these materials are now known. This work has shown that most of these abundantly available and so-called inferior materials can successfully replace the more expensive stone or brick in road construction. Investigations have also shown that since the magnitude of load stresses in the lower layers of pavement crust is low, a merely scientifically processed and well-compacted soil can replace stone for a part of crust thickness in the lower layers.

Certain materials of road construction like kankar, gravel etc. are also not to be seen on the surface but lie buried underneath. It was possible to establish through aerial photography well-defined and distinot patterns for the deposits of theee materials, making it possible to discover hidden deposits.

According to their engineering properties locally available low-grade materials are used in the different layers of a pavement. The engineering properties of these low-grade materials may be improved by the addition of small percentages of lime, cement,

bitumen, etc.

The advantages of these techniques are savings of up to 30% in comparison with conventional road construction and their labour-intensiveness.

Status of Commercialization: The techniques are being used in different parte of the country.

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INDIA

1.5 Food storage and processing

FERRO-CEMENT BINS

008541

Deecription: Process for producing precast ferro-cement cylindrical units for grain storage, water tanke, bio-gas holders and pipes, etc.

Technical and Economic Details: The ferro-cement bins developed at SERC, Roorkee, are cylindrical in shape and are assembled out of prefabricated units, viz. reinforced concrete base slab, ferro-cement wall unit and dome-shaped forro-cement roof unit. A wall unit has a diameter of 120 cm and a height of 100 cm. Depending on the individual consumer's requirement, 1-, 2- or 3 ton bin may be assembled by erecting one, two or three wall units one over the other and filling up the joints with cement mortar. A manhole is provided in the roof unit for loading and an outlet is provided in the bottommost wall unit, for unloading the grain. Rubber gaskets are provided both for the inlet and the outlet to make the bins airtight. Locking arrangements are provided for the inlet and the outlet openings. The external surface of bins is painted with bituminous aluminium paint to make them damp-proof.

The sizes of the various components of the bins have been so selected that these units can be handled and erected by 4 or 5 persons. The base slab, which is the heaviest of the pre-fabricated components, weighs about 140 kg. The cylindrical shape is preferred for the wall unit because it is suitable for mass production at the factory level. These cylindrical wall units are cast using the semi-mechanized process developed at the SERC, Roorkee. The diagrammatic representation of the equipment is shown in Fig. 1. The details of the various pre-fabricated components of 1-, 2- and 3-ton capacity bins are given in Fig. 2.

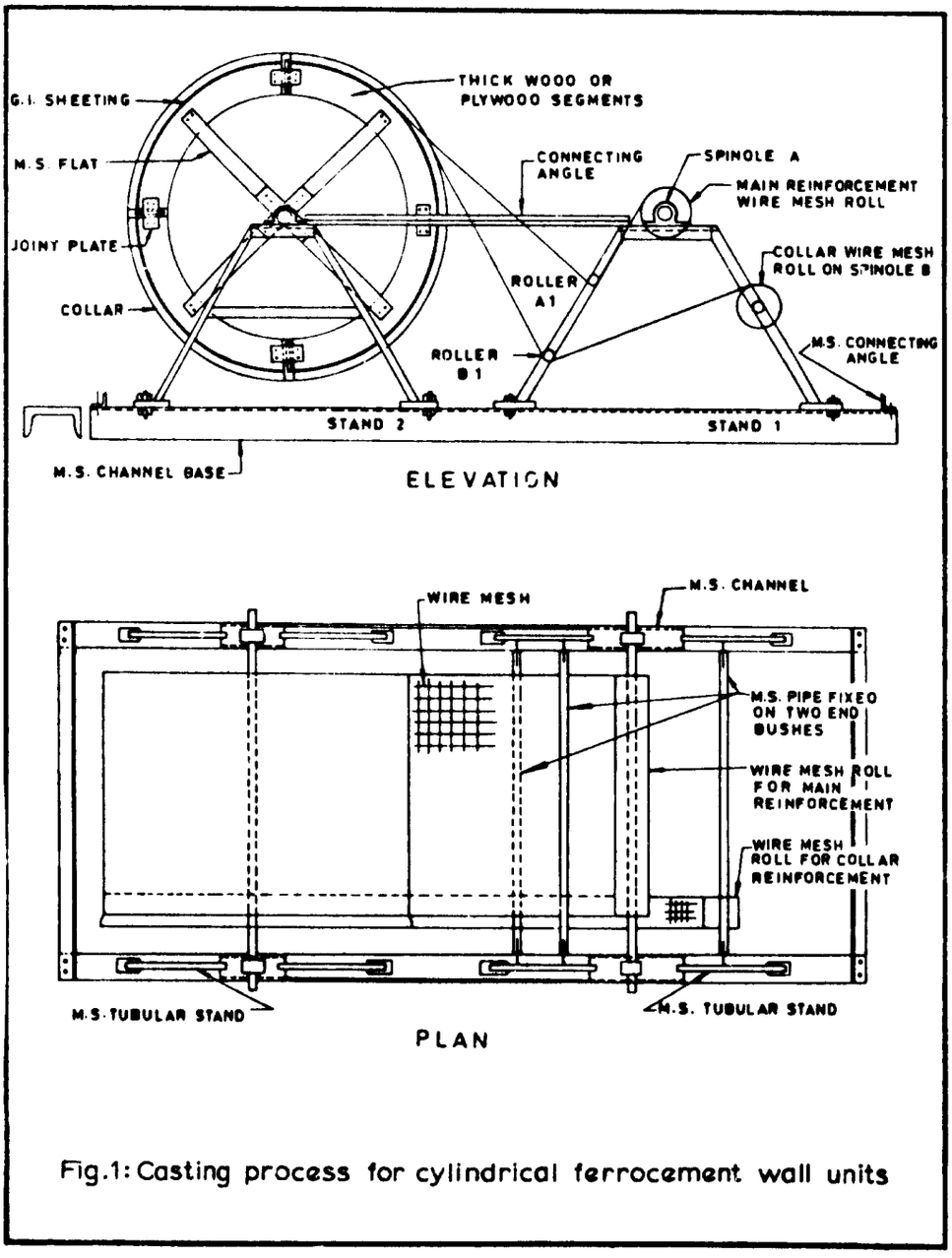


Fig.1: Casting process for cylindrical ferrocement wall units

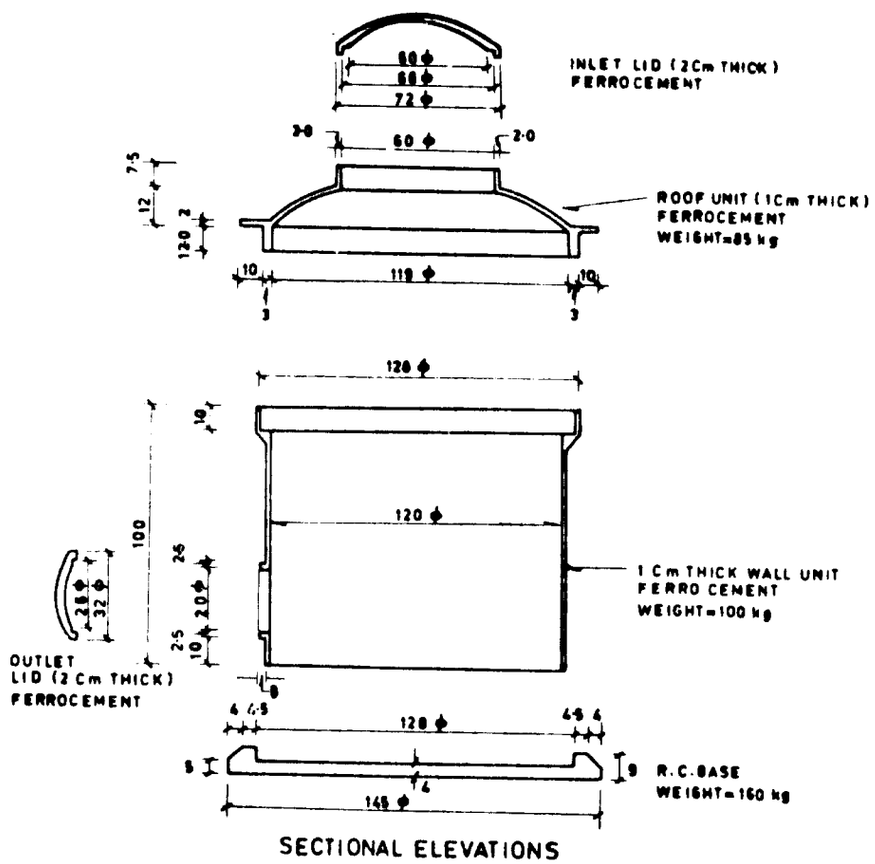


Fig. 2: Pre-fab units for bins up to 3-tonnes capacity

The equipment for casting of wall units consists of a wooden cylindrical collapsible mould resting on two A-frames. A wire mesh spindle feeds wire mesh during casting. The process of casting consists of a manual application of cement mortar on wire mesh. The application is done layer by layer till the required thickness is obtained. After 24 hours, the mould along with the casting is removed from mild steel frames and the unit is demoulded. The wall unit is given a finishing coat on the inside surface and is cured for 28 days.

The ferro-cement bins possess the following advantages: They are cheaper compared to steel bins, reinforced concrete bins and aluminium bins. They are lighter compared to conventional reinforced concrete bins. They require little or no maintenance. The condensation and moisture migration problems in the stored food grains are much less compared to steel bins. They can be easily fabricated at the rural level. The fabrication technique is simple and can be easily acquired by the local labourers. They are rodent-proof, fire-proof, moisture-proof and can be made airtight easily by sealing the inlet and the outlet openings. Any structural damage can be easily repaired by plastering over the wire mesh.

Status of Commercialization: A patent has been filed for the process. The process is commercially applied.

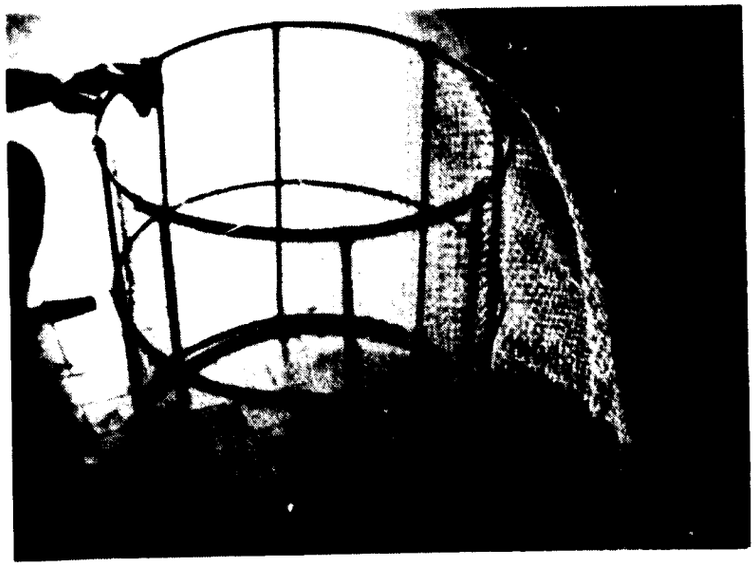
Contact Address: Dr. M. Ramaiah
Acting Director
Structural Engineering Centre
CSIR Complex
Adyar, Madras 600 020
INDIA

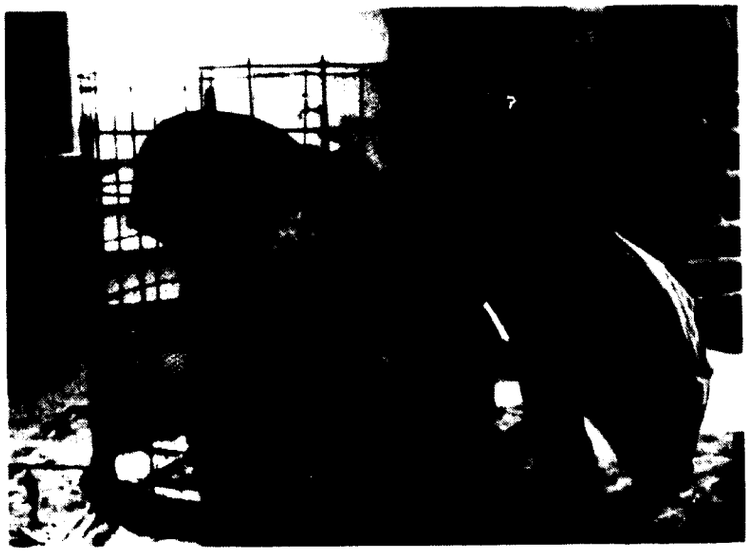
008542

FERRO-CEMENT TANKS FOR LIQUID STORAGE

Description: Low-cost technique to produce ferro-cement liquid storage tanks using non-qualified labour.

Technical and Economic Details: The structure is a framework made of steel bars and fence wire covered with a mortar of sand and cement, with 2.5 cm thickness. A synthetic vase lacquer, applied internally, is used for sealing. The cost is very low when compared to the cost of an ordinary asbestos-cement storage tank. These kind of tanks can be built in any size required and may especially serve remote rural areas.





Status of Commercialization: Ready for commercialization.

Contact Address: Instituto de Pesquisas Tecnológicàs do Estado de São Paulo
S.A. - IPT
P.O. Box 7141
01000 São Paulo
BRAZIL

NARANJILLA CONCENTRATE

Description: Processing and packaging of the naranjilla fruit (solanum quitoenses lam).

Technical and Economic Details: Naranjilla fruits are processed into a greenish amber heavy syrup with a high soluble solid content. This product is packaged into vacuum sealed cans. The canned product can be stored for one year and is used in nectar, juice, soft drinks and the production of frozen confections.

The advantages of this product are its good reconstitution percentage, and the international market for this fruit due to its rather exotic flavour.

Status of Commercialization: The process is commercially applied.

Contact Address: Instituto de Investigaciones Tecnológicas
Avenida 30 No. 52-A-77,
Bogotá
COLOMBIA

008544

DEHYDRATED VEGETABLES

Description: Process of production and packing of dehydrated vegetables.

Technical and Economic Details: Carrots, spinach, spinach beet, onion or garlic are dehydrated and processed into flakes or powder. The product is packaged either in cans packed in nitrogen or in cellophane or in polyethylene bags. It is intended for use by other industries; mainly in spices, foods for infants and instant soups. Specific advantages of the products are:

- Same quality as an ingredient
- Production volume and price are stablized
- No refrigeration required
- Retention of nutritive factors
- Reduction of handling charges
- Quick reconstitution

Status of Commercialization: The process is commercially applied.

Contact Address: Instituto de Investigaciones Tecnológicas
Avenida 30 No. 52-A-77,
Bogotá
COLOMBIA

008545

DEHYDRATED POTATOES

Description: Process of production and packing of dehydrated potatoes.

Technical and Economic Details: The potatoes are processed either into flakes (4% moisture) or sliced into different shapes (4% moisture). Both products are well protected in polyethylene film bags. Their storage life is one year at 14°C under a relative humidity of 70%. Specific advantages of the products are low-cost handling and wrapping, long-term storage, no refrigeration required, and processing of fresh produce stabilizes prices received by farmers.

Status of Commercialization: The process is commercially applied.

Contact Address: Instituto de Investigaciones Tecnológicas
Avenida 3C No. 52-A-77,
Bogotá
COLOMBIA

008546

VEGETABLE TEXTURED PROTEIN

Description: Processing of soybeans into vegetable-textured protein.

Technical and Economic Details: The protein is produced by extrusion cooking of extracted soybean flour and other oilseed cakes and can be used as a partial substitute for meat in food products.

The advantages of this product are its full use of oilseed cakes, suitability for consumer use, good organoleptic quality, and good nutritive value.

Status of Commercialization: The process is commercially applied.

Contact Address: Instituto de Investigaciones Tecnológicas
Avenida 30 No. 52-A-77
Bogotá
COLOMBIA

008547

PRESERVATION OF FISH

Description: Low-cost process for preservation of fish.

Technical and Economic Details: The split fish are buried in salt until the body fluids form a brine liquor. At 30°C - 72% RH, the climatic conditions can be used for the salting-drying processing. If relative humidity is high (85-90%), salting is followed by drying and then the product is taken to milder climatic conditions. The product is sealed in polyethylene film bags and has a storage life of 3 months at 25°C and 85% R.H.

Status of Commercialization: The process is commercially applied.

Contact Address: Instituto de Investigaciones Tecnológicas
Avenida 30 No. 52-A-77,
Bogotá
COLOMBIA

008548

COCONUT CHERRY CUBES

Description: Technology for processing of coconut milk.

Technical and Economic Details: The product is a delicious dessert manufactured from waste coconut water using a bacterial culture. It is syruped in sugar as cubes ½ inch in size and could be flavoured and coloured to suit different markets. The IDB has developed simple ways of preparing this on a cottage-scale in order to popularize this as a home industry.

Status of Commercialization: Ready for commercialization.

Contact Address: Industrial Development Board of Ceylon (IDB)
Katubedde
SRI LANKA

008549

MANUFACTURE OF TOMATO PUREE

Description: Low-cost process for preparation of tomato puree.

Technical and Economic Details: The process for preparation of puree consists of removing the seeds, skins and hard cores from the ripe tomatoes treated by hot break method, and concentrating the tomato pulp to not less than 9.0 per cent solids free of salt. The puree is filled hot into plain A 2½ cans and sealed. The sealed cans are processed at 100° for 25 minutes. By processing 1.5 tons of tomato fruits per day in one shift of 8 hours for 100 working days one can produce 70,000 A 2½ cans tomato puree. Depending on demand the production can be increased threefold by operating three shifts and providing other inputs. The total capital investment amounts to Rs. 5,20,000. The production will employ 10 workers and supervision/ managerial personnel.

Important equipment needdd are washing tanks, steam jacketted kettles, pulper, filling machine, seamers, retort and boiler. The cost of production can be reduced further if the seed can be utilised for sowing purposes. This will call for preservation of the seed viability during crushing and only cold processing of the fruit can ensure this aspect. The machinery required also can be fabricated in many countries with minimum workshop facilities.

Status of Commercialization: The product is commercially produced using this technology.

Contact Address: Central Food Technological Research Institute
Cheluvamba Mansion
Food Technology P.O.
Mysore - 570 013
INDIA

CANNED COCONUT MILK (GATA)

Description: Production and canning of coconut milk

Technical and Economic Details: Coconut cream or "gata" is the white extract of the ground coconut meat rich in vegetable fat, popularly used for culinary and baking purposes in the tropical countries. The procedure for producing canned coconut cream is: Mature and sound de-husked coconuts are selected and cracked, then deshelled to separate the meat from the shell. The coconut meat is then washed, weighed and fed to the grinding machine. The ground meat is then passed through an expeller to extract coconut whole milk. The first extract is pure coconut whole milk. The ground coconut meat (after the first extraction) is then mixed with a half to two times its weight of water and then passed through a screw press. This second extract is centrifuged whereby the cream is separated from the watery and solid portions. The cream is then mixed with a half to two times its weight of water and pasteurized for about 15-30 minutes. The pasteurized cream is mixed thoroughly with a stabilizer and passed through a homogenizer for further blending of the mixture. The homogenized mixture is heated almost to boiling, poured hot in tin cans, immediately sealed and sterilized at 6 to 10 psi for 45 to 70 minutes.

Status of Commercialization: Production had been on a semi-pilot scale only.

Contact Address: Dr. Vedasto R. Jose
Commissioner
National Institute of Science and Technology
P.O. Box 774
Manila
PHILIPPINES

008551

PRODUCTION OF A CARBONATED BEVERAGE FROM GUAVA FRUIT

Description: Processing of Guava fruit into a beverage as a substitute for carbonated beverages based on imported components.

Technical and Economic Details:

The process involves washing of fruit, comminuting, pulping, clarification and carbonation steps. The major pieces of equipment required are:

1) Washing baskets
2) Comminuting machine
3) Pulper
4) Filter Press
5) Carbonation/bottling plant

Capital investment: Zambian Kwacha 40,000 for equipment excluding building.

Status of Commercialization:

Ready for commercialization

Contact Address:

Dr. S.M. Silangwa
Secretary General
c/o National Council for Scientific Research
P.O. Box CH 158
Chelston
Lusaka
ZAMBIA

008552

PECTIN, OIL AND CALCIUM CITRATE FROM LIMES

Description: Process of extracting pectin, oil and calcium from limes.

Technical and Economic Details:

The process consists of crushing the fruits, pressing, distillation of juice to recover the oil, precipitation of calcium citrate from the juice under controlled conditions and manufacture of pectin from the waste peels. The process for pectin manufacture consists of extraction of peels in acidified water under controlled conditions of temperature and pH, filtration of the extract, precipitation of pectin as aluminium pectinate, chemical treatment of the precipitate to free pectin concentrate from aluminium, precipitation of pectin with ethyl alcohol, and drying.

Production capacity	600 tonnes of fruit per season (150 days)
	1.8 tonnes oil
	24 tonnes calcium citrate
	14.5 tonnes pectin (150 grade)
Fixed capital	Rs. 1 250 000
Working capital	Rs. 250 000
Cost of production (approx.)	Oil - Rs. 80/kg.
	Cal. citrate - Rs. 2/kg.
	Pectin - Rs. 45/kg.

Status of Commercialisation:

Process is applied commercially.

Contact address:

Mr. C.P. Natarajan,
Deputy Director
o/o Central Food Technological Research Institute
Cheluvamba Mansion
Food Technology P.O.
Mysore - 570 241
INDIA

PRODUCTION OF WEANING FOOD

Description: Preparation of weaning food from oil seed flours, pulse flours and cereal flour

Technical and Economic Details:

Weaning food is prepared by blending the oil seed flours like groundnut or soybean, pulse flours like green gram, Bengal gram or black gram, with cereal flour. The steps in the manufacture are: pre-cleaning and powdering the raw materials, blending of flours, dispersing and pre-cooking the blend in water, roller drying, and packing. The food contains 28 per cent protein and is useful for feeding weaned infants, and also as a supplement to the diets of schoolchildren and adults.

Production capacity	3 tonnes/day
Fixed capital	Re. 3 200 000
Working capital	Re. 2 000 000 (3 months)
Cost of production	Rs. 9 per kg.

Status of Commercialisation:

Process is applied commercially.

Contact Address:

Mr. C.P. Natarajan,
Deputy Director
c/o Central Food Technological Research Institute
Cheluvamba Mansion
Food Technology P.O.
Mysore - 570 241
INDIA

008554

HIGH FRUCTOSE CORN SYRUP PRODUCTION

Description: Process of production of high fructose corn syrup by means of glucose isomerase. The product is used as sugar substitute.

Technical and Economic Details: Being a microbiological enzyme, glucose isomerase is obtained from the cells of Streptomyces sp. No. 14 (KFCC 35051), which is a newly-isolated strain. The cells are cultured in a medium containing xylose or xylan to induce the enzyme. The cells thus grown can be harvested and used as crude enzymes.

The consumption of high fructose corn syrup will significantly reduce growth rates of the import by providing a domestic sugar substitute. Consequently, the KIST development of glucose isomerase for the production of high fructose corn syrup is anticipated to bring about the double advantage of food technology development and foreign exchange savings. In addition, the research team is investigating methods of producing immobilized enzyme and developing the continuous isomerization process, since the production of high fructose corn syrup is gradually being shifted to the continuous process.

Status of Commercialization: The process is commercially applied since 1976.

Contact Address: The Korea Institute of Science and Technology (KIST)
P.O. Box 131
Dongdaemoon
Seoul
KOREA

008555

IMPROVED METHOD FOR MANIOC PROCESSING

Description: Process to reduce the toxic factors in manioc by 35% yielding a detoxified dried chip which can be stored and, if necessary, processed into flour.

Technical and Economic Details: The process comprises of 8 stages:

1. peeling
2. chipping
3. sundrying I
4. soaking and washing the chips
5. sundrying II
6. oven drying
7. grinding and sieving
8. packing

The first 3 stages may be carried out at the factory or decentralized in households. In the latter case the factory has to buy dry chips instead of raw manioc. For the production of industrial flour, stage 6 is omitted. Provided the water used is bacteriologically satisfactory and the processing hygenic, the product may be used for food purposes, e.g. as a part-substitution for cereal flours. The industrial flour is suitable for preparation of dextrins and other adhesives. The suitability of this flour for textiles is being studied. The main wastes of the process will be rind and soak water. Drying, soaking and redrying of rind followed by grinding will yield a product that can be used as poultry or cattle feed. Because of its high oxygen demand as well as high cyanide content, soak water should not be discharged into the environment without further treatment. For processing 400,000 lbs of raw manioc per year the following requirements would have to be met: over 200 sunny working days with only one wet season a year; 2400 gallons of portable water per day: 1100 square feet drying floors and buildings; 2000 lbs. fresh manioc/day or an equivalent amount of home-dried chips. Two hundred pounds of fresh manioc render 700 pounds of flour. The total capital cost for establishing a plant with a processing capacity of 2000 lbs. of raw manioc/day amounts to Rs. 90 000. This includes the land, the building and the drying area, the machinery, the water supply and the working capital (Rs. 7000). If all 8

stages of the process are done in the factory, a labour force of 2 skilled and 25 unskilled workers is needed for the production of edible flour. A paper with more detailed information about the process is available.

Status of Commercialization: The process is being commercially used.

Contact Address: The Director
Ceylon Institute of Scientific and Industrial Research
P.O. Box 787
Colombo 7
SRI LANKA

008556

SOLAR GRAPE DRIER

Description: Simple and cheap technology for processing grapes into raisins.

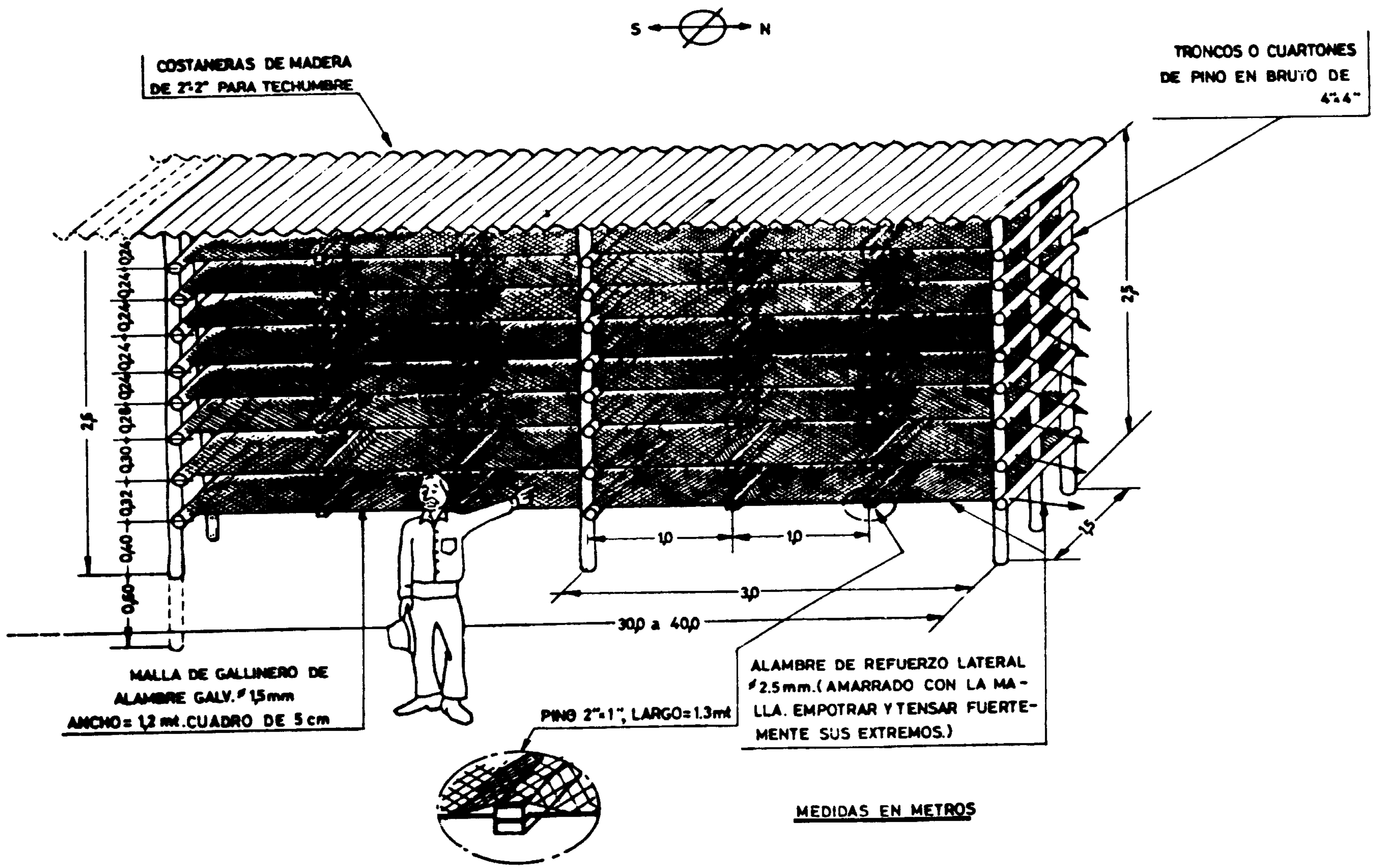
Technical and Economic Details: The process has been adapted by INTEC/CHILE on the basis of Australian and American technologies. It includes a simple chemical pre-treatment (with caustic soda) and a solar drier with a special structure of horizontal mesh. This technique is labour-intensive and can successfully be utilized in a warm ($25^{o}C$) and dry climate.

Capital requirements for a plant with a capacity of 30 tons of grapes a year amount to US$ 75/ton.

Status of Commercialisation: This technology is commercially applied in Chile. Technological information has been forwarded free of charge.

Contact Address: Corporación de Fomento de la Producción
Gerencia de Desarrolho
Casilla 667
Santiago de Chile
CHILE

SOLAR GRAPE DRIER



MEDIDAS EN METROS

008557

PROCESSING OF CASHEW NUTS

Description: Small plant for roasting cashew nuts.

Technical and Economic Details: The plant is a small demountable unit with simple design. Only low capital investment is involved.

A technical report with details and drawings (TD 102.Fin.) and an explanation report of the Ministry of Rural Development are available.

Status of Commercialization: Several plants are working successfully.

Contact Address: The Manager
Technology Development and Advisory Unit
University of Zambia
P.O. Box 2379
Lusaka
ZAMBIA

HAND TEXTURIZER FOR FOOD PROCESSING

Description: Equipment to produce low-cost vegetable protein products at a village level; substitutes extrusion cooking technology.

Technical and Economic Details: The equipment employs the same general functional consideration as the cooker extruder, i.e. temperature, pressure, time and moisture. The base plate and a plug-type lid are heated by a coal briquette fire or any other steady heat source such as charcoal or vaporized fuel oil. Where low-cost electricity is available an electric heater also can be used.

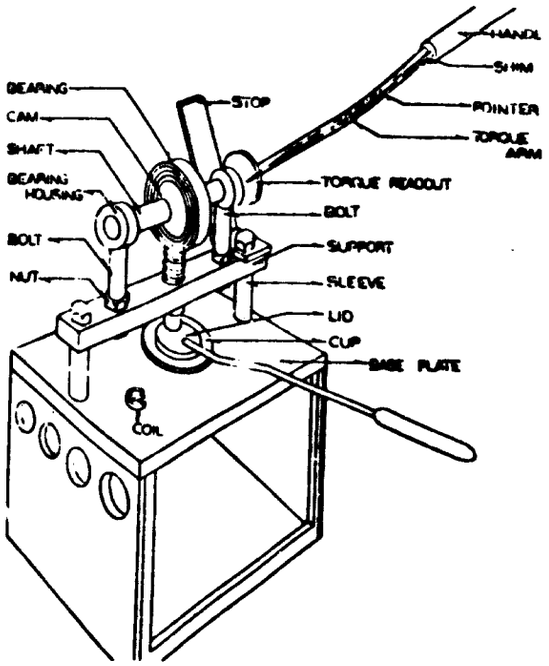
A pre-determined quantity of the raw material is placed into a shallow, 10 cm diameter cyclinder chamber located in the base plate. The lid is placed in proper alignment and pressure is applied to the mixture by a lever and plunger (the plunger mechanism employs an excentric cam action actuated by the lever). The lever is then held down for the required time and at the appropriate pressure. When the lever is released, instantanously the super heated water within the mix explodes in vapour and puffs the product to a diameter of about 15 cm.

The products that could be producted by the texturizer may be divided into two main groups:

- Snack-type products produced from raw materials high in starch and low in protein (10-12% or less) such as rice, corn, sweet potato flakes, cassava flour. The product is generally expanded and can be eaten as it is.
- Meat analogue type products using raw materials high in protein content (20% or more) such as soy flour, peanut meal, glandless cotton seed flour, etc. This type of product develops a meat-like texture which is less expanded. The product which is already cooked can

be consumed after soaking it for several minutes in water which may contain salt etc., and then fried for a short time. Another possibility is to grind the product into flour or chunks and add it to various dishes before cooking, in order to increase their protein level.

The apparatus costs about US$ 42.00 in Korea and is easily made in small machine shops. It can produce products which cannot be obtained by using an extruder cooker (example: structured vegetable proteins with a high fat content). The hand texturizer requires little skill to operate. Almost any raw material having a range of 20 - 60% moisture can be used. A detailed handbook is available from VITA, 3706 Rhode Island Avenue, Mt. Rainier, Maryland, 20822, USA.



General view of MFM modification of the Korean Hand Texturizer. This model uses coal, charcoal or fuel oil.

Status of Commercialization: Ready for commercialization.

Contact Address: International Institute of Protein Food Technology (IIPFT)
Meals for Millions Foundation
1800 Olympic Boulevard,
P.O. Box 680
Santa Monica
California 90406
USA

GARRI-PROCESSING MACHINERY

Deecription: Equipment for processing of the Nigerian etaple food garri.

Technical and Economic Details: The equipment developed will enable mass production and therefore price reduction of this food. It consists of machinery for peeling, grating, de-watering, screening, gas-generation from coal and frying.

Status of Commercialisation: Patents have been obtained. A limited production has been taken up. Semi-mass production is being planned.

Contact Address: Mr. J.I. Chinedo
Ag. Secretary
Projects Development Institute
P.O. Box 609
Enugu
NIGERIA

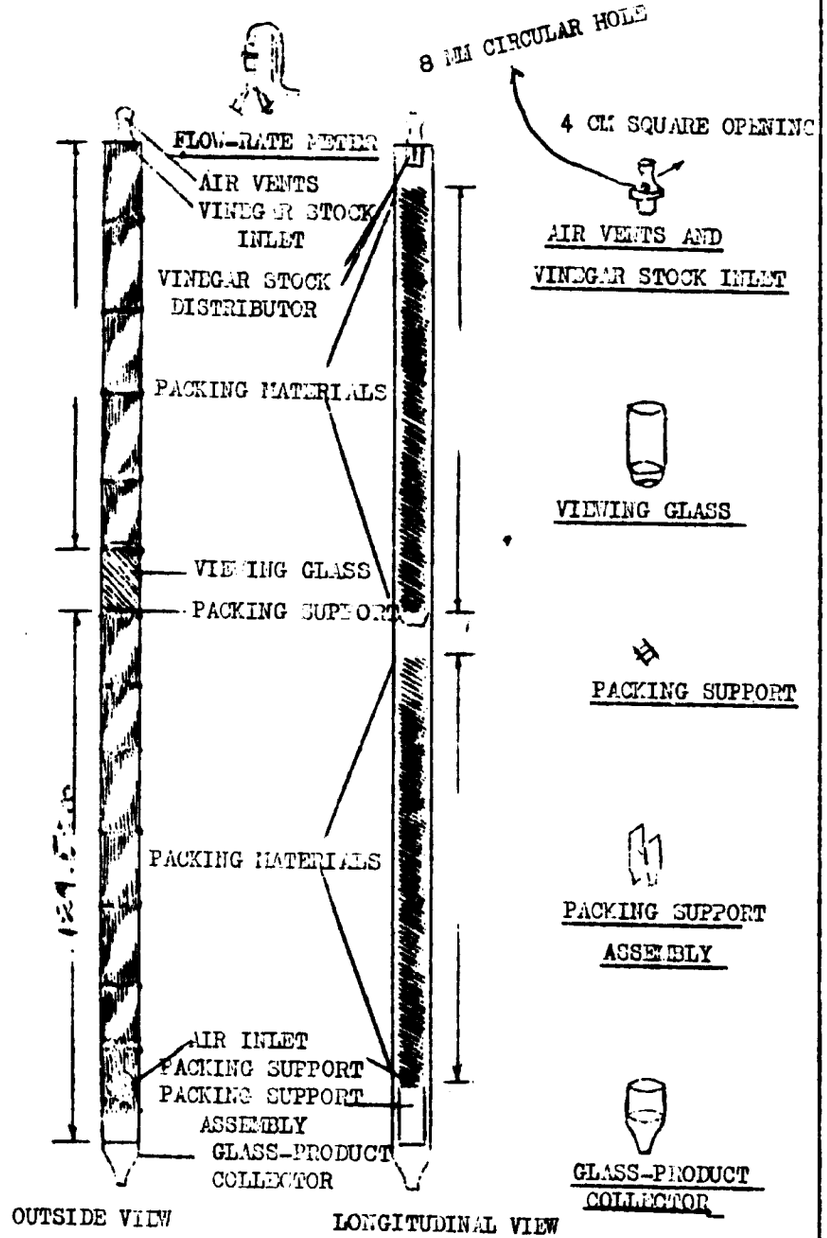
008560

VINEGAR FROM COCONUT WATER

Description: Production of vinegar of a suitable acidity from coconut water ("Generator Process") in a shorter period with the help of a bamboo generator.

Technical and Economic Details: Filter fresh coconut water through muslin cloth or coarse fabric to remove large particles of suspended dirt in a kettle. To ten liters of this filtered coconut water dissolve 1.5 kg. of brown sugar and then pasteurize for 20 minutes. Cool and transfer to the fermentation vessel. Add 5 grams Fleischmann's yeast. Allow this solution to ferment until the vigorous bubble formation stops. This is the alcoholic solution.

To start vinegar production, close the air inlet of the Vinegar generator and trickle down 4 litres of actively fermenting vinegar or laboratory prepared inoculum into the generator for three days. The vinegar generator is made up of a bamboo column about 8.5 cm. (inside diameter) and 2.3 meters high, packed with 0.85 kg. of moist coconut coir fibres. Decant or siphon the upper layer of the alcoholic solution in the fermentation vessel carefully, so as not to disturb the sediment at the bottom of the container. Transfer 10 litere of the solution into the reservoir or container placed on top of the previously inoculated vinegar generator. Trickle down or feed into the vinegar generator the contents of the reservoir at the rate of 0.75 to one liter per hour. Recycle the product collected at the bottom of the generator until an acidity of approximately 6% (total acidity) is obtained. See that the air inlet of the vinegar generator is fully open during the above operation. Pool the resulting clear vinegar and pasteurise or age and then pasteurise depending on its intended use, prior to bottling.



THE BAMBOO VINEGAR-GENERATOR WITH ITS ACCESSORIES

Status of Commercialization: Production is on a semi-commercial scale only.

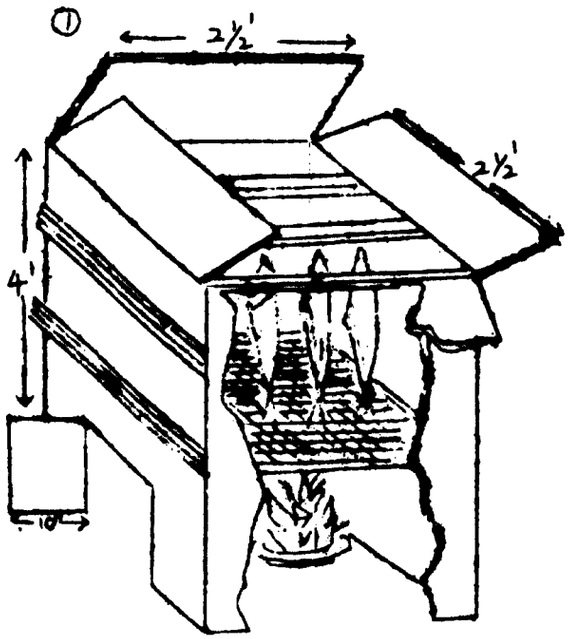
Contact Address: Dr. Vedasto R. Jose, Commissioner
National Institute of Science and Technology
P.O. Box 774
Manila
PHILIPPINES

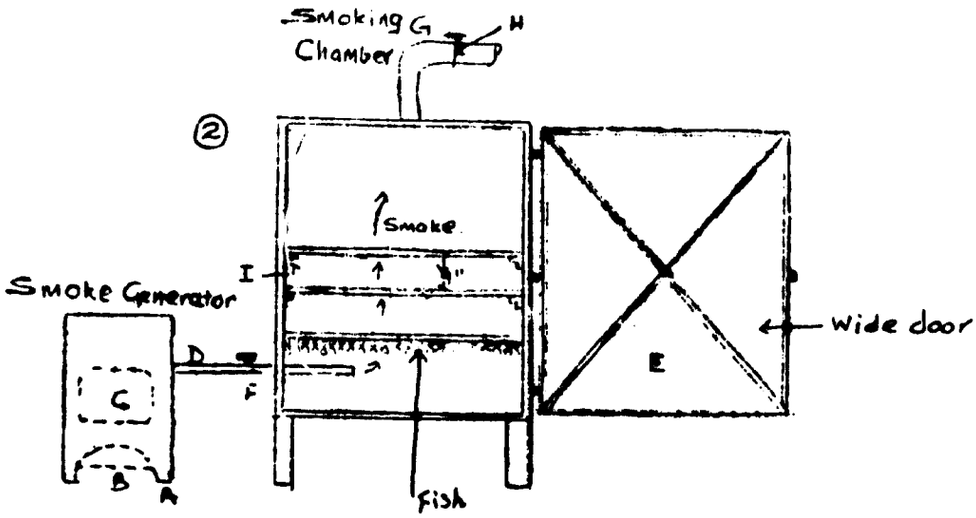
CHAMBER FOR SMOKING FISH

Description: Low-cost equipment for smoking fish.

Technical and Economic Details: The chamber can hold about 100-300 lbs. of fish at a time depending on the variety and size of the fish. The total cost of the unit does not exceed Rs. 500 - and the product obtained is of very high quality.

HOME-SCALE SMOKING UNIT





The fish are hung on pieces of wire in a wooden smoke chamber into which smoke is introduced, produced by a smoke generator.

Status of Commercialization: Ready for commercialization.

Contact Address: Industrial Development Board of Ceylon
Katubedde
SRI LANKA

1.6 Agricultural machinery and implements

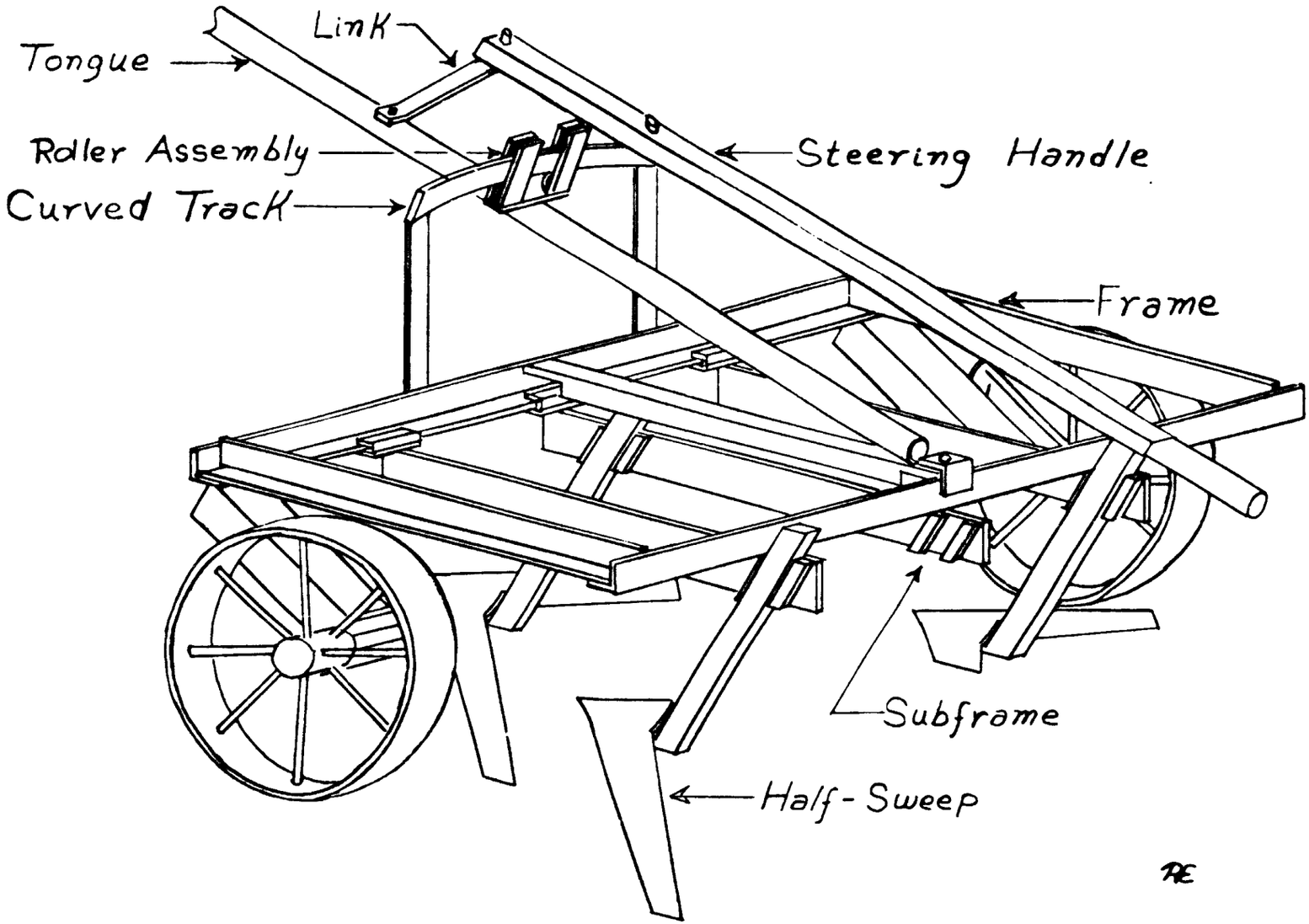
MOCHUDI TOOLBAR

Description: Multi-purpose agricultural machine ("MAKGONATSOTLHE").

Technical and Economic Details: To the ox-driven toolbar almost any type of cultivation tool can be attached and it can also be used for carting or transporting drums of water. By removing some of the components from the toolbar a walking model can be created which allows inter-row cultivation when crops are taller. With this machine a new appropriate tillage system may be realized. At the same time the toolbar can also be fitted with a mouldboard plough and also as a two-row planter so that it can be used with conventional methods too.

The multi-purpose machine consists of an iron frame on two wheels and several implements. The full range of implements are carried on transverse subframes which clamp onto the edge of the angle iron frame. Since subframes can be positioned anywhere along the width of the frame, either one or two planter units may be used at row widths varying from 75 cm to 100 cm. Other tools can likewise be positioned as desired for prevailing circumstances. All of the bolts used in assembly and adjustment of the components are the same size, 12 mm., so that only one size spanner is required.

The frame of the toolbar can be raised and lowered according to the working depth required. A planter unit incorporates the seed metering drum, the seed press wheel, the chain drive and an open drag. The fertilizer applicator consists of a metering device and subsoiler shank with a tube extending down the back to deliver the fertilizer deep into the soil. The unit is designed so that it can be used in combination with the planter. The disk hillers may be used both for throwing away the soil from the plants and for ridge building. Full sweeps may be fitted for stubble mulching. With the tool frame in full down



THE MOCHUDI TOOLBAR

position it is at a very convenient height for carrying water drums or other goods. By fitting floor boards and sides the toolbar becomes a scotch cart capable of carrying 500 kg. A walking implement can be assembled, which can be used for inter-row cultivation.

As well as being extremely versatile, the toolbar incorporates a number of additional features that aid crop productivity and quality. The toolbar will:-

- reduce soil erosion through maintaining the crop residues as a surface mulch,
- conserve moisture also by leaving the surface mulch and tilling only the top ten millimetres of soil,
- control weeds with the use of the Texas style sweeps in combination with disk hillers,
- increase germination and reduce seedling mortality. (A lister share ahead of the planter, will allow the seed to be placed in the moist oil.),
- imbed the seed firmly in moist soil before covering with the seed press wheel,
- make better use of fertilizer through applying the fertilizer below the seed when planting.

A report and a complete set of drawings are available.

Status of Commercialization: The toolbar is used in Botswana since 1973.

Contact Address: Mochudi Farmers Brigade
Box 208
Mochudi
REPUBLIC OF BOTSWANA

008563

MINI THRESHER

Description: Small thresher for dwarf paddy varieties and wheat.

Technical and Economic Details: The machine consists of a threshing cylinder and concave, based on the axial flow principle. Lightweight machine mounted on 2 wheels for easy transport. A two-man crew is needed for feeding the machine and for transporting bundles to it. It is powered with a 5 HP kerosene or 3 HP diesel engine.

Threshing output per hour: wheat : 280 lbs.
paddy : 560 lbs.

Price of the thresher: Rs. 6500 without engine

Status of Commercialisation: May be ordered from producer (see contact address)

Contact Address: Mr. Manohar L. Gill
Bethlehem Technical Foundation (Trading)
P.O. Box 435
Rawalpindi
PAKISTAN

008564

MACHINE FOR DECORTICATION OF SESAME SEED

Description: Very effective method for decortication of Sesame seed.

Technical and Economic Details: Simple labour-intensive process requiring capital investment of Rs. 20 000.

Status of Commercialization: Ready for commercial exploitation.

Contact Address: The Director
Ceylon Institute of Scientific and Industrial Research
P.O. Box 787
Colombo 7
SRI LANKA

008565

RICE THRESHER

Description: Machine for threshing rice and similar dry plants.

Technical and Economic Details: The machine is driven either by pedal or by bicycle. The frame of the machine is wooden. The model is the adaptation of a Chinese thresher. The conditional use for dry groundnuts or soya beans is possible.

Productivity is 35 kg/hour (with pedal) and 60 kg/hour (with bicycle). The threshers are sold by CENEEMA for 20.000 F. (with pedal) and 25.000 F. (bicycle driven) respectively.

Status of Commercialization: The machine is commercially produced.

Contact Address: Centre national d'etudes et d'experimentation du machinisme agricole (CENEEMA)
B.P. 1040
Yaoundé
UNITED REPUBLIC OF CAMEROON

008566

CORN SHELLER

Description: Very simple tool for manual corn shelling.

Technical and Economic Details: There are 4 types available at a price of F.100 - 300.
The productivity of the tool is 10 - 20 kg/h.

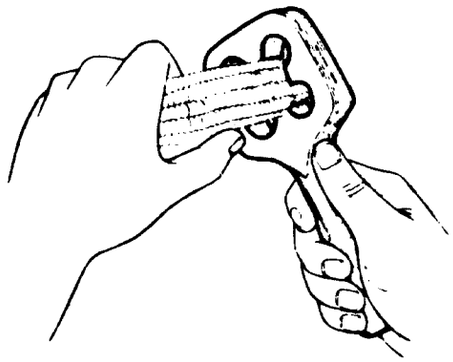
Status of Commercialization: The tool is produced and may be bought.

Contact Address: Centre National d'Etudes et d'Experimentation du Mechanism Agricole (CENEEMA)
Boîte postale 1040
Yaoundé
UNITED REPUBLIC OF CAMEROON

MAIZE SHELLER

Description: Simple hand-held tool for removing maize from the cob.

Technical and Economic Details: The equipment is made from hardwood and can be produced at the village level with simple tools. In use the maize cob is inserted, tip first, into the central hole and rotated with a screwing motion. This rubs the grain out of the cob without damaging or cracking it and without breaking up the cob itself. The grain produced by this method has very little chaff and is easily winnowed to clean it. Where maize cobs are variable in size - for example if both local varieties and hybrids are grown, it may be necessary to make two shellers of different size to cope with large and small cobs. Detailed information is available on request.



Status of Commercialization: The maize sheller is used in rural practise.

Contact Address: Tropical Products Institute
56/62 Grays Inn Road
London WC1X 8LU
UNITED KINGDOM

008568

MINI RICE MILL

Description: Small machine for rice milling

Technical and Economic Details:

The unit consists of paddy cleaner, sheller, separator, and polisher. The sheller is of centrifugal type and is more suited for milling mixed paddy varieties and fresh paddy with higher moisture content. The bran obtained is pure and has high oil content. The equipment requires very little space for installation and can be installed in paddy growing areas.

Operating capacity	500 kg of paddy/hour
Cost of the unit	Rs. 30 000
Size of unit	6' x 4' x 12'
Processing cost of paddy	Rs. 35/tonne

Status of Commercialization:

Process is applied commercially.

Contact Address:

Mr. C.P. Natarajan,
Deputy Director
c/o Central Food Technological Research Institute
Cheluvamba Mansion
Food Technology P.O.
Mysore - 570 241
INDIA

MAIZE MILL

Description: Small machine for processing of maize.

Technical and Economic Details:

Maize, both white and yellow varieties, can be processed into products such as grits, soya, flour, bran and germ fractions using suitable dry milling techniques. The maize mill developed at C.F.T.R.I. consists of precleaning, destoning, conditioning, degerming and grinding operations.

Capacity	400 kg of maize/hr.
Fixed capital	Rs. 125 000 (for plant and equipment)
Processing cost	Rs. 68 per tonne

Status of Commercialisation:

The prototype design is available for commercial fabrication in the form of blueprints.

Contact Address:

Mr. C.P. Natarajan,
Deputy Director
o/o Central Food Technological Research Institute (C.F.T.R.I.)
Cheluvamba Mansion
Food Technology P.O.
Mysore - 570 241
INDIA

008570

SOLAR ENERGY POWERED CROP SPRAYER

Description: The sprayer involves the use of minute quantities of herbicides or insecticide and the energy for spraying is provided by the sun, using silicon photo-voltaic cells and a battery of Ni-Cad cells.

Technical and Economic Details: The photo-voltaic generator comprises a panel, about 33cm^2, equipped with 38 semi-circular silicon cells, 7.5 cm in diameter, connected in series - to deliver about 6 watts at 12 to 14 volts. Cells are rated at a conservative 100 mW/cm^2 light intensity to deliver, each, 500 mA at 0,45 V. The panel is protected by a blocking diode. It also serves as sunshade for the operator and only weighs 1.2 kg. Eight Ni-Cad cells in the handle of the sprayer are series connected and at full charge deliver 1.2 V each (total 9.6 V) with a capacity of 4.0 Ah. They function both as a voltage stabiliser, maintaining a constant 7000 rpm and also to store the considerable excess power generated by the panel during periods of medium to bright sun-light (3 to 6 Watts) over the requirements of the motors in the sprayers (0.8 to 2 Watts). In continuous operation for eight hours a day, seven days a week, the batteries were found to be as full of charge as on the first day.

The advantages of this technology lie in the very light equipment, the reduced quantity of chemical solution necessary (15 litres per hectare instead of some 500 litres), and in the fact that no labour for pumping the sprayer is required.

Status of Commercialization: No details provided.

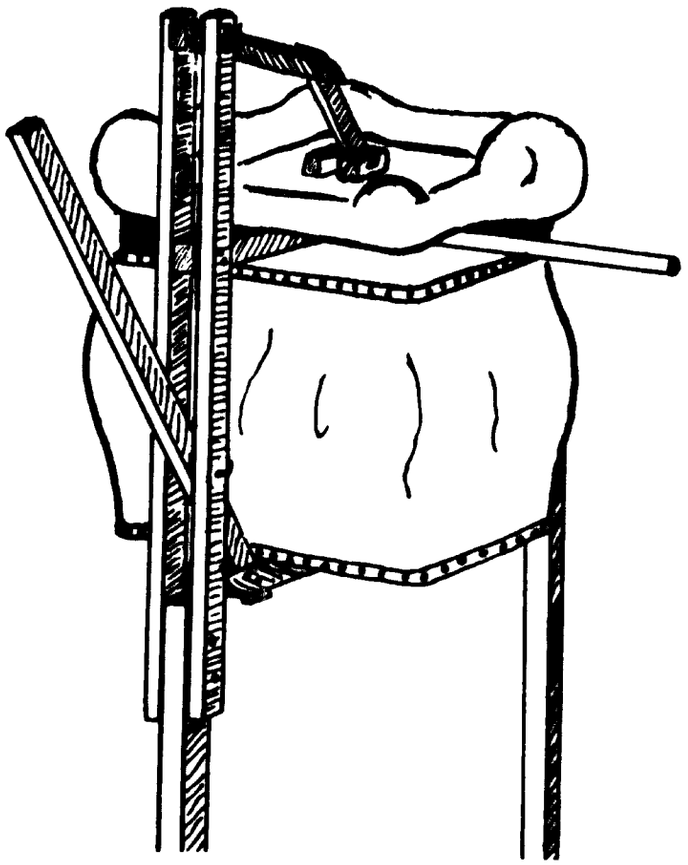
Contact Address: Dr. Ray Wijewardene
International Institute of Tropical Agriculture (IITA)
Ibadan
NIGERIA

1.7 Light engineering and rural workshops

BELLOWS FOR BLACKSMITH

Description: Low cost method for making a blacksmith's bellows.

Technical and Economic Details: Guided by a step-by-step manual everyone is able to construct a bellows with local materials, such as inner tubes of normal car tyres, plywood, nails and pieces of thin sheet metal. Flaps of simple rubber (from inner tubes of tyres) work as valves. The bellows are hand-operated and cost about US $3.



Status of Commercialisation: Bellows constructed according to this method are in use. The design may be used by all persons interested.

Contact Address: South Pacific Appropriate Technology Foundation
P.O. Box 6937
Boroko
PAPUA NEW GUINEA

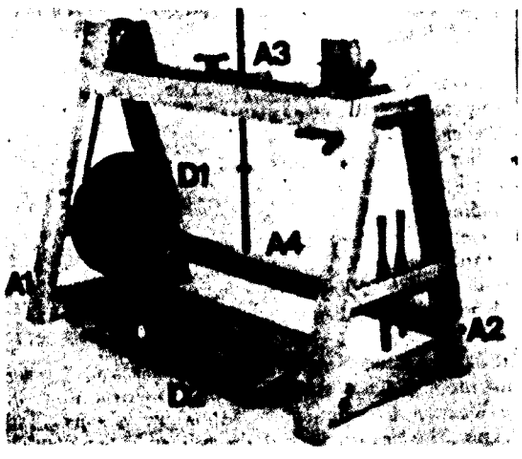
08571

WOODEN LATHE

Description: Wooden lathe for the use of workshops for the manufacture of wooden articles.

Technical and Economic Details: The machine can be used for sanding, drilling, line painting, hot ironing, lacquering, polishing. It is capable to handle pieces of wood up to 95 cm long and 30 cm in diameter. The design is adapted for use by Mexicans (average height 1,67 m. average weight of 65 kg.).

The lathe is formed of 2 pairs of legs (A1 and A2), the bed (A3) and the strut (A4). The headstock is of rigid construction and has a pulley with three speeds, 50, 75 and 100 mm diameter. A standard shaft with a no. 1 tapered hole in each side permits the use of different standard attachments such as faceplates, chucks, etc. In each side of the headstock, one sealed, self-aligning ball-bearing is bolted with 8 mm bolts.



Working a short piece of wood held by a small faceplate and using the short toolrest

The tailstock supports the long toolrest without interferring with its movement. It runs all along the bed and is held down in position with a wing nut.

The moving system uses a flywheel (D1) made in cast iron because its weight makes the movement smooth and constant and this material is suitable for setting the bearings. The manufacture of this flywheel is possible in many villages. The pedal (D2) is of the rocking type and it is 1 metre long, permitting working all along the bed of the lathe.

The headstock and the bed must be made of hardwood. The lathe can be operated by human power but also by a 1½ H.P. motor when available.

Status of Commercialization: Ready for commercialization.

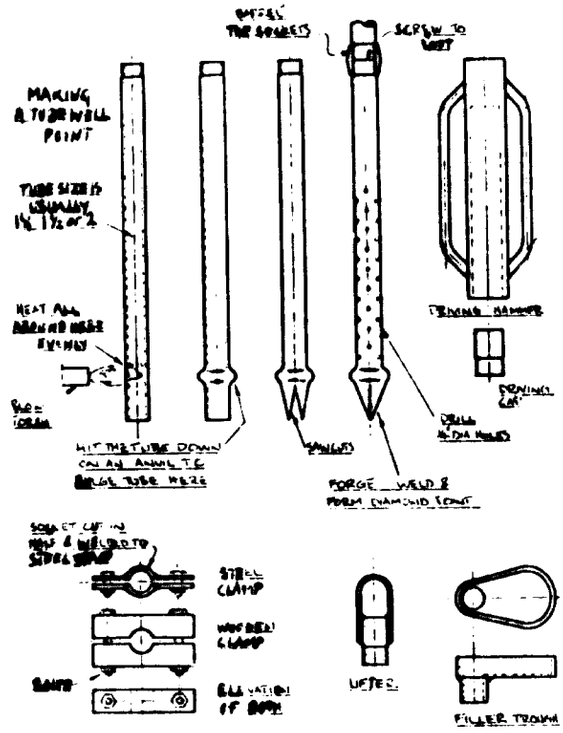
Contact Address: Emilio M. de Velasco
Central School of Art and Design
Mexico City
MEXICO

DRIVEN TUBEWELL

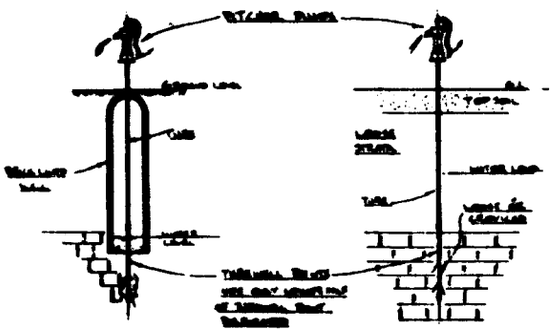
Description: Simple and effective tubewell consisting of a piece of perforated pipe with closed and pointed end.

Technical and Economic Details: The pipe is driven down into the ground. Another unperforated tube is screwed on top and that is driven down, too. The process is repeated until the perforated end has entered and penetrated the aquifer to the desired degree. A pump is screwed on the top and water is drawn up the tube itself.

The tubes usually are not smaller than $1\frac{1}{4}$" or larger than 2", though tubes up to 4" are occasionally used. The pipe sections are 3 to 5 feet in length, the perforated area usually extends only 1 to $1\frac{1}{2}$ feet up from the point and consists of drilled holes of 3/16" or $\frac{1}{4}$" diameter.



Details of tubewell point and tools



Typical arrangements of driven tubewell (not to scale)

It is reasonable to hope for yields of about 300 gallons per hour from a 1¼" tubewell and 800 from a 2" one.

Any kind of suction pump can be used, either drawing directly or from a pipe hanging down inside the tubewell. The usual size of a well is too small to take a deepwell type pump. In practice this means that the suction limit of tubewell is about 20 feet.

The well has the advantage that water can only enter the tube through bottom perforations thus excluding polluted water from upper layers.

Status of Commercialisation: No details received.

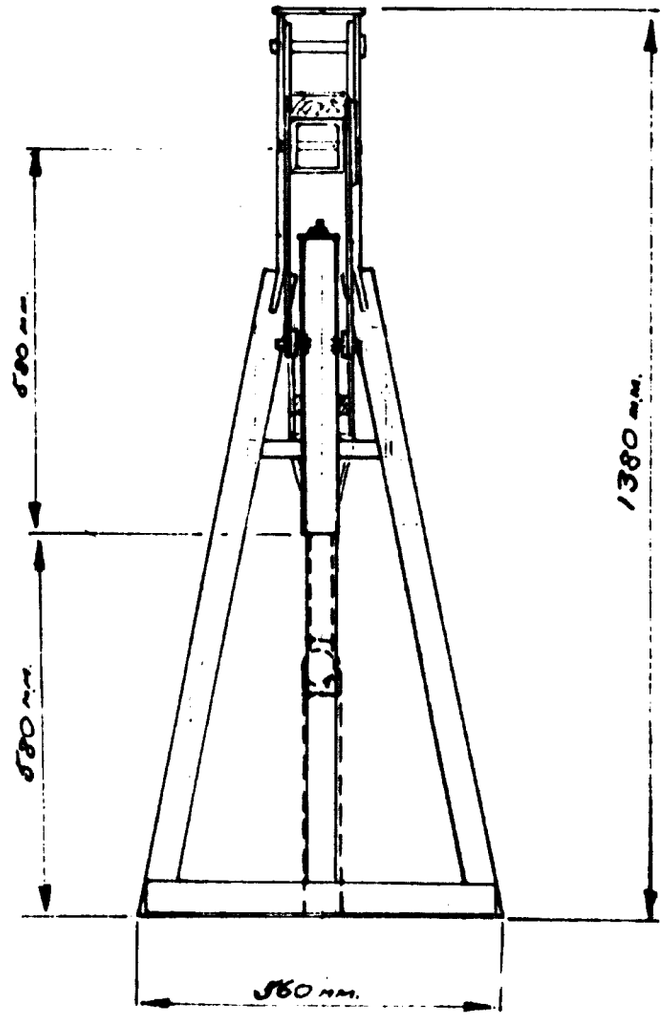
Contact Address: J.C.P. Allsebrook
Intermediate Technology Development Group
Water Panel
9 King Street
London WC2E 8HN
UNITED KINGDOM

008573

BOSWELL WATER PUMP

Description: Equipment for pumping water from medium-depth wells in conjunction with an imported pumping cylinder.

Technical and Economic Details: The pumping head equipment is an all steel construction, except for wooden limit stops. The two main pivoting points have greasable bearings with toughened steel pins.

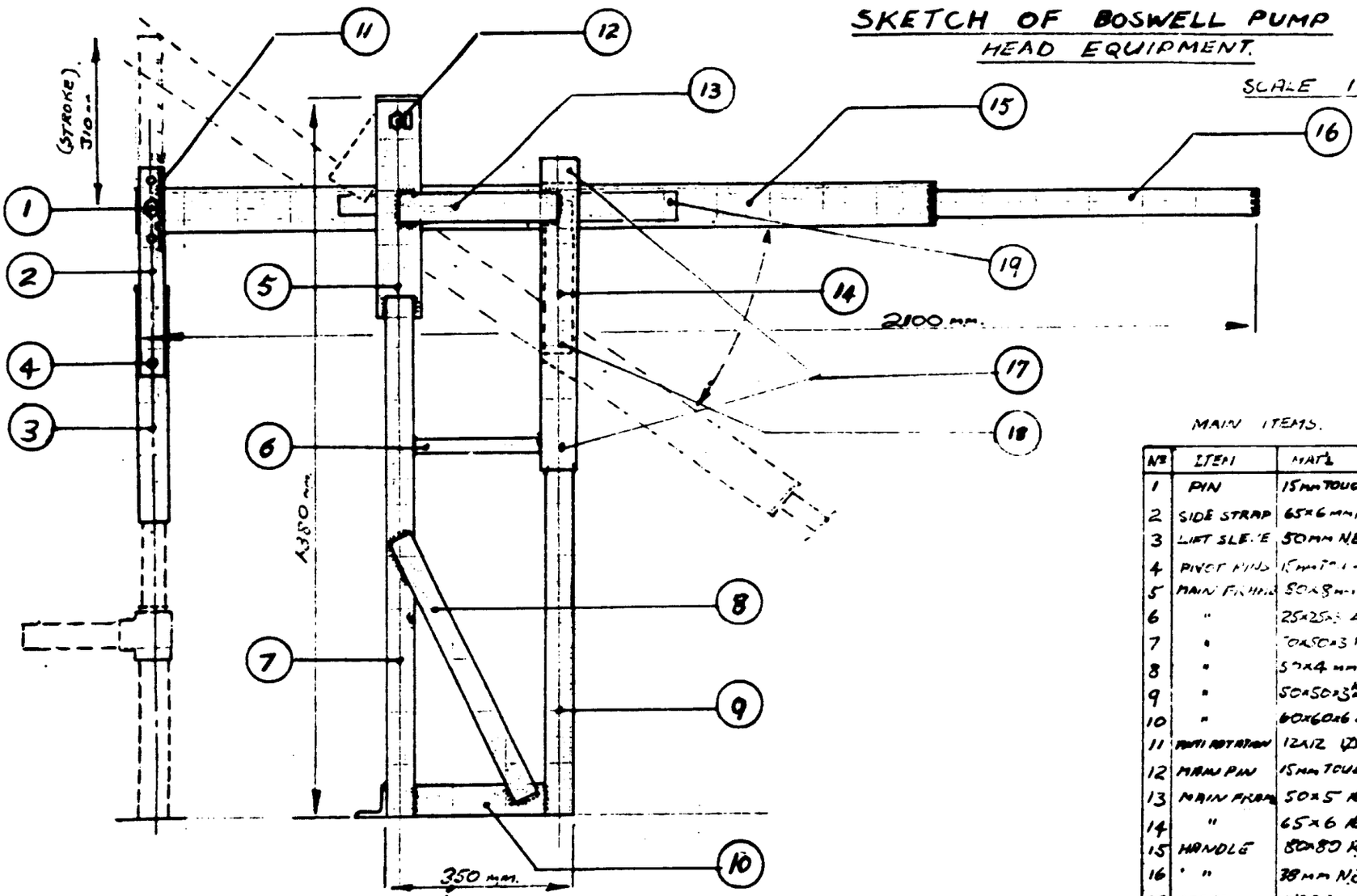


FRONT VIEW

BOSWELL PUMP HEAD EQUIPMENT

SKETCH OF BOSWELL PUMP
HEAD EQUIPMENT.

SCALE 1:10



MAIN ITEMS.

NO	ITEM	MAT'L	QTY
1	PIN	15mm TOUGH STEEL	1
2	SIDE STRAP	65×6 mm M.E.	2
3	LIFT SLEEVE	50mm N.B.	1
4	PIVOT PINS	15mm TOUGH STEEL	2
5	MAIN FRAME	50×8mm M.E.	2
6	"	25×25×3 ANGLE	3
7	"	70×50×3 RHS	2
8	"	50×4 mm M.E.	2
9	"	50×50×3 SHS	1
10	"	60×60×6 ANGLE	3
11	PIPE ROTATION	12×12 SQ	1
12	MAIN PIN	15mm TOUGH STEEL	1
13	MAIN FRAME	50×5 M.E.	2
14	"	65×6 M.E.	2
15	HANDLE	80×80 RHS	1
16	"	38mm N.B.	1
17	STOPS	WOOD	2
18	WEAR PLATE	50×4mm M.E.	2
19	"	65×6 mm M.E.	2

The equipment is designed for pumping water up from 90 metres, using a 12 mm N.B. pipe pump rod and a 50 mm bore pumping cylinder. By adjusting the size of the pumping cylinder and lightening the pump rod, greater depths with smaller flow rate - or more shallow depths with larger flow rate - can be worked. Maximum force on the pump rod end of the handle should not exceed 300 kg. The handle can be counter-balanced by filling it with concrete, or by bolting on weights through a hole provided in the hand-held end.

The lifting sleeve, which can slide over a 38 mm N.B. pipe, is screwed into the top of the delivery pipe, and the well is then sealed against human and animal pollution. A watertight seal could be fitted to this 38 mm pipe, around the pump rod, allowing water to be pumped higher than the head equipment.

The equipment is mostly installed in remote areas where simple construction, using locally-available light machinery and materials, durability and ease of maintenance are key factors. In Addis Ababa the pump can be produced at a price of US$ 250 in the workshop of the programme.

Status of Commercialization: Such pumps are installed in many areas of Ethiopia.

Contact Address: Miss Annelle Winter
Kale Heywet Development Programme
P.O. Box 4181
Addis Ababa
ETHIOPIA

008574

CUPOLA FURNACE FOR MANUFACTORY ENGINEERING

Description: Melting facility as a substitute for old low shaft furnace in local foundries.

Technical and Economic Details: Generally because the majority of local foundries are small and medium-sized, the cupola furnace of 14 inches diameter, with an approximate melting rate of 750 kg/hr., is more suitable for iron production. Because of its small diameter, its design must be sectional to facilitate maintenance of refractory lining after each run. To lower the cost of construction, the cupola is a simple design and has no complicated facilities such as hot blast or O_2 enriched blast air etc. to attach to the conventional one. The capital investment hence includes only the design, construction and test run. Since the Cupola furnace's simple construction can be made locally at a low cost and is easy to handle and maintain, it is suitable for foundries where large capital investment is not available. The careful operational control coupled with an appropriate molding technique and design, allows good castings with high grade metal quality such as ductile iron to be produced economically as compared to the electric furnace operation where the price of electricity is costly.

Status of Commercialization: This type of furnace, at present, is being used in iron foundries for the commercial manufacture of a variety of cast iron products such as machinery parts and components which have been hitherto imported. The design and operational service are available to interested parties on the basis of research contracts.

Contact Address: Applied Scientific Research Corporation of Thailand (ASRCT)
196 Pahonyothin Road
Bangkhen
Bangkok
THAILAND

MANUFACTURE OF MATCHES

Description: Small-scale production unit to satisfy local demand for safety matches.

Technical and Economic Details: The production unit is thought to manufacture 50 gross matchboxes per day (7.200 matchboxes), employing eight full-time or 15 part-time workers.

Capital required per workplace is Rs. 700. (A work place in a normal, automatic plant costs Rs. 90 000.) The total production cost of one matchbox, including duty is about Rs. 0.126 in Pakistan. The fixed capital for one unit with 15 part-time workplaces is about Rs. 5 500.

Status of Commercialization: Production has started in one plant.

Contact Address: Government of Pakistan
Appropriate Technology Development Organization
1-B, 47th Street, F-7/1
Islamabad
PAKISTAN

1.8 Oils and fats

FAT LIQUORS FOR LEATHER PROCESSING

008576

Description: Processes for the production of blends of emulsifying agents like sulphated oils and neutral oils (vegetable, animal marine and mineral) which find extensive applications in the processing of leathers.

Technical and Economic Details: The scope for the production of standard products from indigenous oils like sardine fish, pongam coconut and caster etc. is very great and the Central Leather Research Institute has developed processes for the manufacture of fat liquors. The processes envisage the sulphation of clarified oils of required specifications under standard conditions which vary with the type of oil for the specific types of fat liquors to be produced. The sulphated products are washed free of sulphuric acid and neutralized to the required pH. These are blended suitably with other oils and ingredients wherever necessary. Testing and quality control at different stages starting from the raw material stage are very essential to maintain the standard of the product. Both the oil and finished products are to be of specific quality. These standards have to be specifically adhered to so that tanners get products of uniform quality.

Status of Commercialization: Ready for commercialization.

Contact Address: Dr. T.S. Ranganathan
Central Leather Research Institute
Sardar Patel Road,
Adyar, Madras - 600020
INDIA

008577

SILICONE OILS PRODUCTION

Description: Process to produce methylsilicone oils from dimethyldichlorosilane.

Technical and Economic Details: Dimethyldichlorosilane can be polymerized by hydrolysis to produce cyclic or linear dimethylpolysiloxanes with relatively low molecular weights. These silicone oligomers may be further polymerized by heating in the presence of acid or base catalysts. The molecular weights and viscosity of the silicone oils produced depend on the amounts of the chain stopping agent, hexamethyldisiloxane, used in the catalytic polymerization reaction.

Silicone oils are very stable in heat and cold, very inert to chemical agents, and thus used for a variety of industrial purposes; for example, as dielectric fluid, hydraulic fluids , release agents, antifoamer, water repellants, etc.

Silicone resin, silicone rubber, and semi-conductor silicone, besides silicone oils, are other products of the silicon chemical industry. The raw materials for the silicon chemical industry are silica, salt, and hydrocarbon, which are all readily available from domestic sources.

Status of Commercialization: Ready for commercialization.

Contact Address: The Korea Institute of Science and Technology
P.O. Box 131
Dongdaemoon
Seoul
KOREA

008578

SYNTHETIC PINE OIL FROM TURPENTINE

Description: Process for the production of synthetic pine oil as an alternate source for scarce natural pine oil.

Technical and Economic Details: The process developed by the Shri Ram Institute for Industrial Research is a novel attempt to use local turpentine with a comparatively low pine oil content for the production of synthetic pine oil. The process in brief consists of partially isolating the pine oil fraction, followed by reaction with alcohol in the presence of a catalyst. Since the plant was established by the licencee, M/S. Prabhat General Agencies, details about investment are only available from them.

Status of Commercialisation: The process is under commercial production since 1960. The process is covered by Indian Patent No. 69344.

Contact Address: M/S. National Research Development Corporation of India
61 - Ring Road
Lagpatnagar - III
New Delhi - 110024
INDIA

008579

INTEGRATED PROCESSING OF SESAME SEED

Description: Production of edible oil and protein concentrate from sesame seed.

Technical and Economic Details:

Commercial quality sesame seed is cleaned. The cleaned seeds are chemically treated under optimal conditions, washed and decuticled. The decuticled seeds are expeller-pressed to get edible oil and cake. The expeller cake is solvent to yield edible grade sesame flour. This is further ground and classified into protein concentrate.

Production capacity	10 tonnes of raw material/day
Fixed capital	Rs. 2 900 000
Working capital	Rs. 1 350 000
Cost of production	Rs. 1200/tonne

Status of Commercialization:

Process is applied commercially.

Contact Address:

Mr. C.P. Natarajan,
Deputy Director
c/o Central Food Technological Research Institute
Cheluvamba Mansion
Food Technology P.O.
Mysore - 570 241
INDIA

008580

OIL FROM SHARK LIVER

Description: Process for the extraction of oil and for the preparation of vitamin A concentrate.

Technical and Economic Details: During investigations on edible fish it was discovered that the oil of shark liver was several times richer in vitamin A than cod liver oil. A process for the extraction of oil and the preparation of vitamin A concentrate was developed.

Status of Commercialization: The process is commercially used since 1962.

Contact Address: Pakistan Council of Scientific and Industrial Research
Press Centre
Shahrah-e-Kamal Ataturk
Karachi 01090
PAKISTAN

008581

SUBSTITUTION OF DIESEL OIL BY VEGETABLE OILS

Description: Substitution of fossil fuels by renewable fuels.

Technical and Economic Details: Unrefined peanut oil can be used in diesel engines alone or mixed with mineral oils. Castor oil can be used with ethanol and an ignition additive. A technical report is available at IPT.

Status of Commercialization: Ready for commercialization.

Contact Address: Eng. Nedo Eston de Eston
Instituto de Pesquisas Tecnológicas do Estado de São Paulo S/A -(IPT)
P.O. Box 7141
01000 São Paulo - SP -
BRAZIL

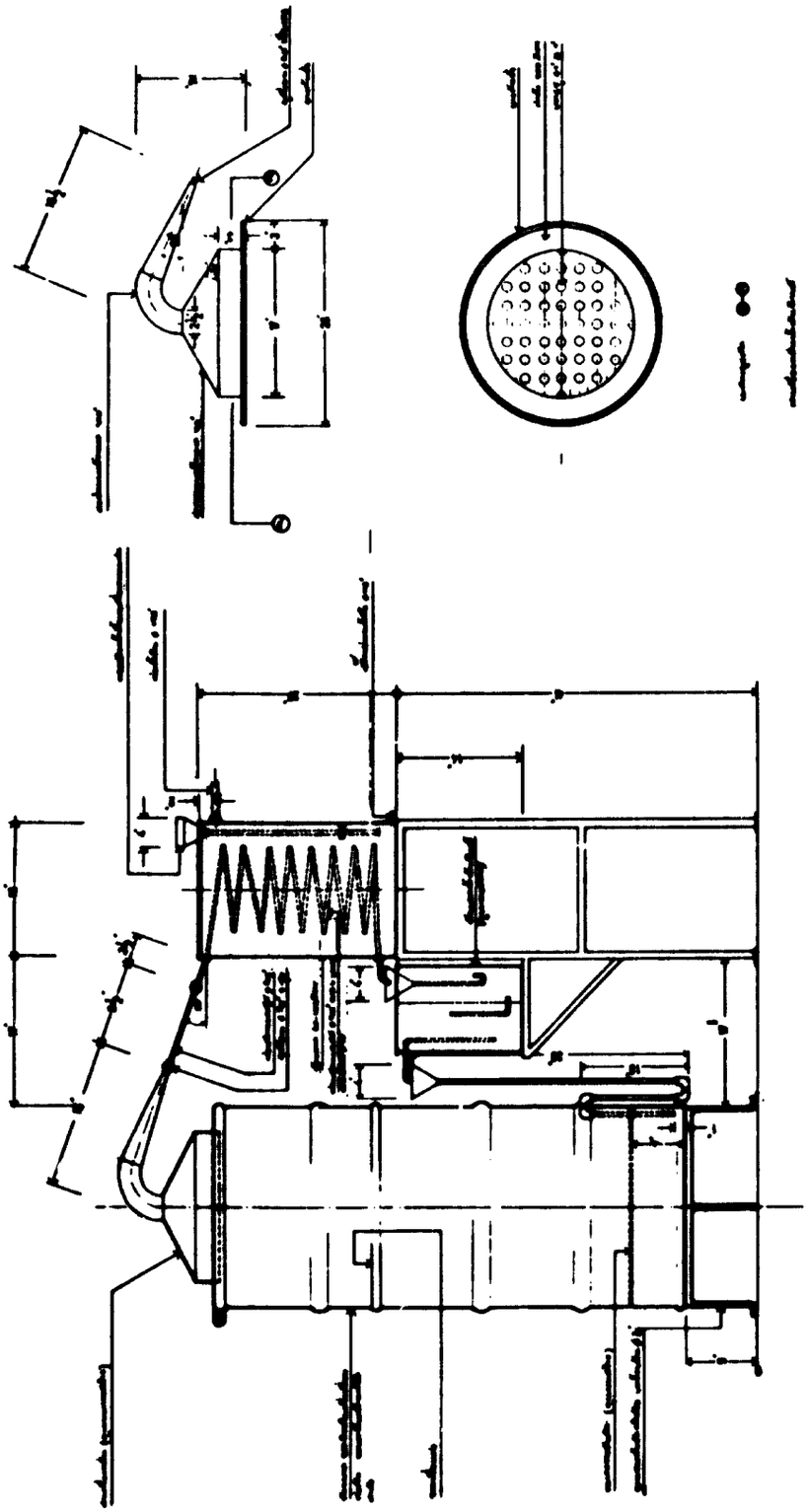
PORTABLE ESSENTIAL OIL DISTILLATION UNIT

Description: Equipment to distil essential oil from leaves in mountainous areas.

Technical and Economic Details: The still is made of one and a half 200 litre oil drums welded together. The condenser is made of stainless steel. The stove could be modified to use wood, spent hay, rice husk, etc. This unit would cost about US$ 200. if manufacture is in Thailand. (A diagram of the destillation unit is presented on the following page.)

Status of Commercialization: The product has been utilized commercially but there is no intention to apply for any patents or any other licenses.

Contact Address: Nitasna Pichitakul, Director
Project Development Department
Applied Scientific Research Corporation of Thailand
196 Phahonyotin Road
Bangkok 9
THAILAND



PORTABLE ESSENTIAL OIL DISTILLATION UNIT

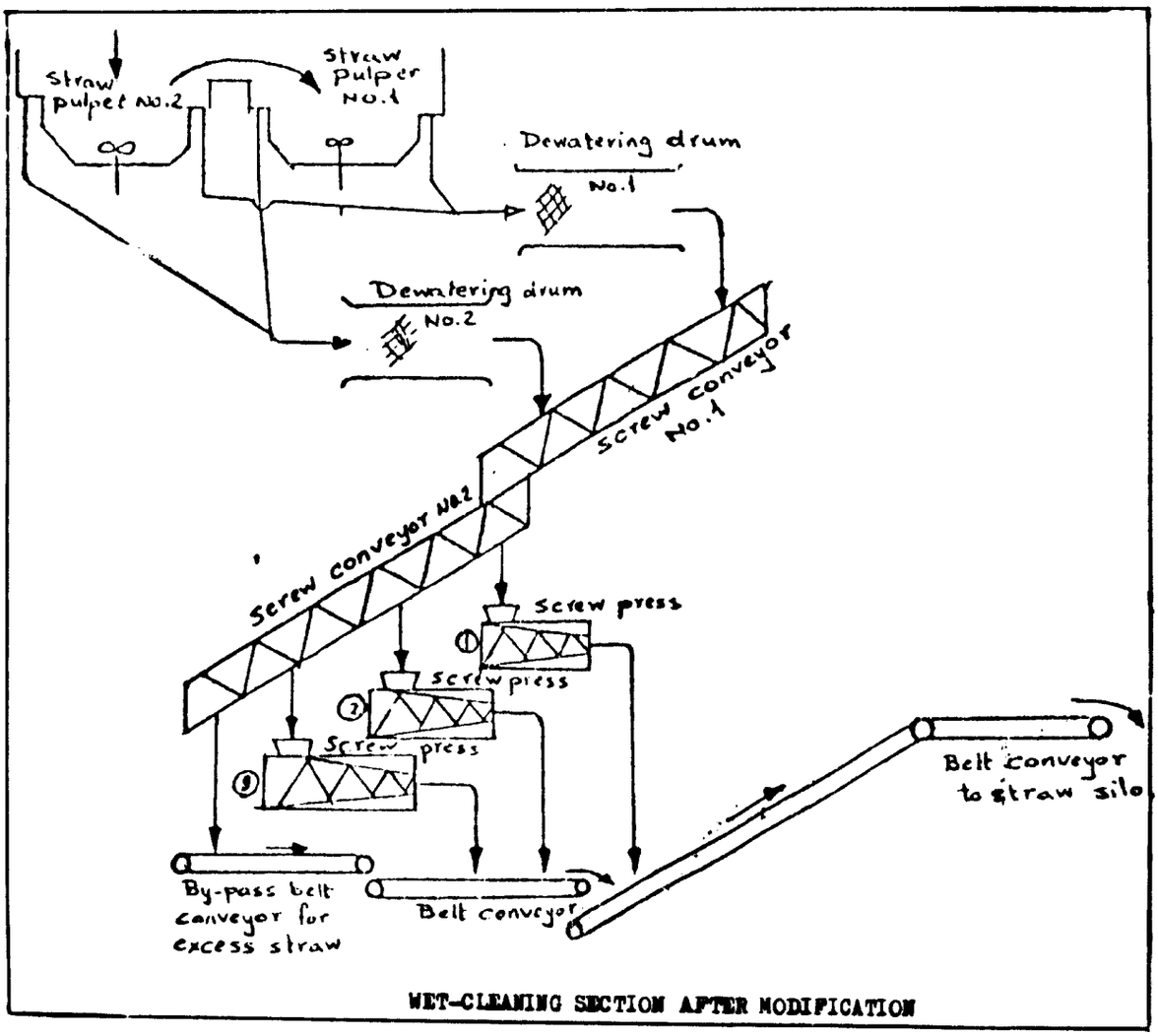
1.9 Paper products and small pulp mills

PULPING OF RICE STRAW

008583

Description: Techniques for the production of pulp from rice straw.

Technical and Economic Details: For the production of bleached pulp for fine paper, it is essential to remove a substantial part of the nonfibrous cells and extraneous materials from rice straw. A new technique for efficient cleaning and upgrading of this raw material has been developed.



WET-CLEANING SECTION AFTER MODIFICATION

This new technique, "the wet-cleaning" of rice straw, was first applied at RAKTA Pulp Mill in 1961 and further developed since then. Over the past 13 years of mill

experience, the wet-cleaning technique has proved the following advantages:

a) An increase in the overall pulp yield by about 2%;

b) A reduction in cooking chemical by about 2% based on straw;

c) A better use of the capacity of the digester by about 15% is achieved. Moreover, the packing of the digester is higher than when using dry straw;

d) A reduction of the silica content of the straw due to the removal of a good part of the leafy and extraneous materials in the wet-cleaning system;

e) The resulting pulp from the wet-cleaned straw has a higher freeness, which leads to easier washing of the pulp in ensuing processes such as the brown stack washers and bleaching washers;

f) The wet-cleaning system opens up the straw, which makes the pre-impregnation with cooking liquor efficient;

g) The removal of leafy and extraneous materials from the straw leads to better bleaching of the pulp, these desired materials if still present would have consumed bleaching chemicals uselessly. Practically, about 15% of the chlorine consumed in the bleaching process is saved by introducing the wet cleaning system;

h) The strength properties of the pulp are appreciably improved.

Although the initial cost for wet-cleaning facilities is about $US 2,000 greater per daily ton of production than for dry cleaning, the advantages of wet cleaning at Rakta mill surpass their greater expense.

A short-cycle pulping process (3 h at 7 atm) has been the development which resulted in raising the production capacity of the pulp mill. In addition, the cooking chemicals are reduced to about 10% NaOH on straw (instead of 13%). Furthermore, the bleachability of the pulp is improved and thus the bleach chemicals are reduced.

Another advantage of this process is that the pulp produces more opaque paper sheets, by virtue of the higher silica content retained in the pulps. This has led to a reduction in the fillers added in papermaking and to save savings in hard currency needed to import such fillers. Consequently, the cost per ton of pulp is considerably reduced.

It has been found that these pulps differ appreciably in their dewatering property. The reed and bagasse pulps are much freer and drain more easily than rice straw pulp. By blending rice straw pulp with reed or bagasse pulp and studying the bleaching characteristics of such pulp blends the following results are obtained:

a) Improving the dewatering property of rice straw pulp;
b) Increasing the capacity of the bleach plant;
c) Raising the efficiency of the pulp washers and thickeners;
d) Reducing the bleach chemicals, water and power;
e) Producing uniform bleached pulp blends with better strength properties.

Status of Commercialisation: These techniques are applied on a commercial basis.

Contact Address: The Director
General Company for Paper Manufacturing (RAKTA)
El Tabia
Alexandria
EGYPT

008584

PULP MAKING FROM RICE STRAW

Description: Dilute ammonia process of making pulp from agricultural residues such as rice straw, bagasse and grass family plants.

Technical and Economic Details: Existing processes for rice straw and agricultural residue are expensive because caustic soda and sodium sulphite are used which cannot easily be recovered and result in inevitable pollution if the wastes are indiscriminately discharged into rivers.

The new process developed in Malaysia is different in that ammonium hydroxide is used and digestion takes place in a pressurised vessel heated by coils carrying steam. Previous attempts of this type elsewhere had failed because concentrated ammonium hydroxide was used in the mistaken belief that it is a weak alkali at high pressure and temperatures. Actually, vapour pressure problems prevented reaching a workable temperature at safe pressures.

This problem was solved by using dilute ammonia (2% - 7%) together with catalytic agents which permitted temperatures of 140/150 degrees Centigrade to be reached at pressures of 150/200 psi. Cooking time under these conditions is less than one hour as against 15 hours previously.

Straw or bagasse is cut, washed and fed to the digester and a solution of ammonium hydroxide is filled into the digester and heated under pressure. The non-fibrous material like lignin and carbohydrates etc. dissolve or swell up into jelly. After the digestion the pressure is released through a recovery unit for collecting the ammonia and the digester is put under vacuum until no ammonia remains. The pulp, now free from ammonia, is run out into washers, refiners, bleachers and other specialized plant before being made into sheets. If a paper plant is adjacent to the pulp mill the pulp is mixed with various fillers, sizes, waterproofing compounds and pumped into the paper making section for conversion to paper. Black liquor wastes are

evaporated to dryness and used as fuel or sold for various purposes.

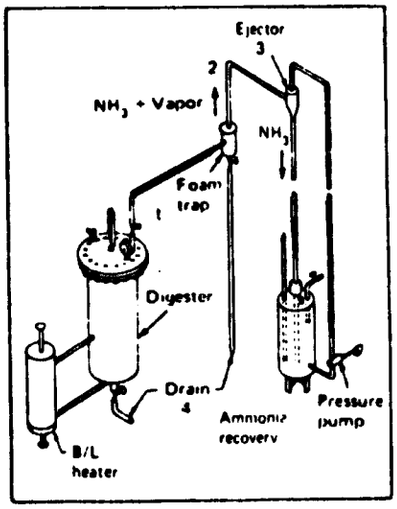


Fig. 1. Experimental 50-liter digester for the dilute ammonia process with NH_3 recovery unit.

The new ammonia pulping process provides these advantages:

1. Cost of pulp production is low compared with conventional chemical processes, because of the recovery of the ammonia.
2. Cellulose fibre is not affected by ammonia and therefore the pulp is much stronger than soda and sulphate pulp.
3. Variation of yield of pulp is obtained by adjusting the ammonia concentration and cooking time; reduced boiling time gives a large yield, by partial removal of lignin etc.
4. The lignin-rich residual black liquor normally available in this process contains a higher concentration of solids, and requires less heat to evaporate to dryness.
5. Ammonia does not attack any silica in plant tissues or entrained silica hence evaporation of black liquor is straightforward.

6. If the digestion temperature is low and the raw materials are cereal straws or grasses, the evaporated residues from the black liquors are so pure that these can be used as animal feed additives.
7. The lignin residues also may be utilized as fuel, fertilizer, plastic filler, wood adhesives, base for alcohol manufacture and for other uses, solving the problems of disposal and attendant pollution.

Status of Commercialization: The process is covered by patents in several countries while in other countries patents are pending.

Contact Address: Industrial Patents (M) Sdn. Bhd.
905A, Ene Plaza
128, Jalan Pudu
Kuala Lumpur
MALAYSIA

USE OF AGATHIS LORANTIFOLIA FOR PAPER PULP

Description: Use of potential softwood species, Agathis Loratifolia, as raw material for paper pulp.

Technical and Economic Details: The sulphate process and C-E-H-H bleaching sequence was used during the investigation. The pulping behavior was relatively good, with a rather low yield (44-48% pulping yield) and the physical properties were comparable with other softwood species like Pinus Merkusii. Using 20% of this Afathis pulp with 80% of imported short fiber pulp (LBKP), 28 gr/m^2 of writing printing paper were produced with good results.

Status of Commercialization: This process has been utilized commercially in a paper mill. No patents have been obtained yet.

Contact Address: Lembaga Penelitian Selulosa (Cellulose Research Institute)
Jln Raya Dayeuhkolot 158
Bandung
INDONESIA

DACRIDIUM SPP FOR PULPWOOD

Description: Utilization of Dacridium sp. for pulpwood and for manufacturing cement bag paper.

Technical and Economic Details: Dacridium spp, as a softwood (average fiber length 5.47 mm) is a potential species for reforestation in South Kalimantan. R and D was made to study its suitability for manufacturing wrapping paper as well as kraft paper for cement bags. Laboratory as well as pilot plant scale studies were carried out using sulphate process. It seems that with adequate refining, a strong wrapping paper could be produced which is comparable with kraft paper for cement bags.

Status of Commercialization: This process has been applied commercially at a paper mill to produce wrapping paper.

Contact Address: Lembaga Penelitian Selulosa (Cellulose Research Institute)
Jln. Raya Dayeuhkolot 158
Bandung
INDONESIA

EUCALYPTUS SALIGNA FOR DISSOLVING PULP AND ITS VISCOSE RAYON MAKING

Description: Utilization of Eucalyptus species for dissolving pulp and its viscose rayon making.

Technical and Economic Details: The experiments were carried out by using sulphate process proceeded by water prehydrolysis, and gave relatively good pulp yield with low pentosan content, but with rather a high ash content. The dissolving pulp obtained is comparable with imported dissolving pulp. Rayon stable fiber was made from it and no significant problem arose during the spinning.

Status of Commercialization: This process has not been utilized commercially since no rayon industry exists in Indonesia. No patents have been obtained yet.

Contact Address: Cellulose Research Institute
Jln. Raya Dayeunkolot 158
Bandung
INDONESIA

USE OF RUBBER TREE FOR PULP AND PAPER

Description: Utilization of old rubber trees for pulpwood for manufacturing of writing and printing paper.

Technical and Economic Details: As the rubber tree (Hevea Brasiliensis) contains latex, problems arise during the pulping process; i.e. clogging on the screens, etc. By using the sulphate process, or any process containing sulfur, the latex was not sticky and the removal by screening became easier.

The sulphate process and soda-sulfur process were used in this investigation.

Status of Commercialization: This process has been utilized commercially in a paper mill for the production of duplicating paper (cyclostyle). No patents have been obtained yet.

Contact Address: The Director
Cellulose Research Institute
Jln. Raya Dayeuhkolot 158
Bandung
INDONESIA

008589

PAPER PULP MOULDING SYSTEM

Description: System for the production of paper pulp moulds such as egg trays, egg boxes, meat trays, seed pots, wine bottle pack,fruit trays, etc.

Technical and Economic Details: This technology has been developed by Development Techniques (the engineering subsidiary of Intermediate Technology Development Group Ltd., London) and the commercial company Tomlinson (at present sale licensee).

The process consists of the following steps:

1. A pulp preparation machine breaks the paper down into its constituent fibres and disperses them uniformly in water together with small quantities of soluble wax and aluminium sulphate.
2. At this stage the moulding machine immerses a forming mould into the pulp and by vacuum draws water through the mould to leave a mat of fibres on its surface. The water is recycled to be used again in the preparation of more pulp.
3. The wet moulding is removed from the forming mould by means of a transfer mould using vacuum and compressed air.
4. In the final stage of the process the excess water is removed by a drying machine.

The hot air drying system gives controlled drying of the mouldings. The air is heated by steam, electricity, gas or oil. The drying system is designed to recirculate up to 90% of the air and is thus very efficient in the use of fuel.

The small-scale equipment produce from 180 30 egg trays/hour up to 2,000 30 egg trays/hour according to packaging needs and the corresponding type of machins. As raw material, clean newspaper can be used.

Status of Commercialization: A licence has been issued. A transfer of its manufacture under an agency (and, ultimately, a licensing) arrangement to India and Brazil is being negotiated.

Contact Address: Tomlinsons (Rochdale) Ltd.
Newhey Road
Milnrow, Rochdale
UNITED KINGDOM

1.10 Energy for rural requirements

008590

BICYCLE-POWERED WATER PUMP

Description: A commercially available water pump is driven by a single Vee Belt from the bicycle wheel rim.

Technical and Economic Details: The advantages of this equipment are its simple and solid construction, the fact that no energy is required and its low cost. The pump is able to furnish more than 3 gallons per minute by vertical distances up to 50 feet.

The pump has also been successfully tested being driven by a small ½ h.p. overshot water wheel providing a village water supply.

Status of Commercialization: This technology is being used.

Contact Address: Secretary
Pindiu Rural Development Association
Pindiu, Morobe Province
PAPUA NEW GUINEA

008591

DIAPHRAGM PUMP

Description: Water pump for low lift irrigation application

Technical and Economic Details: Foot-operated, paddle system with discharge of 55/60 gallons/min. at maximum head of 6 feet. Mild steel cylinder divided in two chambers with inlet and exhaust valves, mounted on a wooden frame.
Price: Rs. 1200.

Status of Commercialisation: May be ordered from producer (see contact address)

Contact Address: Mr. Manohar L. Gill
Bethlehem Technical Foundation (Trading)
P.O. Box 435
Rawalpindi
PAKISTAN

008592

DIAPHRAGM PUMP

Description: Mechanical device for lift irrigation.

Technical and Economic Details: The pump is relatively light and can be manually carried for field operations. Important features of this pump are design and fabrication simplicity, a 50-60 gallon capacity under low lift conditions and manual operation. The pump also exhibited the shortcomings of short life of the canvas bellows and potential rotting of the bellows during storage. Preliminary tests carried out by the IDB with the prototype developed, gave good results, showing that an average person could pump 50-60 gallons of water per minute against 6-8 ft. of water head. Rubber diaphragms of circular shape are not subjected to excessive stress concentrations and it is expected that they will have a satisfactory service life. The pump can handle muddy water with small solid impurities without any problems.

Status of Commercialization: Ready for commercialization.

Contact Address: Industrial Development Board of Ceylon
Katubedde
SRI LANKA

008593

HYDRAULIC RAM PUMP

Description: Pump without motor, actuated by the water itself.

Technical and Economic Details: The pump is made of simple galvanised iron pipe fittings and has been developed by the South Pacific Appropriate Technology Foundation. It has very few moving parts and is simple in construction. The construction requires only handtools and a drill press -- no special skills are required, no threading, machining brazing or welding.

This ram can pump several thousand litres of water a day over long distances and up to heights of 50 metres or more, using the energy of falling water. The The construction is described, step-by-step in a manual. In Papua New Guinea the construction of this pump costs K. 40.

Status of Commercialization: Ready for commercialization.

Contact Address: Appropriate Technology Development Unit
P.O. Box 793
Lae
PAPUA NEW GUINEA

008594

HYDRO-POWER FOR RURAL DEVELOPMENT

Description: Technology of small-scale hydro-electric power generation (10 - 100 kW).

Technical and Economic Details: The Intermediate Technology Development Group and a private company have developed new concepts and construction techniques which offer greatly improved economics for small turbine construction. At present they can offer pilot plants for use with heads of water either in a low range from 2-10 m, utilizing a propeller turbine design, or impulse turbines that are most effective with heads in excess of 20m. A turbine for the intermediate range heads is being developed.

Since the systems are intended for small-scale manufacture within the country of use they are to be applied in those countries with a considerable potential in terms of site availability for a continuing programme of micro-hydro-electric plant installation.

One of the innovative features of this system is the use of load control to avoid any need to vary the water flow to cater for fluctuations in power requirement. Instead, the turbine is set to carry its full water flow continuously and therefore produces the full rated electrical output from its alternator continuously; any surplus electrical power that is not required by the normal variable demand load is simply dissipated via a bank of electrical resistances which are capable of absorbing even the full output of the alternator at times when no electrical power is demanded. The necessary electrical switching can easily be arranged by using modern electronics, which allow extremely rapid responses to any change in demand compared with traditional flow control systems, however load control can equally be applied by other methods of switching, including even manual switching in some cases.

Because there is no need for "switching" the water supply (as with flow control), much simpler turbine designs can be used without gates, variable pitch blades or adjustable automatic valves, and also there is no need for a mechanical controller capable of providing the necessary control forces for automatic adjustment of valves.

An electronic load controller needs negligible power for switching, has no maintenance requirement whatsoever and costs in the range £200 to £1000 depending on rating and number of output phases. It is less expensive to install, is inherently more reliable, and has the potential for delivering more usable power from a given system if the load can be split between a primary demand circuit and a secondary "by-product" circuit. Load control does require that the alternator runs continuously at full power, but since it is normal to use a larger frame size than might be used in an equivalently rated engine powered system, it is possible to ensure that the system is in fact conservatively enough loaded to ensure very long life (of the order of 30 years plus) with only occasional maintenance. The extra costs of installing a rather larger alternator than in equivalent systems are more than recovered through the long amortisation period that can be allowed.

A simple but effective Pelton Wheel impulse turbine has been developed for any head of water in excess of 20m which - in connection with load control - can be 2 or 3 times as powerful as one with a spear valve needed with flow control. The Evans TTDC load controller (see Fig. 1), consists of a Triac electronic switching circuit, (one per phase of output is required), which is used in combination with a suitable ballast load circuit capable of absorbing surplus electrical power. Two or three nozzles (or even four) can be used giving proportionate increases in flow. This also allows a large measure of (manually applied) control to cover large seasonal changes in flow, as nozzles can be switched in or out by using simple gate valves.

As low and medium head turbines, propeller turbines have been adapted and an upward flow turbine with a vertical shaft proved to be the most favoured configuration. A turbine is being developed to replace the Francis Turbine for use on heads from 10 - 20m. It will use a similar flow path to the Turgo wheel but it runs partly as a reaction turbine.

ITDG is also quite independently developing a device that operates on zero head of water and utilizes no more than the kinetic energy of the flow of a river's current. This machine is in principle more like a windmill than a traditional turbine as it is not encased, but runs in free-stream supported either by a pontoon or in some cases sunk onto the bed of the river.

The aim was and is to produce systems in which as much as possible can be locally manufactured and where the quality is such that long and reliable operational lives can be expected. It should be added that turbine construction will only require machine/welding shop facilities of the kind that are commonly available and that, at least initially, the alternator, control equipment and other electrical components will probably be more economically imported than manufactured locally. Special care is to be dedicated to the choice of electrical appliances that will be powered by the system.

Status of Commercialization: The propeller turbine system and the controller were both successfully installed in plants in the United Kingdom and in some developing countries. ITDG is looking for opportunities for joint projects in developing countries.

Contact Address: Intermediate Technology Development Group Ltd.
9 King Road
London WC2E 8HN
UNITED KINGDOM

008595

LOW-GRADE HEAT RECOVERY TURBOPACK SYSTEM

Description: Turbine working on acetone-based Rankine loop, with a turbine entry temperature of 60°C only. Heat may be delivered by waste heat from industries, chemical plants, geothermal energy or solar energy.

Technical and Economic Details: This technology permits the use of energy at a low temperature level, e.g. solar energy, and therefore may be used in rural areas. The system has a low power rating of 1 to 6 kW

Acetone is used as working fluid, which is easily available (in India), non-toxic and non-corrosive.

The Rankine cycle is operated around atmospheric pressure to simplify shaft sealing problems and to reduce disc friction loss at high speed.

One variant of the turbopack runs at 3000 r.p.m., directly driving a pump or an alternator, thus eliminating belt/gearing. This design which provides for almost hermetic sealing of the working fluid and also drives a condensate pump impeller mounted on the same shaft, is expected to offer long life, reliability and easy maintenance even in rural areas.

The estimated cost of this system is Rs. 15 000 per installed kW. If waste heat is available in the form of hot water or steam continously at a temperature of about 80°C and assuming 80% availability in a year and 20% of capital cost as annual charges for depreciation, interest and maintenance, such a system will produce electric energy at a cost of Rs. 0.50 per kW.

The economics of this system in conjunction with solar energy will be practically governed by the cost of flat-plate solar collectors.

Acetone-based Rankine loop : NAL, Bangalore

Status of Commercialization: Ready for commercialization.

Contact Address: National Aeronautical Laboratory (NAL)
Bangalore
INDIA

008596

WINDMILL FOR IRRIGATION

Description: Cheap and simple technology for subterranean water pumping for irrigation purposes using wind energy.

Technical and Economic Details: The pumping equipment has been designed to allow for a simple manufacture with cheap materials and by means of autoconstruction where this is convenient. The windmill has a sail diameter of 4.5 m with a pumping capacity of 60 m^3/day at a wind speed of 8 m/sec. during 4-5 hours/day. The estimated cost is US$ 1000 per irrigated hectare.

The technology has been developed by INTEC/CHILE for small farmers.

Status of Commercialisation: The technology is being tested at the pilot level and will be forwarded to interested persons free of charge.

Contact Address:
Corporación de Fomento de la Producción
Gerencia de Desarrolho
Casilla 667
Santiago de Chile
CHILE

08597

SOLAR WIND VENTILATED DRYER

Description: Solar-powered dryer for grains, vegetables, etc.

Technical and Economic Details: This technology was based on development work carried out in other countries utilizing solar dehydration for drying purposes. It is a chamber type with a wind-powered rotary vane suction and consists mainly of a solar collector connected to a drying chamber comprising six mesh shelves, each 4 x 3 sq. ft. in area. Actual temperatures recorded in the wet zone were between 50°C and 53°C. A temperature greater than 60°C is anticipated in the almost cloudless dry zone where a period of nearly nine months of the year is without rain. This equipment could be used for drying grains, vegetables, fruits and fish, making it possible to preserve the excess food materials in the villages at a very low cost.

Status of Commercialisation: Ready for commercialization.

Contact Address: Industrial Development Board of Ceylon
Katubedde
SRI LANKA

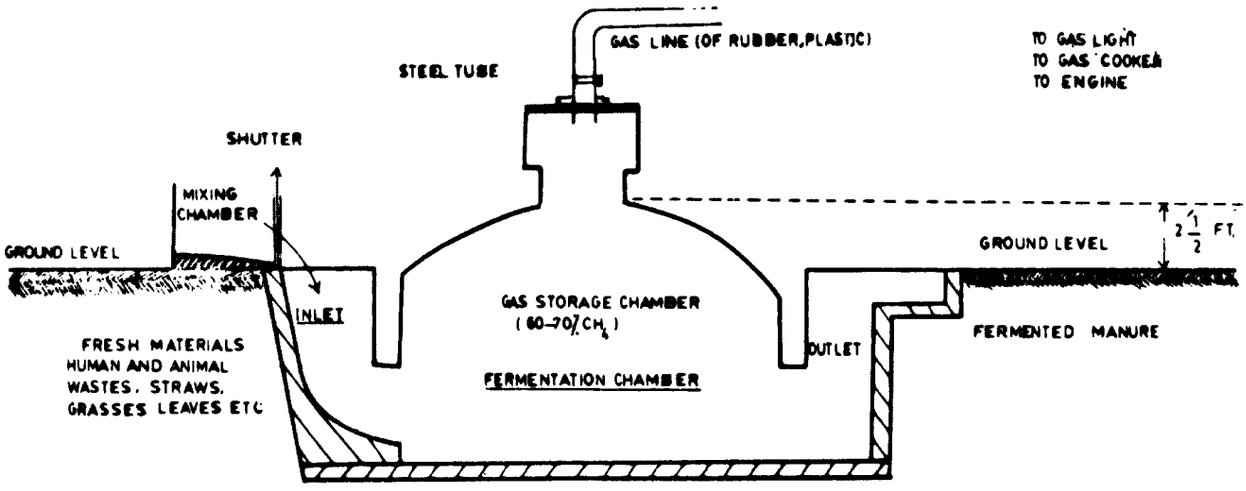
GOBAR GAS PLANT

008598

Description: Modified Chinese type bio-gas plant providing gas and fertilizer slurry. The gas holder may be constructed easily for a size of 10 to 100 m^3. The advantage lies in the easily available raw material (dung) and therefore in the very low running costs.

The construction of the gas storage chamber does not require skilled people. It is mainly made of bricks and cement. A plant of 10 m^3 with a daily production of 3 m^3 of gas covers the basic needs of one family. Five head of cattle are required for the production of the necessary dung. The fixed costs for the construction of the plant (bricks, cement, sand, gas pipes, burners, labour, technical assistance, etc.) are about Rs. 3000. The total annual costs (annual equipment and running costs) are about Rs. 500.

The medium lifespan of the plant is 30 years.



Status of Commercialization: Several plants of this design are successfully operating.

Contact Address: Government of Pakistan
Appropriate Technology Development Organisation
1-B, 47th Street, F-7/1
Islamabad
PAKISTAN

"LAKGEN" BIO-GAS GENERATOR

Description: Modified low cost bio-gas generator.

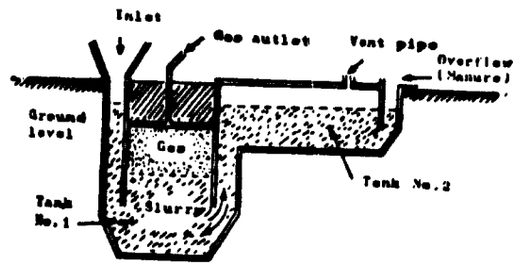
Technical and Economic Details: The traditional gas generator now in use has a floating gas holder made out of sheet metal by welding. The cost of the metal gas holder and the cost of fabrication according to present day prices have prevented a large number of interested individuals from erecting gas plants on their premises.

Efforts at the IDB to overcome this problem have culminated in the development of a simple foolproof generator made out of brick and cement which could be built by any village mason without much expert guidance.

This invention eliminates the metal gas holder. The main components are two brick static tanks. The cost should be within the reach of people with low incomes. In the suburbs of Colombo and even in the rural areas septic tanks are built near some of the houses to serve the drainage system. In such cases the 'Lakgen' principle could be used thereby solving the problems of fuel requirements. Its advantages are as follows:

1. The 'Lakgen' generator invented at the IDB could be used for a very long period without much attention.
2. It is very cheap in construction.
3. It develops a higher pressure than the earlier generator.
4. The efficiency is greater as the sludge is being automatically churned from time to time and the scum that is said to be interfering with some of the Indian plants will not arise.
5. The gas plant does not encroach on garden space as the tanks remain buried in the earth.
6. As there are no metal components only a mason's services are needed.
7. As it is made of cement there is hardly anything that needs replacement or repair.

'LAKGEN' BIO-GAS GENERATOR



The waste material such as cow dung, straw, household refuse etc. is fed with water from an inlet which comes down and gets collected in tank No. 1. The generation of bio-gas commences here. When the gas gets collected in tank No. 1, the pressure created thereby pushes the slurry into tank No. 2, which is at a higher elevation than tank No. 1. When the gas flows to the burner, the flow-back of slurry from tank No. 2 to tank No. 1 facilitates the outflow of gas.

Status of Commercialization: Ready for commercialization.

Contact Address: Industrial Development Board of Ceylon (IDB)
Katubedde
SRI LANKA

BIO-GAS GENERATOR

Description: Generator of methane using agricultural wastes and garbage with the isolated and screened bacteria as starter.

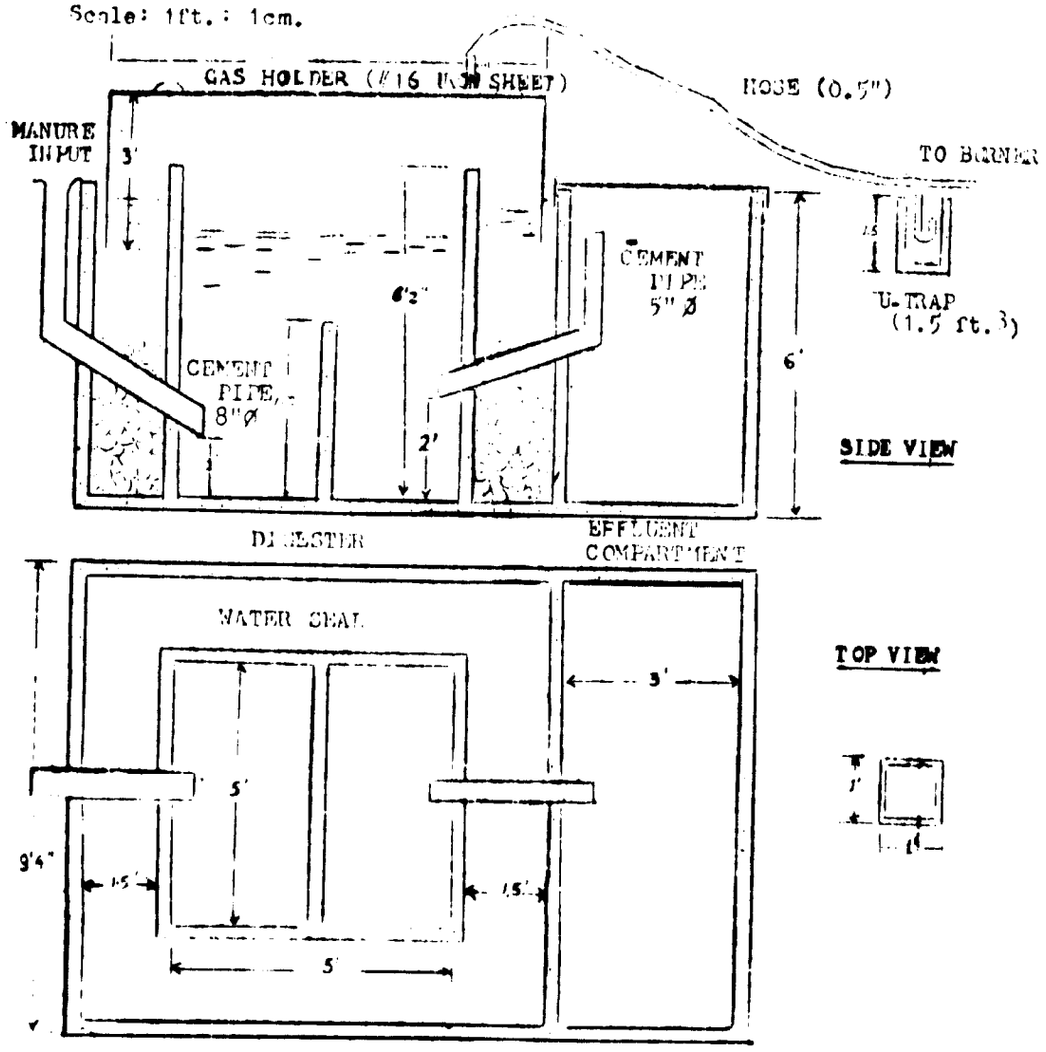
Technical and Economic Details: For a multiple unit of bio-gas digester, a minimum number of 20 (6 to 8 months old) pigs is necessary to supply the raw material (approximately 20 kg.) needed for gas production sufficient to sustain the daily fuel requirements of four families. A single unit digester is enough for a family and will need five pigs to supply the raw materials. If the generator is made of hollow blocks and cement, it is suggested that it should be water and gas proof and first be cleaned by placing water (half full) for a week. This will remove acids, carbonates and other chemical impurities which may cause detrimental effects on the bio-gas producing micro-organisms. Remove the water after one week and let the digester dry up for two days. Put the fresh manure and/or other decomposable material in the digester (charging) with two parts of water for every one part of manure. In the initial charging, 1/3 level of the digester must be filled up.

For a single digester, introduce 3 litres of methane-producing bacteria into a digester to serve as the starter. In the prepared starter are required for bio-gas production ten different selected bacteria. These selected bacteria were first grown separately on agar slants for about two weeks. The cultures are kept in an anaerobic chamber and maintained by regular monthly transfers. A nutrients solution was prepared and dispersed in half-liter bottles with tight screw-caps and sterilized at 15 psi for 15 minutes. Two-week old cultures in test tubes were suspended and mixed in the solution and incubated for a week at a room temperature of 28° to 30° until good bubbling was observed.

When in operation, the gas holder must always be water-sealed to prevent escaping of the bio-gas. Bio-gas could be obtained after 8 to 1? days from the time the first charging is done. The gas holder rises as the gasss accumulate in the digester.

Continue adding the decomposable material with the right amount of water everyday. For a single digester, a daily addition of 5 kg. of solid organic matter is necessary to supply the day-to-day gas consumption of an average family. For a multiple bio-gas digester, 20 kg. of wastes everyday and 4 liters of starter is needed to supply four families.

SINGLE UNIT METHANE GENERATOR



After continuous use for about a year, the digester should be cleaned by removing sediment and other undecomposed matter. For the resumption of the operation, the same procedure must be followed with a new batch of starter. Collect the sediment and use as fertilizer and soil conditioner for vegetables and other crops.

A plant based on 60 head of cattle or 45 pigs may produce 90-100 m^3 gas per day which, if used for the generation of electricity, would be equivalent to 80 kW per day or 10 kW for 8 hours (if used to drive, for instance, 1 or 2 corn mills) or 16 kW for 5 hours (or sufficient to illuminate a mile of road). The cost of material for the construction of a multi-unit amounts to about P. 4000 and for a one-unit to about P. 2000.

Status of Commercialisation: Several bio-gas generators of the described type are successfully in use.

Contact Address: Dr. Vedasto R. Jose
Commissioner
National Institute of Science and Technology
P.O. Box 774
Manila
PHILIPPINES

008601

CHARCOAL FROM BABAÇU NUT ENDOCARP

Description: Utilization of natural energetic resources by transformation of babaçu endocarp into high quality charcoal.

Technical and Economic Details: This process consists essentially of the following operations: Endocarp drying, granulometric classification and carbonization in a continuous vertical furnace with partial combustion of the endocarp itself by controlled air admission. Products originated from distilling are recovered, namely: tar, acetic acid, phenols furfural, alcohols, etc., and gases. The carbonized product is dried and classified by size. The charcoal can be used either straight or after pelletizing. Coke and/or active carbon can be also produced.

Status of Commercialization: After pilot plant production the implementation of the process on an industrial scale is being negotiated.

Contact Address: Instituto de Pesquisas Tecnológicàs do Estado de São Paulo S.A. (IPT)
P.O. Box 7141
01000 São Paulo - SP -
BRAZIL

1.11 Low-cost transport for rural areas

TRANSPORT BICYCLE

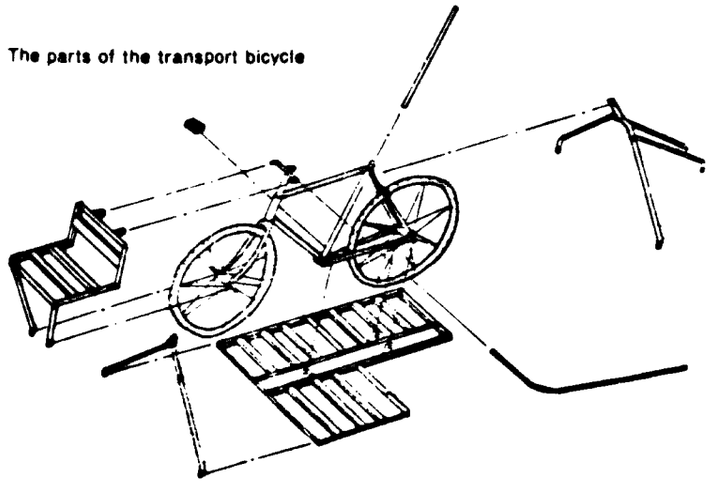
008602

Description: Bicycle with metal frame for carrying large loads.

Technical and Economic Details: A metal frame has been designed that can fit onto an existing bicycle for carrying loads of up to 200 kg. The operator walks alongside the bicycle which can be used in rugged areas inaccessible to cars and trucks.

The frame is welded and bolted together and then attached to the bicycle. The design has to be adapted to local requirements. The construction is straightforward, although some experience in machining, welding and working with metal will be necessary. The materials needed are a bicycle, an angle bar, tubing and wood strips. Dimensional drawings with text and photos are available.

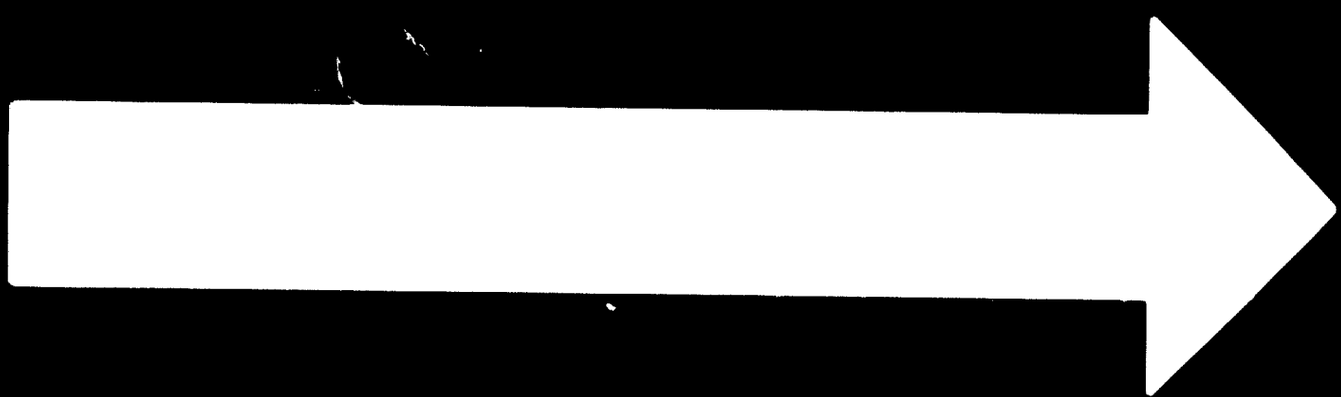
The parts of the transport bicycle



Status of Commercialization: The transport bicycle is being widedly used.

Contact Address: Liberation Support Group
P.O. Box 2099
Dar es Salaam
TANZANIA

G-12



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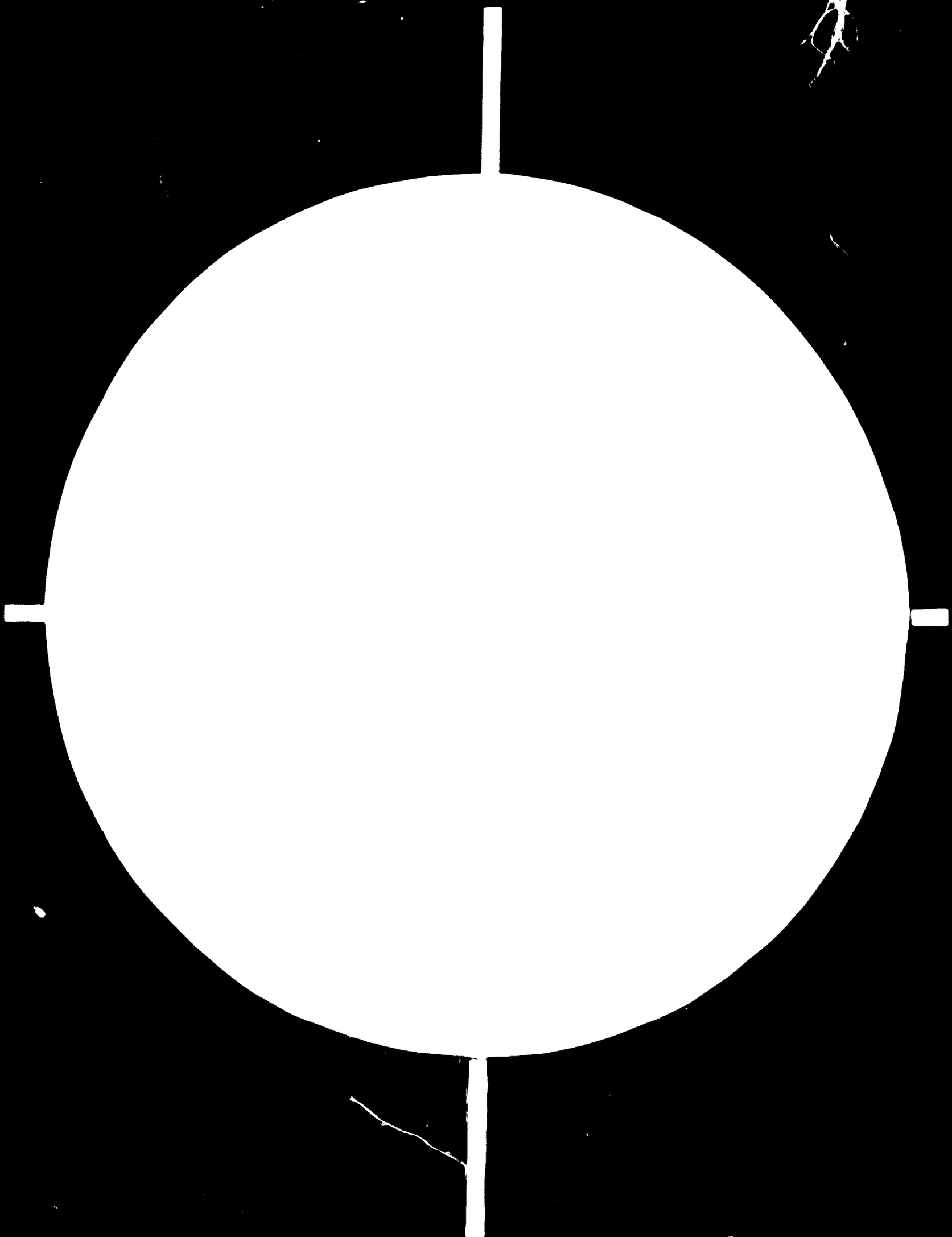

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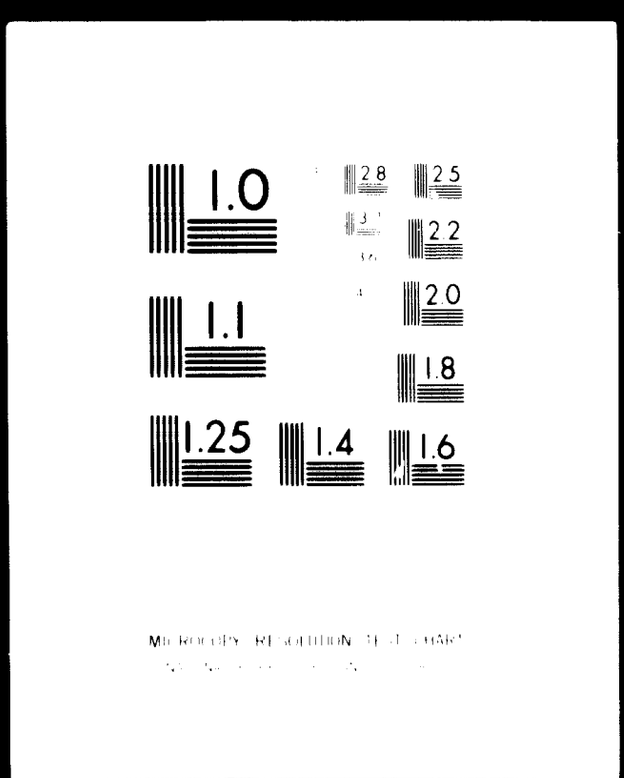
08605



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THREE-WHEELED VEHICLES

008603

Description: Simple three-wheeled vehicles for taxi and freight-handling serviced.

Technical and Economic Details: The three-wheeled vehicles are powered by two-stroke engines and are usually motor-scooter derivatives modified by the addition of two chain-driven back-wheels. In one instance a heavier commercial vehicle is built around a single front-wheel drive.

The four major producers in this field are:

(a) Bajaj Auto, Poona. Three-wheeled vehicles based on the Italian Vespa motor-scooter with a 150 cc engine, now manufactured with 98 per cent Indian components and spares. The three-wheeler is mainly used as a taxi, but the vehicle is also available in the form of a pick-up truck, delivery van and articulated trailer;

(b) Automotive Products of India, Bombay. Three-wheeled vehicles based on the Lambretta motor cycle, now effectively manufactured with 100 per cent Indian components and spares, with 175 cc engine. The vehicle is available in a wide range of forms, but is primarily supplied as the basic body and cowl for adaptation to the final purpose of the user;

(c) Bajaj Tempo, Poona. Three- and four-wheeled vehicles. The company was historically linked with Bajaj Auto but is now completely separate. The Tempo is a single front-wheel-drive vehicle derived from a Heinkel 395 cc engine based on an original design of a company in the Federal Republic of Germany, now effectively manufactured with 100 per cent Indian components. Unlike the motor-scooter derivatives, the Tempo has a fully enclosed driver's cab. Like them it is used for both passenger and goods carriage. The plant is now primarily engaged in manufacture of the four-wheeled Matador van;

(d) Scooters India Ltd. Lucknow. Two-wheeled and three-wheeled vehicles. The company, which is publicly owned, has acquired the Italian Lambretta plant. A separate foundry is under construction, and several semi-independent ancillary industries have been established. A research unit is working on the development of three-wheeled variants.

Status of Commercialization: The vehicles are commercially produced.

Contact Address: See the firms mentioned under (a) to (d), all in India.

ASIAN UTILITY VEHICLE

008604

Description: Simple vehicle designed for local conditions.

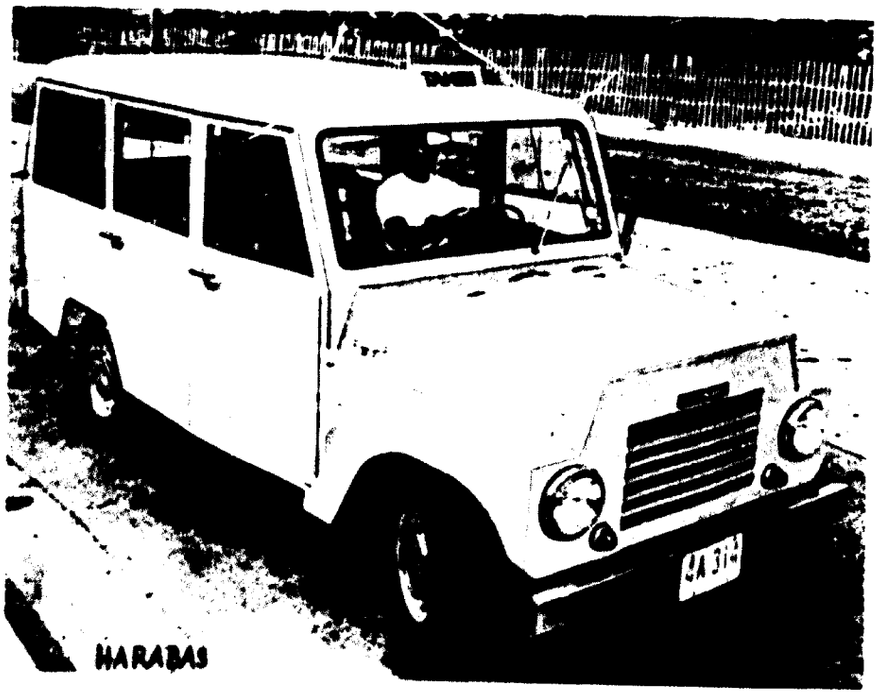
Technical and Economic Details: Five firms manufacture versions of the AUV. Basically a simple vehicle has been designed around a standard four-cyclinder engine. The chassis is simple and easily fabricated. Maximum use is made of flat body panels that require little forming other than simple banding, usually on a press brake. The development of the AUV has been actively encouraged under the Progressive Car Manufacturing Plan. The lead in the design for the vehicles came from the two major United States manufacturers, Ford and General Motors, both of which have subsidiary assembly companies in the Philippines. There is a comparatively low investment needed for facilities and equipment and a high degree of local labour and local material needed in the manufacturing and assembly operations.

In 1975, an estimated 12,500 AUVs were manufactured. The vehicles are all available as simple chasis and cabs (in some cases also as chassis and cowl), as low-side pick-up, as high-side pick-up (with or without canopy), as a van and as a Jeepney. The five main models are listed below:

(a) Fiera, manufactured by Ford Philippines at Rizal. Escort engine, 1,100-1,300 cc, imported, payload is 1200/1700 lbs, Philippine content 43 per cent, is also being assembled/built in Thailand and Taiwan.

(b) Harabas, manufactured by General Motors Philippines at Manila. United Kingdom Bedford engine, 1,256 cc., payload is 550/750 kg. In addition to the usual range, available as a station wagon. Design was adapted to local conditions in co-operation with the Francisco Motors Corporation. This basic transport vehicle is also built/assembled in 19 other developing countries.

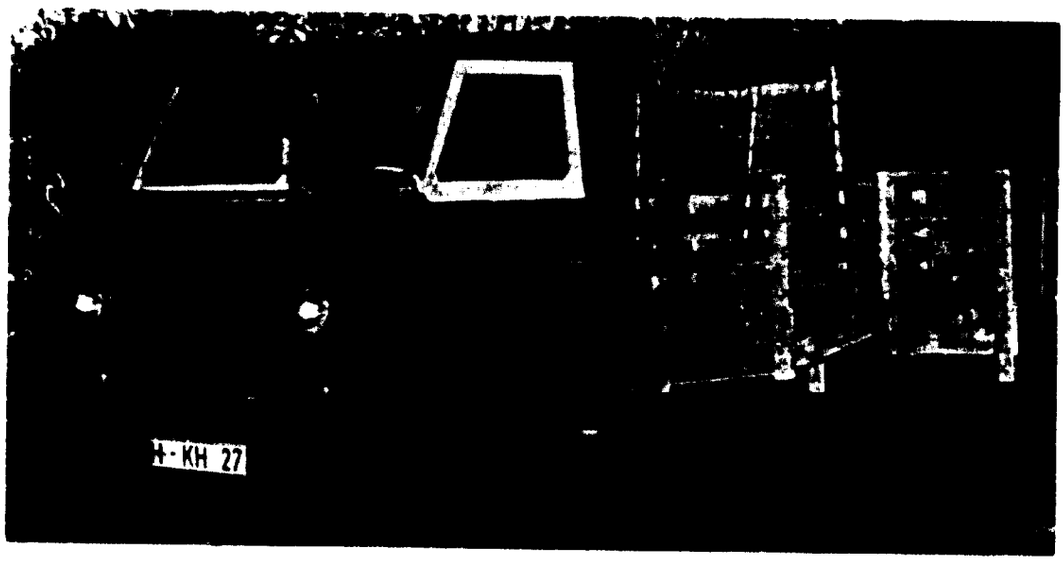

+IERA Jeepney


HARABAS

(c) Cimarron, manufactured by Chrysler Philippines at Rizal (P.O. Box 4592, Manila). Developed by Chrysler and Mitsubishi in the Philippines. Neptune engine, 1,400-1,600 cc imported.

(d) Trakbayam, manufactured by DMG Quezon (P.O. Box 1263, Manila). Volkswagen engine, 1,600 cc, imported from Brazil, payload is 1000 kg.. DMG also manufactures a 1,500 cc car, the Sakbayan. The main parts supplied by the Volkswagenwerk AG are the engine, the transmission, the axle drive and steering gear while the frame, the drivers cab, the body and all other remaining parts are manufactured in the Philippines. The design of the vehicle is proposed by VW but finally created by the manufacturer in the Philippines. The vehicle is also manufactured in Ghana, Indonesia, Pakistan and Senegal.

TRAKBAYAM



(e) Pinyo, manufactured by the Francisco Motors Corporation at Rizal. Mazda engine, 1,200 cc, manufactured in Japan. Developed by Francisco Motors with benefit of experience of General Motors in developing the Harabas.

Status of Commercialization: The vehicles are commercially produced.

Contact Address: See firms mentioned under a) to e), all in the Philippines.

Status of Commercialization: This technology is used in many parts of the world.

Contact Address: The Manager
Ferro-cement Boatyard
National Fishermen's Cooperative Society
P.O. Box 27
Chittagong
BANGLADESH

2. RESEARCH AND DEVELOPMENT INSTITUTES

2.1 Africa and the Middle East

BUILDING AND ROAD RESEARCH INSTITUTE

Postal Address: University
P.O. Box 40
Kumasi
Ghana
West Africa

Cable Address: BRIGA

Telephone: 4221/2

Telex: -

Status: Governmental

Established: 1952

Number of Staff: 80 professional, 130 technical and over 500 others

Contact Person: Mr. M.D. Mengu, Liaison Officer

Main Areas of Activities: Building materials, building technology, low-cost housing, architecture and planning, traffic and transportation engineering and planning, soil mechanics and foundation engineering, structures.

Technologies Included: -

On going R and D Projects: Use of timber for school buildings, production of bricks and tiles on medium scale, kiln for commercial production of lime, use of local materials, such as bauxite waste for use as cementing mater.al in building, production of Portland cement, utilization of mining wastes, pyrolytic conversion of agricultural and timber wastes into char, oil and gas, low-cost roofing materials.

CENTRE NATIONAL D'ETUDES ET D'EXPERIMENTATION DU MACHINISME AGRICOLE (CENEEMA)

Postal Address: B.P. 1040
Yaoundé
United Republic of Cameroon

Cable Address: -

Telephone: 22 32 50

Telex: -

Status: Governmental

Established: 1974

Number of Staff: 9 German advisers, 15 Cameroonian agricultural engineers, 9 technicians and about 50 workers

Contact Person: M. Ela Evina, Director

Main Areas of Activities: Agricultural mechanization, post-harvest technologies, agro-industry; development, adaptation and testing of agricultural equipment suitable for the country Cameroon; training of agricultural advisers and farmers in all fields of agricultural mechanization; training of mechanics and tractor drivers; provision of advice and recommendations to the Government, governmental and other institutions as well as private persons in all questions of agricultural mechanization.

Technologies Included: Corn sheller, rice thresher

On going R and D Projects: Construction of agricultural machinery, partly as an adaptation of appropriate technologies developed elsewhere; utilization of local raw matsrials.

FAMILY FARMS LTD.

Postal Address: P.O. Box 281
Monze
Zambia

Cable Address: -

Telephone: -

Telex: -

Status: Non-profit private development organization

Established: -

Number of Staff: 2

Contact Person: Mr. H.M. Hansen, Technologist

Main Areas of Activities: Training and consultancy for small farms on agricultural machinery, development of intermediate technology in this field.

Technologies Included: -

On going R and D Projects: Planter; winged chisel plough; machinery for ground-nuts, sugar beans and sunflowers; small-scale shelling and winnowing techniques; solar cooker, windmill.

INDUSTRIAL TESTING AND RESEARCH CENTER

Postal Address: P.O. Box 845
Damascus
Syria

Cable Address: INTEST

Telephone: 662438

Telex: -

Status: Governmental

Established: 1974

Number of Staff: No information received.

Contact Person: Eng. T. Sheikh El-Shabab, Vice Director

Main Areas of Activities: Analysis, materials-testing, industrial information.

Technologies Included: -

On going R and D Projects: Food and beverage technology, waste treatment, effect of fuel oil on glass quality.

INTERNATIONAL INSTITUTE FOR TROPICAL AGRICULTURE (IITA)

Postal Address: P.M.B. 5320
Ibadan
Nigeria

Cable Address: TROPFOUND IKEJA

Telephone: 23741

Telex: -

Status: International institution registered according to Nigerian law

Established: 1967

Number of Staff: 600

Contact Person: Dr. Ray Wijewardene, Systems Engineer

Main Areas of Activities: R and D, evaluation, information, consultanoy

Technologies Included: Solar energy crop sprayer

On going R and D Projects: Alternative to the prevailing shifting cultivation practised in lowland humid tropics, equipment and process for a minimum tillage with special reference to the reduction of drudgery and to the need for non-animal sources of energy. Extension of appropriate technology work to housing, schools, water, power and sanitation is under discussion.

KGATLENG DEVELOPMENT BOARD

Postal Address: P.O. Box 208
Mochudi
Botswana

Cable Address: -

Telephone: 356 Mochudi

Telex: -

Status: Non-profit organization directed by a board of trustees composed of local community leaders, local government officials and representatives of donor agencies.

Established: 1968

Number of Staff: 2 professional and 10 other staff

Contact Person: The Secretary

Main Areas of Activities: R and D, training and consultancy in agriculture, building, leather work and mechanics, secondary school education, production

Technologies Included: Mochudi toolbar

On going R and D Projects: Agricultural technology, horticulture, conservation farming

LEATHER RESEARCH INSTITUTE OF NIGERIA (LERIN)

Postal Address: P.M.B. 1052,
Zaria
Nigeria

Cable Address: LEATHER ZARIA

Telephone: 0632-2565

Telex: -

Status: A corporate body of the Federal Government of Nigeria

Established: 1976

Number of Staff: 32 senior professional and technical staff

Contact Person: Dr. C.M. Ojinnaka, Head
Research Division

Main Areas of Activities: Leather manufacture; engineering and process research; application of indigenous materials in leather processing.

Technologies Included: -

On going R and D Projects: Local salts and vegetable preservatives for treatment of hides and skins; standardization of local vegetable tannages, treatment of tannery effluents, local liming material for leather processing.

NATIONAL COUNCIL FOR SCIENTIFIC RESEARCH

Postal Address: P.O. Box CH 158
Chelston
Lusaka
Zambia

Cable Address: NACSIR

Telephone: 75321

Telex: -

Status: Governmental

Established: 1967

Number of Staff: 68 professional staff and 118 technical staff

Contact Person: Dr. S.M. Silangwa, Secretary-General

Main Areas of Activity: Food science and technology research, radioisotopes application, textiles testing, cement and concrete testing, building research, animal (local) productivity, water resources research, pest (tick and tsetse fly) research, and tree improvement.

Technologies Included: Carbonated beverage from Guava fruit, floor tiles from red burning clay, acid resistant bricks from red burning clays, wall tiles from unrefined China clay.

On-going R and D Projects: Production of soya milk, soya flour and baby foods; production of sanitary ware from local ceramic raw materials.

PROJECTS DEVELOPMENT INSTITUTE

Postal Address: 3 Independence Layout
P.O. Box 609
Enugu
Nigeria

Cable Address: -

Telephone: 252560

Telex: -

Status: Governmental

Established: 1970

Number of Staff: 20 professional, 281 technical and 106 administrative staff

Contact Person: Mr. J.I. Chinedo, Ag. Secretary

Main Areas of Activities: Process and product R and D, technical assistance, engineering.

Technologies Included: Garri-processing machinery

On going R and D Projects: Equipment for par-boiling of rice, pulp from rice straw and other wastes, school laboratory equipment, ceramic products, etc.

SPECIALIZED INSTITUTE FOR ENGINEERING INDUSTRIES

Postal Address: Jamburia Street No. 192
P.O. Box 5798
Baghdad
IRAQ

Cable Address: MAHAD

Telephone: 69791

Telex: 2226 SIEI

Status: Governmental

Established: 1972

Number of Staff: 35

Contact Person: Dr. Abid Ali Sahib Abbas, Director General

Main Areas of Activities: Product design and development, product technology engineering, quality control, industrial information and documentation, techno-economic study.

Included Technologies: -

On going R and D Projects: Redesign of air cooler, testing of tractor air filters, testing of agricultural machines, design of fixtures for electr cal appliance assembly, quality control systems, etc.

TECHNOLOGY CONSULTANCY CENTRE

Postal Address: University of Science and Technology
Kumasi
Ghana

Cable Address: KUMASITECH

Telephone: Kumasi, 5351

Telex: -

Status: University department

Established: 1971

Number of Staff: 7 professional staff but drawe upon the services of 350 professionals in the University.

Contact Person: Dr. J.W. Powell, Director

Main Areas of Activities: R and D in engineering, architecture, industrial art, pharmacy, etc.; training, consultancy, small-scale credit.

Technologies Included: -

On going R and D Activities: Soap production, pyrolytic converter, steel bolt production, non-ferroue metal casting, sugar production, vegetable oils, lost wax castings for engineering products, handloom weaving, textiles, agricultural machinery and implements, animal feeds, alternative energy sources, craft products, glass and ceramics, glues based on cassava starch and rubber latex.

TECHNOLOGY DEVELOPMENT AND ADVISORY UNIT

Postal Address: P.O. Box 2379
Lusaka
Zambia

Cable Address: -

Telephone: 54755

Telex: -

Status: University department

Established: 1975

Number of Staff: 4 engineers and 1 technician

Contact Person: Mr. A.M.C. Vissar, Deputy Manager

Main Areas of Activities: Research and development activities, especially in mechanical and agricultural engineering; testing and evaluation of new equipment, pilot production

Technologies Included: Soil-cement brick making machine, Cashew nut processing plant.

On going R and D Projects: Development of: inter-row cultivator, beef marker, cattle cake, cyclone ground-nut shelter, hydraulic ram, solar water heating, alternative sources for electrical energy, low-cost school science equipment, ground-nut decorticating equipment, simplified borehole drilling rig

2.2 Asia and Oceania

THE AHMEDABAD TEXTILE INDUSTRY'S RESEARCH ASSOCIATION

Postal Address: Polytechnic P.O.
Ahmedabad 380015
India

Cable Address: ATIRA

Telephone: 42671-72-73

Telex: -

Status: Registered autonomous society

Established: 1949

Number of Staff: 77 scientists and 127 supporting staff

Contact Person: Dr. B.V. Iyer, Assistant Director and Head
Information Centre

Main Areas of Activities: Research and development in the areas of textile manufacture (mainly of cotton and cotton/man-made fibre blends) and allied fields. Consultancy and technical services to the textile industry.

Technologies Included: Use of foam pads at sizing, improved mechanical slub catcher, rapidry system for cylinder dryers, auxiliary buffer for picking stick on overpick looms, roof cooling system, modified washing machine, staggering tappets, swell release motion, fibre-length tester, bleaching process for polyester/cotton blends, catalyst for wash and wear finishing.

On going R and D Projects: Large number of projects to increase productivity, reduce cost, improve quality, develop new products, all within the framework of intermediate technology.

APPLIED SCIENTIFIC RESEARCH CORPORATION OF THAILAND (ASRCT)

Postal Address: 196 Pahonyothin Rd.,
Bangkhen
Bangkok
Thailand

Cable Address: RESCORP

Telephone: 5791121-30

Telex: -

Status: State enterprise

Established: 1964

Number of Staff: 175 proffesional and 231 technical staff

Contact Person: Wadanyu Nathalang, Governor

Main Areas of Activities: Research on utilization of natural resources and services in applied science.

Technologies Included: Portable Essential Oil Distillation Unit and Cupola Furnace for manufactury engineering

On going R and D Projects: No details given.

APPROPRIATE TECHNOLOGY DEVELOPMENT ORGANIZATION (ATDO)

Postal Address: P.O. Box 1306
1-B, 47th Street
Islamabad
Pakistan

Cable Address: -

Telephone: -

Telex: -

Status: Governmental, attached to the Planning and Development Division of the Government of Pakistan

Established: 1974

Number of Staff: -

Contact Person: M.M. Qurashi, Director General

Main Areas of Activities: Identification of technology "gaps", own R and D, commission of R and D by other suitable organizations, economic evaluation of technologies, promotion and information.

Technologies Included: Gobar gas plant, small-scale manufacture of matches

On going R and D Projects: Utilization of indigenous iron ore for steel production in mini-steel mills, vegetable dehydration, manufacture of blackboard chalk, small scale candle-making, simple wool spinning machine, screw-type cane crushing machine, village-level food processing.

BETHLEHEM TECHNICAL FOUNDATION (TRADING)

Postal Address: P.O. Box 435
Rawalpindi
Pakistan

Cable Address: BETHFOUND RAWALPINDI

Telephone: 44972

Telex: 1973

Status: Private

Established: 1973

Number of Staff: 6 professionals and 3 others

Contact Person: Manohar L. Gill, Proprietor

Main Areas of Activities: Manufacture of equipment for agriculture, soil sampling, land survey and levelling, and water management and climatological instruments.

Technologies Included: Diaphragm pump, mini thresher

On going R and D Projects: No own R and D activities; production of cultivators, plows, weeders, planters, harrows, sprays, etc., is planned.

THE BOMBAY TEXTILE RESEARCH ASSOCIATION

Postal Address: Lal Bahadur Shastri Marg,
Ghat Kopar (West)
Bombay - 400 086
India

Cable Address: MILITRA

Telephone: 582651

Telex: -

Status: Autonomous society supported by members and by the Central Government through the Ministry of Industry.

Established: -

Number of Staff: 167 technical and 70 administrative

Contact Person: Mr. T.V. Ananthan, Director

Main Areas of Activities: R and D in textile technology, with particular reference to cotton and cotton-blends.

Technologies Included: Remover of oil/grease stains from textiles.

On going R and D Projects: Basic research in the field of textile physics, chemistry and mathematics; applied research in spinning and weaving and in bleaching, dyeing and printing; development of suitable mechanical and electronic instruments for use in the textile mills.

CENTRAL BUILDING RESEARCH INSTITUTE

Postal Address: Central Building Research Institute
Roorkee (U.P.)
India

Cable Address: 'BILDSERCH'

Telephone: 243, 428, 293

Telex: -

Status: Governmental

Established: 1947

Number of Staff: 180 scientific, 172 auxiliary technical and
34 technical staff

Contact Person: Prof. Dinesh Mohan, Director

Main Areas of Activities: Building materials; soil engineering; building physics; building processes, plant and productivity; architecture and physical planning; fire research; and rural buildings and environment

Technologies Included: Clay flooring and roofing tiles, wood wool boards, large size clay products with improved strength, corrugated roofing sheets from coir waste or wood wool, building lime from sugar press mud, masonry cement from waste lime sludge and Portland cement, cementitious binder from waste lime sludge and rice husk.

On going R and D Projects: More than 50 projects are distributed over the seven main areas of activities.

CENTRAL LEATHER RESEARCH INSTITUTE

Postal Address: Sardar Patel Road, Adyar
Madras - 600020
India

Cable Address: LESERCH

Telephone: 412616, 412713, 412868, or 412993

Telex: MS 514

Status: Public organization (national laboratory under the Council of Scientific and Industrial Research (CSIR) functioning under the Ministry of Education, Government of India)

Established: 1951

Number of Staff: 138 scientific and 107 technical

Contact Person: Dr. T.S. Ranganathan, Scientist, Information Area Leader

Main Areas of Activities: Raw hides and skins and microbiology; slaughter house and carcass by-products; tanning agents and mechanism of tannages; collagen; polymer; leather auxiliaries; leather trades engineering; extension; economics; leather goods and footwear; tanning and finishing; tannery effluents and environmental biology; technical training; information.

Technologies Included: Fertilizer from waste hair, extraction of glue and gelatine, fat liquors for leather processing, mangrove extract, blend extract from myrobalan and babul/konnam, and pancreatin production

On going R and D Projects: More than 80 projects in the R and D areas mentioned above.

CENTRAL ROAD RESEARCH INSTITUTE (CRRI)

Postal Address: P.O. CRRI
New Delhi - 110020
India

Cable Address: -

Telephone: -

Telex: -

Status: Governmental

Established: 1952

Number of Staff: About 200 scientific and technical staff

Contact Person: Mr. Y.C. Gokhale, Assistant Director

Main Areas of Activities: Highway engineering research

Technologies Included: Lime burnt clay puzzolana, burnt clay puzzolana, low-grade materials for road construction, utilisation of fly-ash, coconut-pith as expansion filler and building board.

On going R and D Projects: R and D in many aspects of appropriate technology in road construction.

CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE

Postal Address: Cheluvamba Mansion
Food Technology P.O.
Mysore - 570 013
India

Cable Address: FOODSEARCH, Mysore

Telephone: 22660

Telex: 0946 241 FTRI IN

Status: Public organization registered under the Societies Act.

Established: 1950

Number of Staff: 307 professional and 208 technical staff

Contact Person: Mr. C.P. Natarajan, Deputy Director

Main Areas of Activities: R and D activities and training in the field of food science and technology.

Technologies Included: Weaning food; pectin, oil and calcium citrate from lime; integrated processing of sesame seed; manufacture of tomato puree; mini rice mill; maize mill.

On going R and D Projects: More than 100 on going projects in the following areas:

a. Biochemistry and applied nutrition
b. Microbiology, fermentation and sanitation
c. Plantation products and flavour technology
d. Rice milling and pulse technology
e. Flour milling and baking technology
f. Fermentation technology

g. Lipids technology
h. Protein technology
i. Infestation control and pesticides
j. Fruit and vegetable technology
k. Meat, fish and poultry technology
l. Packaging technology

CEYLON INSTITUTE OF SCIENTIFIC AND INDUSTRIAL RESEARCH (CISIR)

Postal Address: P.O. Box 787
Colombo 7
Sri Lanka

Cable Address: CISIR

Telephone: 93 80 7

Telex: -

Status: Governmental

Established: 1955

Number of Staff: 85 graduates and 75 non-graduates

Contact Person: E.E. Jeya Raj, Deputy Director

Main Areas of Activities: Process and product research on locally available raw materials and residues.

Technologies Included: Decortication of sesame seed, manufacture of ceramic floor tiles, improved method for manioc processing.

On going R and D Projects: Solar energy for stills and drying of material.

INDUSTRIAL DEVELOPMENT BOARD OF CEYLON

Postal Address: 615 Galle Road
Katubedde
Sri Lanka

Cable Address: KARMANTHA

Telephone: 072-450, 452, 394, 323

Telex: -

Status: State institution

Established: 1966

Number of Staff: No information received.

Contact Person: L.S.G. Tillekeratne, Director, Extension Services

Main Areas of Activities: Promotion and development of small-scale industries, development of appropriate technologies.

Technologies Included: Diaphragm pump, the 'Lakgen' bio gas generator, solar wind ventilated dryer, smoked fish chamber, and coconut cherry cubes.

On going R and D Projects: Peanut butter manufacture from ground-nuts, turkey red oil (wetting agent) manufacture from castor oil, soya milk manufacture from soya beans, agar-agar manufacture from seaweed, handmade paper manufacture from waste paper etc., small scale rubber products manufacture, etc., stearic acid from rubber seed oil, vegetable dyes from various plants and flowers, plaster materials from dolomite and extraction of magnesium from dolomite, lime pozzolonas, acetic acid from coconut shell, carbon black substitute and manufacture of board from waste coir dust, and paddy husk ash as a filler for rubber products, etc.

INDIAN INSTITUTE OF PACKAGING

Postal Address: Plot E. 2, M.I.D.C.
Andheri (East)
Bombay - 400093
India

Cable Address: -

Telephone: 573342 or 57663

Telex: -

Status: -

Established: 1967

Number of Staff: 35 technical/professional and 45 others

Contact Person: Mr. M.R. Subramaniam, Deputy Director

Main Areas of Activities: Research and development, problem-solving, consultancy training and education, testing and information and other promotional efforts.

Technologies Included: -

On going R and D Projects: Packaging of cement, transport packaging, plastic packaging, packaging under tropical conditions.

INSTITUTE OF TEXTILE TECHNOLOGY

Postal Address: Jalan Jendral A. Yani 390
Bandung
Indonesia

Cable Address: INTITEKS

Telephone: 71214

Telex: -

Status: Governmental

Established: 1922

Number of Staff: 100 professional and 300 technical

Contact Person: Mr. Soerjosoejarso

Main Areas of Activities: Research, testing, consulting, education, training, demonstration plant in textile technology.

Technologies Included: -

On going R And D Projects: Treatment of textile fibres, modification of handloom to varify the design in weaving, batik printing on cotton and wool blended fabric, tolerance of colour difference for colour matching and quality-control of dyed fabric, standardization, and textile quality control.

THE KOREA INSTITUTE OF SCIENCE AND TECHNOLOGY (KIST)

Postal Address: P.O. Box 131
Dongdaemoon
Seoul
Korea

Cable Address: KISTROK

Telephone: 967-8801

Telex: K27380 KISTROK

Status: Non-profit independent research organization

Established: 1966

Number of Staff: 344 research staff and 84 technical staff

Contact Person: Mr. Dal Hwan Lee, Associate Manager, Project Development Dept.

Main Areas of Activities: Research and development such as product development, process development, scientific and technological survey and analysis in the following fie_ds: Mechanical engineering, metal and metallurgical engineering, material science, electrical and electronic engineering, food and biotechnology, industrial economics and systems development, and chemistry and chemical engineering.

Technologies Included: Alumina from coal ash, silicone oils production, ethabutol production, high fructose corn syrup production, ethambutol production, copper-plated steel wire.

On going R and D Projects: A great number of projects in the areas mentioned above.

LEMBAGA PENELITIAN SELULOSA (CELLULOSE RESEARCH INSTITUTE)

Postal Address: Jln. Raya Dayeuhkolot 158
Bandung
INDONESIA

Cable Address: -

Telephone: 50623 and 59811, or 81031 and 81032

Telex: -

Status: Governmental

Established: 1968'

Number of Staff: 11 senior professional and 17 junior professional, and 83 technical staff

Contact Person: Garjito Pringgo Sudirjo, Director

Main Areas of Activities: R and D activities on utilization of indigeneous fibrous resources for cellulose industries (pulp, paper and viscose rayon); engineering and consulting services for cellulose industries; conduct and coordinate in-plant training programmes; conduct and coordinate technical meetings, seminars, etc.; and publication of research activities.

Technologies Included: Use of rubber tree for pulp and paper, use of Dacridium spp as pulpwood, use of agethis Lorantifolia for paper pulp, and use of Eucelyptus Saligna for paper pulp.

On going R and D Projects: Utilization of tropical wood species and of agricultural waste for the pulp and paper industry; pollution abatement problems of the cellulose industry.

NATIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY

Postal Address: P.O. Box 774
Metro Manila
Philippines

Cable Address: -

Telephone: 50-30-41

Telex: -

Status: Governmental

Established: 1901

Number of Staff: 272 technical and 318 non-technical

Contact Person: Dr. Vedasto R. Jose, Commissioner

Main Areas of Activities: Engineering, process research; product standardization; drug chemistry; plant and animal ecology.

Technologies Included: Canned coconut milk, vinegar from coconut water, coconut water as intravenous fluid, bio-gas generator

On going R and D Projects: Use of local raw materials, mineral deposits and agricultural wastes; improved methods of manufacture; drugs from local plants.

PAKISTAN COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (PCSIR)

Postal Address: Research Press Centre, IInd Floor
Shahrah-e-Kamal Ataturk
Karachi
Pakistan

Cable Address: CONSEARCH

Telephone: 212173

Telex: -

Status: Public organization

Established: 1953

Number of Staff: 550 professional and technical and 1400 other staff

Contact Person: Mr. M. Aslam, Member (Technology)

Main Areas of Activities: R and D utilization of indigenous raw materials and for solving problems of the industrial sector, industrial extension services, standardization, establishment of new science-based industries.

Technologies Included: Oil from shark liver, foam cement.

On going R and D Projects: A large number of projects in the following fields:

a. Agrochemicals technology
b. Food and fermentation technology
c. Oils, fats and waxes technology
d. Minerals technology
e. Glass and ceramics technology
f. Pharmaceuticals and fine chemicals technology

g. Fuel technology
h. Leather technology
i. Fibre technology
j. Chemical engineering and design
k. Industrial organic and inorganic chemicals
l. Marine foods and applied biology
m. Physical standards
n. Electronics and instrumentation

PHILIPPINE TEXTILE RESEARCH INSTITUTE

Postal Address: General Santos Ave. Bicutan
Taguig
Metro Manila
The Philippines

Cable Address: Philtex

Telephone: 83-99-31 or 78-23-93

Telex: Philtex

Status: Governmental

Established: 1967

Number of Staff: 50 research staff and 37 Technicians

Contact Person: Mrs. Maternidad Palmario, Science Research Supervisor

Main Areas of Activities: Textile research, industry development and Extension Services

Technologies Included: -

On Going R and D Projects: Sericulture, utilization of pineapple fibres for textiles, crease resistance finishing of jusi fabrics, fabric handle of ramie blends, easy-care finish for woven cotton, non-wovens from textile processing waste, fabrics for Philippine weather conditions.

RUBBER RESEARCH INSTITUTE OF MALAYSIA

Postal Address: 260 Jalan Ampang
P.O. Box 150
Kuala Lumpur - 01-02
Malaysia

Cable Address: SEARCHING, KUALA LUMPUR

Telephone: 467033

Telex: RRIM MA 30369

Status: Statutory body (Quasi-Government)

Established: 1925

Number of Staff: Over 200 senior staff

Contact Person: Haji (Dr.) Ani Bin Arope, Director

Main Areas of Activities: R and D activities in planting, cultivating and processing of rubber; applied economics; information and documentation; training.

Technologies Included: -

On going R and D Activities: A large number of projects in the following areas:

a. Analytical and applied chemistry
b. Crop protection and microbiology
c. Plant science
d. Rubber technology
e. Quality control
f. Polymer chemistry and physics
g. Soils and crop management
h. Smallholding rubber cultivation

SINGAPORE INSTITUTE OF STANDARDS AND INDUSTRIAL RESEARCH

Postal Address: 179 River Valley Road
Singapore 6
Republic of Singapore

Cable Address: SISIR

Telephone: 360933

Telex: -

Status: Governmental

Established: 1973

Number of Staff: 100 professional and technical, 184 others

Contact Person: Ms. Yeoh Quee Nee, Secretary, SISIR

Main Areas of Activities: Standardisation and quality control, testing and verification of materials, non-destructive testing and metals technology, instrumentation, metrology, applied research and development, design, and consultancy.

Technologies Included: -

On going R and D Projects: In the electrical/electronic, food and souvenir sector

SHRI RAM INSTITUTE FOR INDUSTRIAL RESEARCH

Postal Address: 19, University Road
Delhi - 110007
India

Cable Address: SRISANDHAN

Telephone: 227954

Telex: 3751

Status: Public organisation run by a Foundation

Established: 195

Number of Staff: Technical staff of 104 and 86 others.

Contact Person: Dr. R.T. Thampy, Director

Main Areas of Activities: Process research in the areas of polymers, fibres, organic chemicals, environmental pollution control and analysis and testing.

Technologies Included: Manufacture of: ABS plastics, improved PVC, improved catalyst systems, protective coating for metal parts, unsaturated polyesters, diallyl phthalate monomer, prepolymer and moulding compositions, pentaerythritol, synthetic pine oil from turpentine, bisphenol-A, ethyl ether, carbonxy methyl cellulose, srifirset resins for textiles, organdie finish, srifircides for rot-proofing agents, plaster of aris, and puzzolana clays.

On going R and D Projects: Rubber reinforced thermoplastics by suspension technique, polyelectrolytes by gamma irradiation, natural rubber reinforced thermoplastics of commercial importance by irradiation technique, biodegradable polymers, fluoroolefin based polymers based on tetrafluoroethylene, poly-p-hydroxy benzoic acid, PVC compounds, flocculants and polymeric lubricants.

THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION

Postal Address: P.B. No. 3205,
Coimbatore Aerodrome Post,
Coimbatore 641 014
India

Cable Address: SITRA

Telephone: 87-367

Telex: -

Status: Sponsored by the Textile Industry and supported by the Government of India.

Established: 1956

Number of Staff: 106 professional and technical staff

Contact Person: K. Sreenivasan, Director

Main Areas of Activities: Basic as well as applied research in the fields of fibre technology, processing technology up to spinning, weaving problems, machinery development and instrumentation and operational research activities relating to textiles as well as human relations. Research relating to problems of the decentralized sectors like handlooms, powerlooms and hosiery industries is being carried out.

Technologies Included: High Dome Licker-In Cover for carding engine, double carding, single yarn mercerization, high tenacity cotton yarns by mercerization, use of unconventional fibres, crease-resistant raw silk fabrics, and two-for-one twisting machines.

On going R and D Projects: Effect of fibre property variables and processing factors on yarn and fabric quality, novel yarns and fabrics from natural and man-made fibres and filaments, increasing wear-life of cellulosics, machinery and instruments, blending of natural and man-made fibres, reduction of costs and increase of productivity in mills.

SOUTH PACIFIC APPROPRIATE TECHNOLOGY FOUNDATION

Postal Address: P.O. Box 6937
Boroko
Papua New Guinea

Cable Address: -

Telephone: 212499

Telex: -

Status: Quasi-governmental

Established: 1977

Number of Staff: 13

Contact Person: Nigel Florida, Associate Director

Main Areas of Activities: Information services on the concept and availability of appropriate technology; importation, testing, evaluation and marketing of A.T. equipment (through Village Equipment Supplies Ltd.); development of appropriate tools and techniques (joint venture with the University of Technology and the Liklik Bak Information Centre).

Technologies Included: Hydraulic ram pump, blacksmith' bellows

On going R and D Projects: Methods of repair and/or recycling of dumped equipment; design of an appropriate hydroelectric generating unit for rural areas.

2.3 Europe

BUILDING RESEARCH ESTABLISHMENT

Postal Address: Bucknalls Lane
Garston, Watford
United Kingdom

Cable Address: RESEARCH WATFORD

Telephone: 09273 - 74040

Telex: 923220

Status: Governmental

Established: 1921

Number of Staff: 15 professional and technical in Overseas Division
total of about app. 350 professional and technical staff

Contact Person: Dr. R.F. Stevens, Head of Overseas Division

Main Areas of Activities: Research into low-cost materials designs and technology for low-cost house construction in developing countries, advice and assistance to developing countries on all aspects of housing and construction.

Technologies Included: -

On going R and D Projects: No details received.

INTERMEDIATE TECHNOLOGY DEVELOPMENT GROUP (ITDG)

Postal Address: 9 King Street
London WC2E 8HN
United Kingdom

Cable Address: IT/DEV, LONDON WC2

Telephone: 01-836 9434/39; 836 6379

Telex: -

Status: Non-profit private organization

Established: 1965

Number of Staff: About 50; draws on the expertise of over 200 professional advisors operating in 14 panels.

Contact Person: Dennis H. Frost, Chief Executive

Main Areas of Activities: R and D, evaluation, promotion, information/publication, consultancy, production

Technologies Included: Driven tubewell, paper pulp moulding system, hydro-power for rural development

On going R and D Projects: Small-scale glass ware, windmills and river turbines for irrigation pumping, multi-purpose pedal tricycles, mini-paper making plant, mini-sawmills, fibre/cement roofing and other building materials, small spinning machinery.

TROPICAL PRODUCTS INSTITUTE (TPI)

Postal Address: 56-62 Gray's Inn Road
London WC1X 8LU
United Kingdom

Cable Address: -

Telephone: -

Telex: -

Status: Governmental, part of the British Ministry of Overseas Development

Established: -

Number of Staff: 380

Contact Person: The Director

Main Areas of Activities: R and D, information, consultancy, training.

Technologies Included: Maize sheller

On going R and D Projects: Projects related to problems of post-harvest storage, preservation, processing, marketing and utilization of plant and animal products.

2.4 Latin America and the Caribbean

CARIBBEAN INDUSTRIAL RESEARCH INSTITUTE (CARIRI)

Postal Address: Tunapuna Post Office
Trinidad,
West Indies

Cable Address: CARIRI, Trinidad

Telephone: 662-7161/5

Telex: -

Statue: Governmental

Established: 1970

Number of Staff: More than 100

Contact Pereon: The Director

Main Areas of Activitiee: R and D, training, information, consultancy, standardization in economics, electronics, engineering, food and chemistry, materials technology.

Technologies Included: -

On going R and D Projects: Electrical and electronic components, sugar manufacture, use of local agricultural crops, agricultural machinery, weaning food, pollution studies, local pottery and ceramics, construction material and metal processing.

CENTER FOR ECONOMIC AND SOCIAL STUDIES OF THE THIRD WORLD (CEESTEM)

Postal Address: Coronel Porfirio Díaz No. 50
San Jerónimo Lídice
México 20, D.F.

Cable Address: -

Telephone: 595-20-88

Telex: 1777579

Status: Governmental

Established: 1976

Number of Staff: 64 researchers and 12 technicians in the Center.
12 engineers and 2 technicians in the area.

Contact Person: Julio A. Cortés Hernández, Chemical Engineer

Main Areas of Activities: Studies in the areas of food, population, culture and education, communication and information, international relations, appropriate technology; R and D on village-level technology.

Technologies Included: -

On going R and D Projects: Establishment of a rural workshop for the development, testing and manufacture of machinery for the village level, special programme on medicinal plants.

INSTITUTO DE INVESTIGACIONES TECNOLOGICAS (IIT)

Postal Address: Avenida 30 No. 52-A-77
Bogota
Colombia

Cable Address: TECNOLOGICO

Telephone: 2-35-00-66

Telex: -

Status: Non-profit organisation

Established: 1958

Number of Staff: 52 professional, 28 technical and 47 others

Contact Person: Ms. Teresa S. de Buckle-Jorge Beltran

Main Areas of Activities: R and D, quality control, pilot plant production.

Technologies Included: Hydrated potatoes, hydrated vegetables, naranjilla concentrate, vegetable textured protein, and preservation of fish.

On going R and D Projects: No information received.

INSTITUTO DE INVESTIGACIONES TECNOLOGICAS (INTEC - CHILE)

Postal Address: Avda. Santa María 06500 - Lo Curro
P.O. Box 667
Santiago
Chile

Cable Address: INTEC/CAS.667

Telephone: 289066

Telex: 40421-CORFO-CL
PARA INTEC

Status: Public organisation

Established: 1968

Number of Staff: 77 professionals, 33 techniciens, 58 administrative and services

Contact Person: Sergio Varas, Project Manager

Main Areas of Activities: R and D, techno-economical studies, transfer of technology, consultancy for industry, industrial information and documentation.

Technologies Included: Solar grape drier, windmill for irrigation

On going R and D Projects: Production of papaina from the Chilenean fruit *Papaya carica*, processing of the castor oil plant (*higuerilla*), use of thermoplastics from rubbish, utilisation of sawdust, etc.

INSTITUTO NACIONAL DE TECNOLOGIA INDUSTRIAL - CENTRO DE INVESTIGACIONES TEXTILES (INTI - CIT)

Postal Address: Leandro N. Alem 1067 - 5° piso
1001 Buenos Aires
Argentina

Cable Address: -

Telephone: 755-7255

Telex: INTI BAIRES 012-1859

Status: Governmental

Established: INTI - 1957 and CIT - 1967

Number of Staff: 7 professional and 6 technical staff

Contact Person: Ing. Héctor J. Vázquez, CIT Director

Main Areas of Activities: CIT gives technical assistance to the Argentine textile industry on the following subjects: research on processes, raw materials and their uses, quality control, etc.

Technologies Included: -

On going R and D Projects: Spinning potential of several varieties of national cotton fibers, test methods for textiles, open-end spinning of man-made fibres, manufacture of wool standards for the Air-Flow apparatus, determination of breaking, resistance, elongation and resilience of wool fibres, influence of scouring parameters on wool quality, waste waters in the textile industry, relationship between crystallinity and the mechanical and dyeing properties of polyester fibers, and quality and behaviour of wool and part-wool yarns made by self-twist spinning.

INSTITUTO NACIONAL DE TECNOLOGIA

Postal Address: Avenida Venezuela No. 82 - 7° Andar
Rio de Janeiro - 20.081
Brazil

Cable Address: -

Telephone: 243.8070

Telex: -

Status: Governmental

Established: 1921

Number of Staff: 299 professional and 102 technical

Contact Person: Fernando Magalhães Machado, Programme Coordinator

Main Areas of Activities: Industrial research, development, engineering and marketing in the areas of renewable natural resources and pollution prevention and control.

Technologies Included: Ethanol production from manioc, integral use of cellulosic residues by acid hydrolysis process.

On going R and D Projects: Soil, liquid and air pollution prevention and control; industrial design, vegetable oils as diesel engines' fuel and/or lubricants; ethanol stillage; derivate products and their use; continuation of acid hydrolysis of cellulosic residues and production of ethanol.

INSTITUTO DE PESQUISAS TECNOLÓGICAS

Postal Address: P.O. Box 71411,
01000 São Paulo, SP
Brazil

Cable Address: TECNINST

Telephone: (011) 268.2211

Telex: (011) 22831 INPT BR

Status: Governmental

Established: 1899

Number of Staff: 562 professional, 482 technical, 1,080 other staff

Contact Person: Alberto Alburquerque Arantes, Technical Director

Main Areas of Activities: Civil engineering, naval engineering, packaging, technical standards and specifications, geology and mining.

Technologies Included: Lightweight aggregate from urban sewage slime, substitutions of diesel oil by vegetable oils, charcoal from babassu nut endocarp, ferro-cement tank for liquid storage, thermophosphate production in mace roasting furnace.

On going R and D Projects: Saw mill for eucalyptus and pine spp, pre-cast concrete elements for school buildings, organic urban wastes for methane gas production, small-scale production of alcohol from sugar, metal atomisation by gas, metal processing by means of explosives, production of ethylene, alternative fuels for motors, etc.

INSTITUTO DE INVESTIGACION TECNOLOGICA INDUSTRIAL Y DE NORMAS TECNICAS

Postal Address: Apartado postal No. 145
Lima
Peru

Cable Address: -

Telephone: 40 10 40

Telex: -

Status: Decentralised public institution

Established: 1973

Number of Staff: 90 professionals and 10 technical

Contact Person: Dr. Jorge E. Vega, Director of Technology

Main Areas of Activities: Technological researoh and development, technical information, national standards, metrology, patents.

Technologies Included: -

On going R and D Projects: Energy: Development of solar energy apparatus for cooking of food, dehydration of fruits, desalinisation of water, water heating and house heating; development of microhydroelectric centrals up to 50 kW ; development of windmills for electric energy generation and water pumping.
Agriculture: Development of simple agricultural tools as well as harvesting, conservation, storage and transport techniques.
Housing: Adobe housing (two-storey), use of natural building, reinforcements, house sanitation systems, roofing techniques.

Food; Development of industrialization technologies for Peruvian Natural products like: Lupinus, Aguaje, Quinua, Ungurahui, Majuey, etc.

TECHNOLOGY POLICY GROUP

Postal Address: P.O. Box 3237
Lima
Peru

Cable Address: JUNAC LIMA

Telephone: 414212

Telex: 20104

Status: Andean subregional organisation

Established: 1969

Number of Staff: Four professionals and 20 technical staff

Contact Person: Eng. Luis Soto Krebs, Chief
Science and Technology Policy Group

Main Areas of Activities: Science and technology policy in connection with integration and development on specific projects in the area of importation or innovation of technology at the subregional level.

Technologies Included: Dissolution of copper from copper sulphides.

On going R and D Projects: No information received.

ANNEXES

I. Index of technologies

II. Index of R and D Institutes

Africa

Building and Road Research Institute, Ghana
Centre National d'Etudes et d'Experimentation due Machinisme Agricole (CENEEMA), Cameroon
Family Farms Ltd., Zambia
Industrial Testing and Research Centre, Syria
International Institute for Tropical Agriculture (IITA), Nigeria
Kgatleng Development Board, Botswana
Leather Research Institute of Nigeria (LERIN)
National Council for Scientific Research, Zambia
Projects Development Institute, Nigeria
Specialized Institute for Engineering Industries, Iraq
Technology Consultancy Centre, Ghana
Technology Development and Advisory Unit, Zambia

Asia and Oceania

The Ahmedabad Textile Industry's Research Association, India
Applied Scientific Research Corporation of Thailand (ASRCT)
Appropriate Technology Development Organization (ATDO), Pakistan
Bethlehem Technical Foundation (TRADING), Pakistan
The Bombay Textile Research Association, India
Central Building Research Institute, India
Central Leather Research Institute, India
Central Road Research Institute, India
Central Food Technological Research Institute, India
Ceylon Institute of Scientific and Industrial Research
Industrial Development Board of Ceylon
Indian Institute of Packaging
Institute of Textile Technology, Indonesia
The Korea Institute of Science and Technology
Lembaga Penelitian Selulosa (Cellulose Research Institute), Indonesia
National Institute of Science and Technology, Philippines

Pakistan Council of Scientific and Industrial Research (PCSIR)
Philippine Textile Research Institute
Rubber Research Institute of Malaysia
Singapore Institute of Standards and Industrial Research
Shri Ram Institute for Industrial Research, India
South India Textile Research Association
South Pacific Appropriate Technology Foundation, Papua New Guinea

Europe

Building Research Establishment, United Kingdom
Intermediate Technology Development Group, United Kingdom
Tropical Products Institute, United Kingdom

Latin America and Caribbean

Caribbean Industrial Research Institute (CARIRI), Trinidad
Center for Economic and Social Studies of the Third World, Mexico
Instituto de Investigaciones Tecnológicas, Colombia
Instituto de Investigaciones Tecnológicas (INTEC-CHILE)
Instituto Nacional de Tecnologia Industrial - Centro de Investigaciones Textiles (INTI - CIT), Argentina
Instituto Nacional de Tecnología, Brazil
Instituto de Pesquisas Tecnológicas, Brazil
Instituto de Investigacion Tecnologica Industrial y de Normas Tecnicas, Peru
Technology Policy Group, Peru

III. Bibliography

Intermediate Technology Publications Ltd. (9 King Street, Covent Garden, London WC2E 8HN, United Kingdom) regularly publishes an updated list of publications on intermediate/appropriate technology.

Directories of institutes

Appropriate Technology in the Commonwealth: A Directory of Institutions gives up-to-date information on 118 institutions in 26 Commonwealth countries. There is a comprehensive index for particular equipment and processes.

64 pp, 1977, price: £1

May be purchased from: Commonwealth Secretariat Publications
Marlborough House
London SW1Y 5HX
United Kingdom

Institutions and Individuals Active in Environmentally-Sound and Appropriate Technologies

Preliminary world-wide listing of institutes and individuals with activities or an interest in appropriate technology. Information on the institutes and detailed indication of areas of activities. No index for particular equipment and processes.

281 pp, May 1978, no price indicated

Orders, questions and comments may be addressed to:

The International Reference System
United Nations Environment Programme (UNEP)
P.O. Box 30552
Nairobi
Kenya

Information sources on technologies

Appropriate Technology Source-book

A comprehensive guide to plans and methods for village and intermediate technology with focus on agriculture, food and crop preservation and storage, energy, water supply, housing and health care.

304 pp, second edition 1976, price: US$4 (US$2 for local groups in developing countries).

The book can be ordered from: Appropriate Technology Project
Volunteers in Asia
Box 4543
Stanford, Cal. 94305
U.S.A.

UNIDO Guides to Information Sources

This is a series of guides to selected information sources on branches of industry of primary concern to developing countries. Each publication gives information on organizations, directories, statistics, dictionaries and encyclopaedias and various other kinds of publications; bibliographies and other potential sources of information, all related to a specific industrial sector. So far the following Guides have been published:

No. 1 Meat-processing Industry
No. 2 Cement and Concrete Industry
No. 3 Leather and Leather Goods Industry
No. 4 Furniture and Joinery Industry
No. 5 Foundry Industry
No. 6 Industrial Quality Control
No. 7 Vegetable Oil Processing Industry
No. 8 Agricultural Implements and Machinery Industry
No. 9 Building Boards from Wood and Other Fibrous Materials
No. 10 Pesticides Industry
No. 11 Pulp and Paper Industry
No. 12 Clothing Industry
No. 13 Animal Feed Industry
No. 14 Printing and Graphics Industry
No. 15 Non-alcoholic Beverage Industry
No. 16 Glass Industry
No. 17 Ceramics Industry
No. 18 Paint and Varnish Industry
No. 19 Canning Industry
No. 20 Pharmaceutical Industry
No. 21 Fertiliser Industry
No. 22 Machine Tool Industry
No. 23 Dairy Product Manufacturing Industry
No. 24 Soap and Detergent Industry

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FERRO-CEMENT BOATS

Description: Method for the production of boats and vessels with ferro-cement.

Technical and Economic Details: Ferro-cement is easily fabricated to any shape is watertight, fireproof, highly resistant to corrosion and, in comparison with reinforced concrete, is considerably lighter for equal strength. It is best utilized in a thin shell construction, and it can be considered as a replacement for wood, steel and reinforced concrete in a variety of applications.

Ferro-cement has gained acceptance as a boat building material in many parts of the world, and a fairly large body of technical knowledge has been developed in this application. It is particularly suited to boat building in developing countries for three major reasons:

- The construction techniques can be made labour-intensive rather than capital-intensive if desired;
- The technology can be introduced at a level to utilize existing indigenous skills. Except for one or two critical phases, the labour skills required to fabricate with ferro-cement are relatively low;
- In most countries, the cost of materials is comparatively low.

Ferro-cement working vessels and barges have been successfully constructed with lengths ranging from 20 to 100 feet. In general, the material is somewhat heavier than a wooden or steel construction, and it has a lower resistance to impact. However, with a proper design, these deficiencies can be overcome satisfactorily. The major technical advantage of the material is that high quality ferro-cement requires little or no maintenance and, if damaged, can be easily repaired. In addition, it is unaffected by marine worms and rot.

No. 25 Beer and Wine Industry

No. 26 Iron and Steel Industry

No. 27 Packaging Industry

No. 28 Coffee, Cocoa, Tea and Spices

No. 29 Petrochemical Industry

No. 30 Non-conventional Energy Resources

The price varies according to the number of pages. These guides may be obtained from bookstores and distributors throughout the world or directly from:

Sales Section
United Nations
Geneva (for orders from Africa, Europe and Western Asia) or
New York (for orders from Asia and the Pacific and North and South America)

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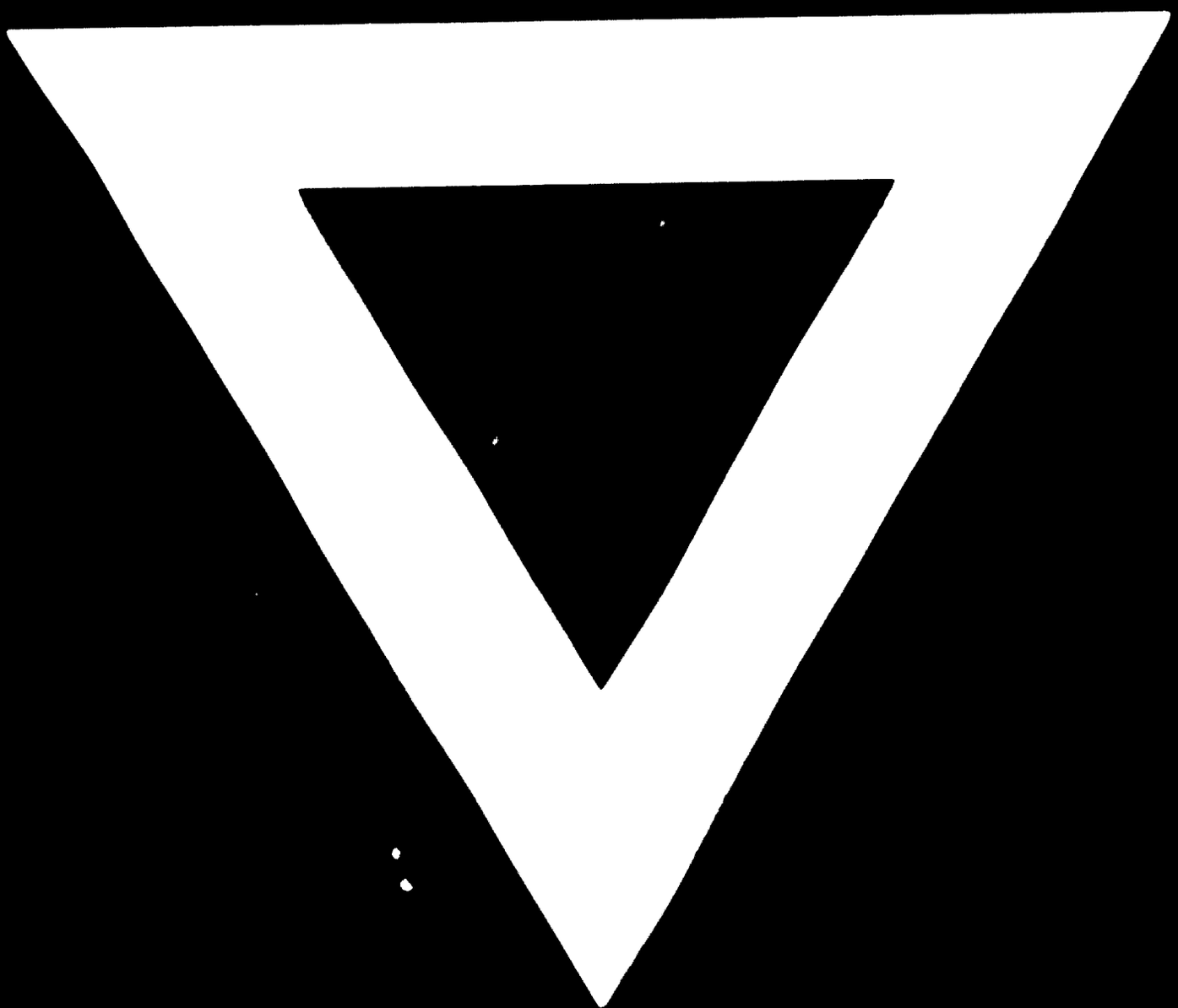

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