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Contributions to a mail survey on practical solutions in drinking water supply and wastes disposal for developing countries

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9. ABSTRACT

(ENGINEERING--HYDRAULICS R&D)

Urban and industrial growth in developing countries has increased the demand for water and the related need for more information on water and sewage treatment. This project, conducted by the University of Oklahoma, focuses on that need by developing a global network of adaptive and innovative technologies based on economic, social, political and cultural factors. A series of detailed reports have been produced that are designed to assist planners in their selection of suitable water and wastewater treatment processes appropriate to the material and manpower resource capabilities of particular countries at particular times.

"Prediction Methodology for Suitable Water and Wastewater Processes," George W. Reid and Richard Discenza.
PN-AAB-491 English
PN-AAD-291 Spanish

"Prediction Methodology for Suitable Water and Wastewater Processes. Supplement I: Manual Computation Methods," George W. Reid and Richard Discenza.
PN-AAD-292

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"Prediction Methodology for Suitable Water and Wastewater Processes. Supplement II: Computer Program," George W. Reid and Richard Discenza.
PN-AAD-293

"Data Requirement," University of Oklahoma Bureau of Water and Environmental Resources Research.
PN-AAD-295

"A Mathematical Model for Predicting Water Demand, Wastewater Disposal and Cost of Water and Wastewater Treatment Systems in Developing Countries," George W. Reid and Michael I. Muiga.
PN-AAD-294

"Treatment Methods for Water Supplies in Rural Areas of Developing Countries," Ir. L. Huisman.
PN-AAD-284
PN-AAD-285

"Sewage Treatment in Developing Countries," L.W. Canter and J.F. Malina.
PN-AAD-286

"Contributions to a Mail Survey on Practical Solutions in Drinking Water Supply and Wastes Disposal for Developing Countries," International Reference Centre for Community Water Supplies, The Hague.
PN-AAD-287

"A Catalog of Water Supply and Waste Disposal Methods for Individual Units," George W. Reid.
PN-AAD-283

"Historic Implication for Developing Countries of Developed Countries' Water and Wastewater Technology," George W. Reid and Kay Coffey.
PN-AAD-288

"Evaluation of Lower Cost Methods of Water Treatment in Latin America," Odyer A. Sperandio and Jose Perez C.
PN-AAD-289

"Socio-Economic Conditions which Pertain to Cost of Construction and Operation of Water and Sewage Treatment Facilities and Quality of Water Consumption in Kenya," Erasto Muga.
PN-AAD-290

"A Water Sterilization Study in the Philippines," Reynaldo M. Lesaca.
PN-AAD-282

"The Study of Microbial Treatment of Nightsoil," Taiwan Institute of Environmental Sanitation.
PN-AAD-281

"Study of an Existing Water Treatment Plant on Simple Design and Operating System for Supplying Drinking Water to Rural Communities in the Lower Mekong Basin Countries," Thailand Ministry of Public Health, Department of Health, Rural Water Supply Division.
PN-AAD-280

CONTRIBUTIONS TO A MAIL SURVEY ON PRACTICAL SOLUTIONS IN DRINKING WATER SUPPLY AND WASTES DISPOSAL FOR DEVELOPING COUNTRIES

Under Contract With
The University of Oklahoma Project
on
Lower Cost Methods of Water and Waste Treatment in Developing Countries
(USAID Contract Number: AID/CM-ta-C-73-13)

F I N A L R E P O R T

Prepared by

International Reference Centre
for Community Water Supply
The Hague

February 19

CONTRIBUTIONS TO A MAIL SURVEY

ON

PRACTICAL SOLUTIONS IN DRINKING WATER SUPPLY AND WASTES DISPOSAL FOR DEVELOPING COUNTRIES

International Reference Centre
for Community Water Supply
The Hague, February 1977

INTRODUCTION

In a collaborative effort between the University of Oklahoma and the International Reference Centre for Community Water Supply, a Global Workshop on Appropriate Water and Waste Water Treatment Technology for Developing Countries was held in Voorburg in November 1975.

One of the contributions to this workshop were the results of a mail survey which the International Reference Centre conducted with the purpose to collect field experience and unpublished data with particular reference to practical solutions in drinking water supply and wastes disposal in developing countries.

There is a need for a compilation of information on alternative techniques which are uncomplicated, easy to work with and require less maintenance, which can be managed by the local people. They can be non-current techniques, adaptations of existing ones or new developments. Widely made available such a compilation will enable engineers to select from it the solutions which would best suit the social, cultural and economic conditions of the country and technical level of their personnel. It will be a tool in promoting self-reliance and in getting an increased coverage of drinking water supply and basic sanitation in the developing countries.

Most such information is not published, but in the day to day experience of field workers. The mail survey was intended to open up these sources of unpublished information. The information collected varied from mere indications of some interesting application or ideas requiring evaluation to solutions which were readily applicable. Even though the information frequently was incomplete it was thought that dissemination would be of value to engineers in the field and stimulate further development and activities. No effort was made at this stage to review and evaluate each contribution on its merits, rather it is reported as it comes in, to evoke comments and with the purpose that more detailed information will be reported back to the International Reference Centre, so that a more complete document can be issued in due course.

For practical reasons the contributions were reported in two parts; the first one contains the more complete information which may stimulate directly further testing and development activities at local level. Other contributions such as studies and those of general nature, or which are specific local applications are reported in part II. For both parts additional information or comments are very welcome.

Dissemination of the collection will hopefully lead to an increasing interest and activity in developing local solutions and adaptations and towards a better communication between engineers in the sector.

ir. T.K. Tjiook

Note: Information from this document can be quoted with due recognition of the source i.e. IRC mail survey.
Please send copies of correspondence with contributors to the IRC, P.O. Box 140, Leidschendam, The Netherlands.

INDEX

PART I

I N D E X (cont.)

PART I

100 WATER SUPPLY GENERAL

200 WATER SOURCES AND RECOVERY

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33604

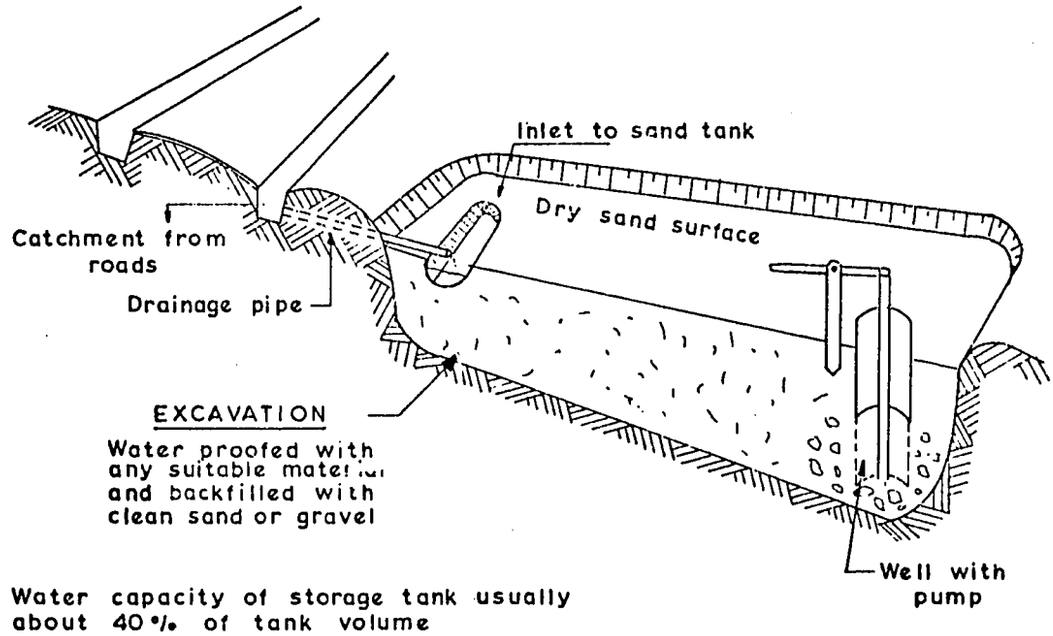
Title: Rainwater collection, filter and storage

Country: -

Characteristics: Utilization of rainwater run-off from roads

Principle/Description:

Storage of rainwater run-off from roads in a dug well filled with sand or gravel. Presettling is necessary if water is heavily contaminated with soil. The tank serves as a horizontal slow sand filter. Detention time is about 36 hours.



RAINWATER COLLECTION

Reference: Mann, H.T., Water Research Centre, Stevenage Laboratory, Elder Way, Stevenage, Herst, SG1 1TH, England

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

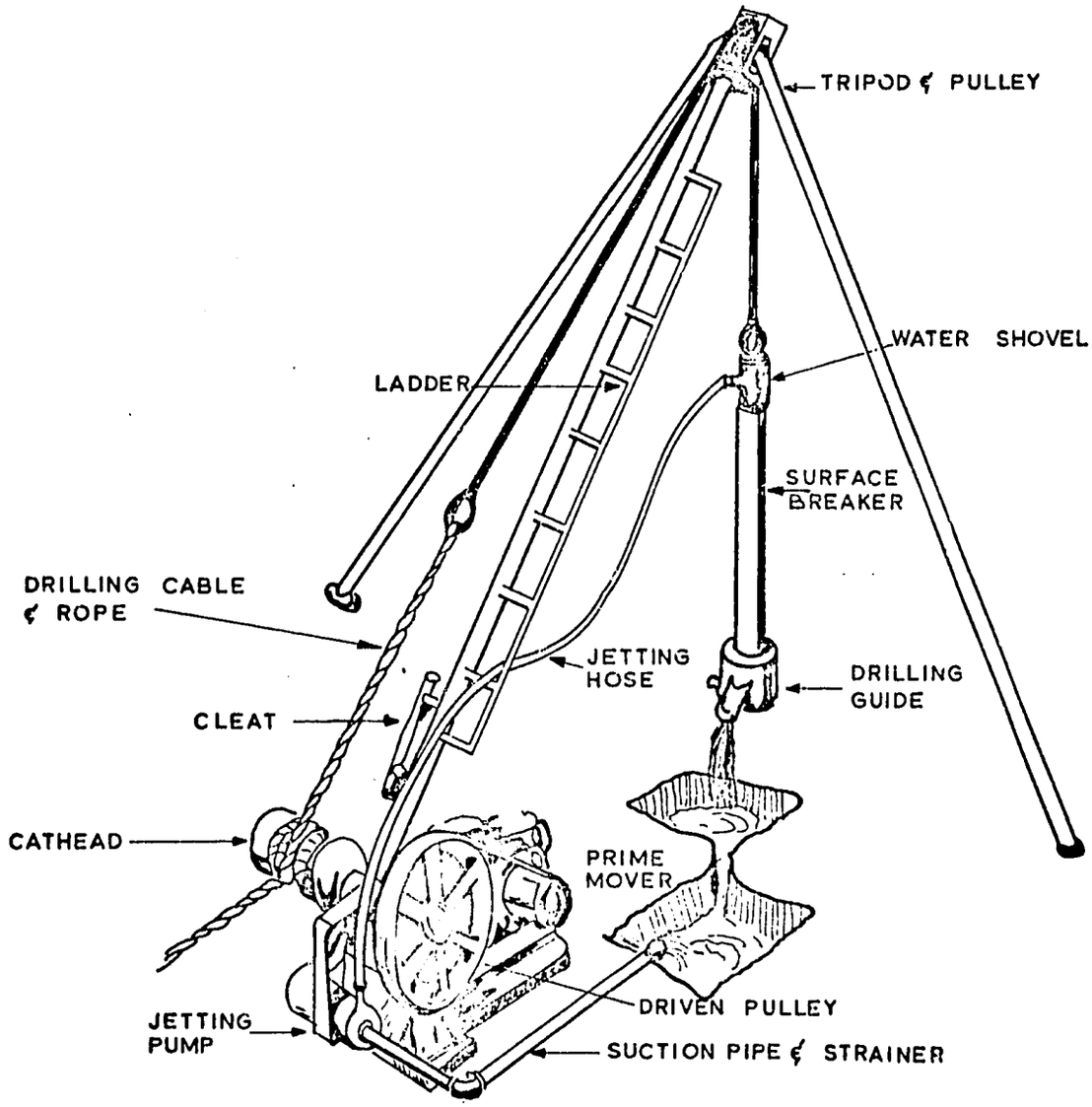
Title: Drilling Rig

Country: Philippines

Characteristics: Portable unit

Principle/Description:

Drilling by jetting, hydraulic percussion or core drilling. For 2 to 12 inch wells with corresponding depths of 100 and 45 meters.



Reference: Reported by: Spangler, C.D., 10212 Brookmoor Drive, Silver Spring Maryland 20901, U.S.A.

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33604

Title: Bamboo for well casing

Country: El Salvador/Ecuador

Characteristics: Joints with iron sheets

Principle/Description:

Well casing consists of ripe, long bamboo canes, over 12 feet in length and about 4 to 6 inches in diameter. The partition at each node is gouged out, using a rounded chisel head welded to the end of a pipe. Part of the bamboo casing is converted into a rudimentary screen by drilling holes into it with a hand drill. The screen end and the casing lengths are lowered down the well using a bamboo tripod with a block and tackle. In soft unconsolidated sediments, wells can be drilled down to a depth of 40 feet using hand augers. The auger extensions can be supported by again using a bamboo cane tripod. For joining one casing length to the other, one of the more satisfactory methods was to wrap a thin sheet of iron around the joint and fasten it in place using nails which were small enough so as not to protrude inside the cane. The jointing material will, no doubt, corrode away with time but a group stability will be obtained once the casing sections are placed and the earth is packed around them.

Reference: Ferrer, A.J., San Salvador

Remarks: Reported by Prof. P. Straub, Ph. D. University of Minnesota, Minneapolis, Minnesota 55455, U.S.A.

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 99 42 51, telegr.: worldwater the hague, telex: 33604

Title: Bamboo tube well

Country: India

Characteristics: Indigenous technology

Principle/Description:

Split bamboo stems are nailed to 4" - 8" iron rings (made from 1" strips) as a frame. The lower part of the pipe is wrapped with two layers of coir string and the upper part with one layer of coir string and one layer of polyethylene sheeting forming tubes up to 25ft length. Coir string is made from coconut husks. It does not pass sand and does not rot in water. A bamboo scaffold was used for lowering the pipe.Most costly in the pumping set equipped with a 5 HP diesel engine. Used collectively the pump can be transported from well to well by bullock cart. Useful life is estimated at 3-5 years. General acceptance and use in Saharsa and Purnea districts (Bihar) for irrigation since its introduction in 1969. Capacity 30 cu.m/hr.

Reference: Dommen, Arthur J. - "The Bamboo Tube Well: A Note on an Example of Indigenous Technology" - Economic Development & Cultural Change Vol. 23, No. 3, April 1975, 483-489

Remarks: Reported by Prof. G.F. White

who international reference centre for community water supply

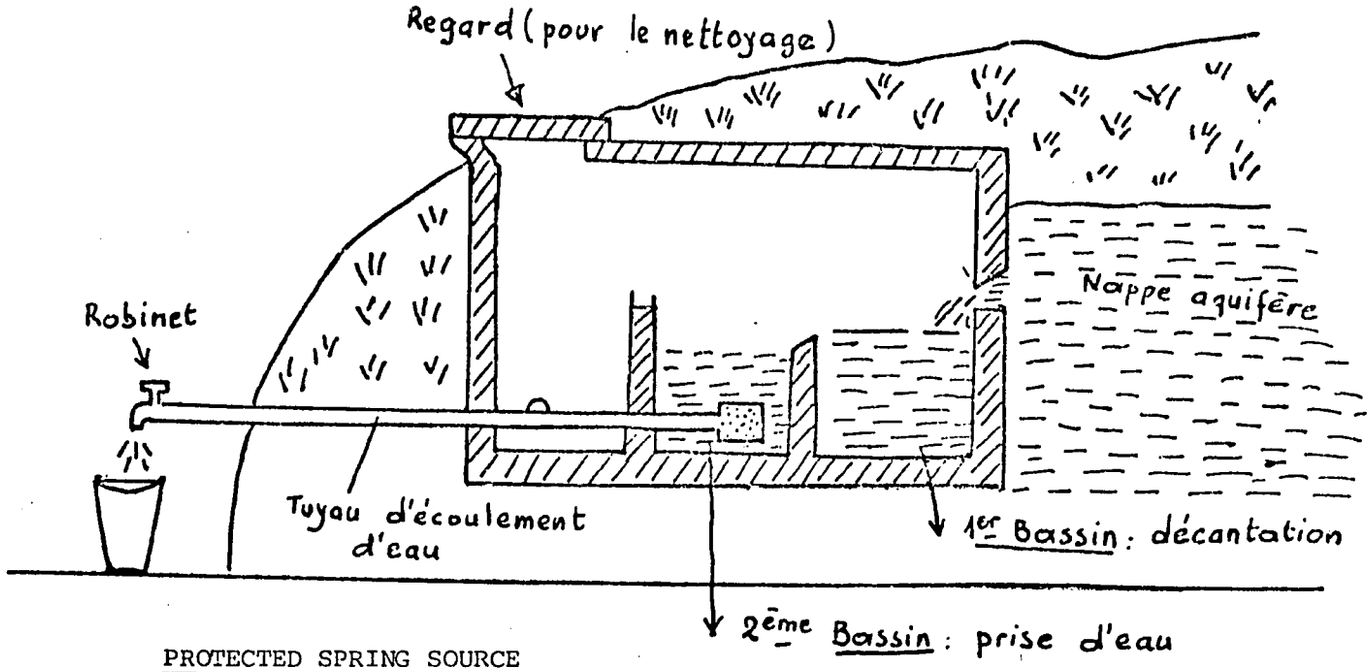
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

Title: Protected Spring Source

Country: Guinea

Characteristics:

Principle/Description:



PROTECTED SPRING SOURCE

Reference: Dabo, M.T., Ministry of Public Health, Conakry, Guinea

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33004

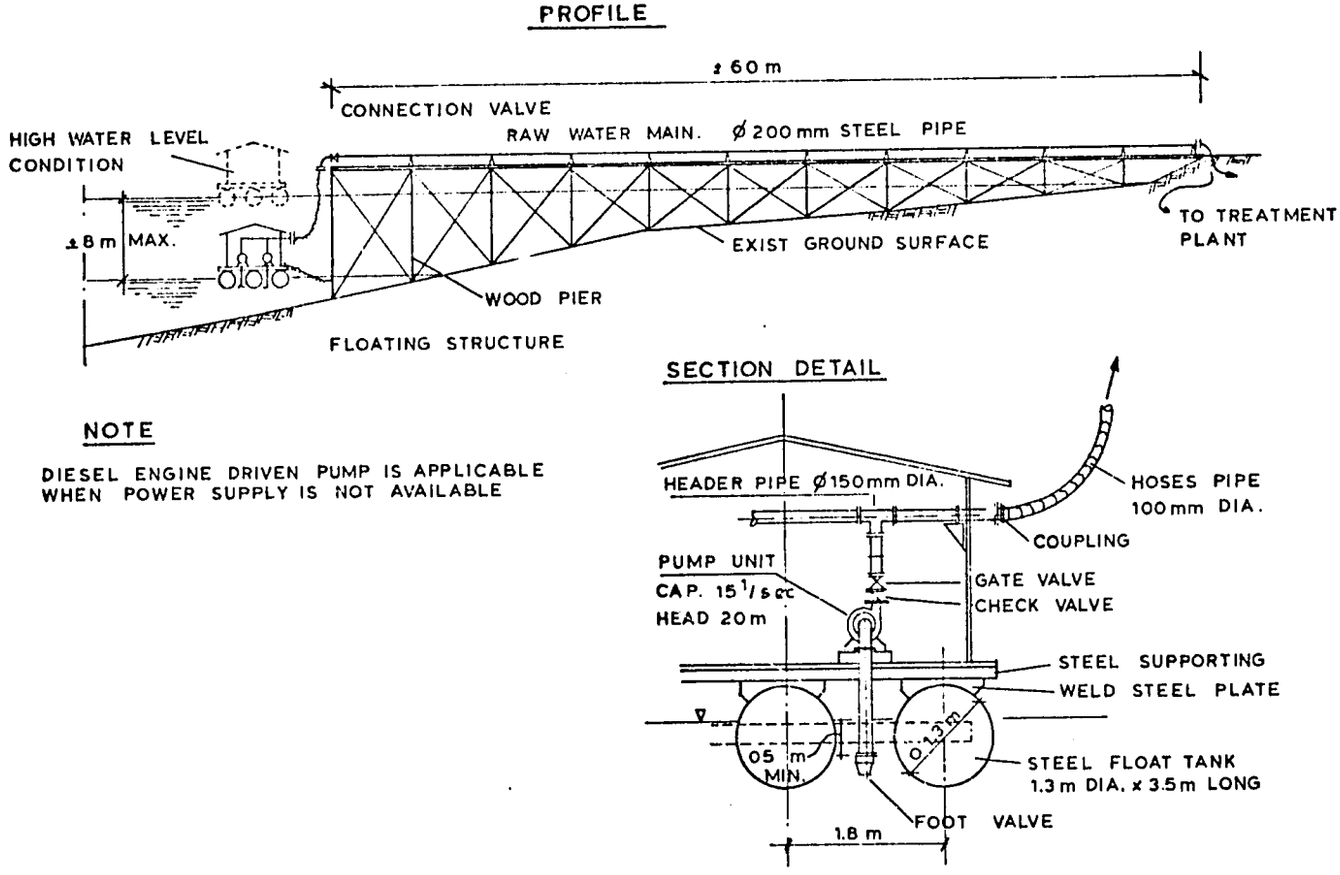
Title: Floating Pump station

Country: Jambi, Indonesia

Characteristics:

Principle/Description:

The floating pump is connected with a flexible pipe to the raw water main. Water level variation in the river can be as much as 8 meters.



NOTE

DIESEL ENGINE DRIVEN PUMP IS APPLICABLE WHEN POWER SUPPLY IS NOT AVAILABLE

Reference: Shigeki Nakujima, Dr., 3-10, Nishi-Okubo, Shinjiku-ku, Tokyo, Japan

Remarks:

who international reference centre for community water supply

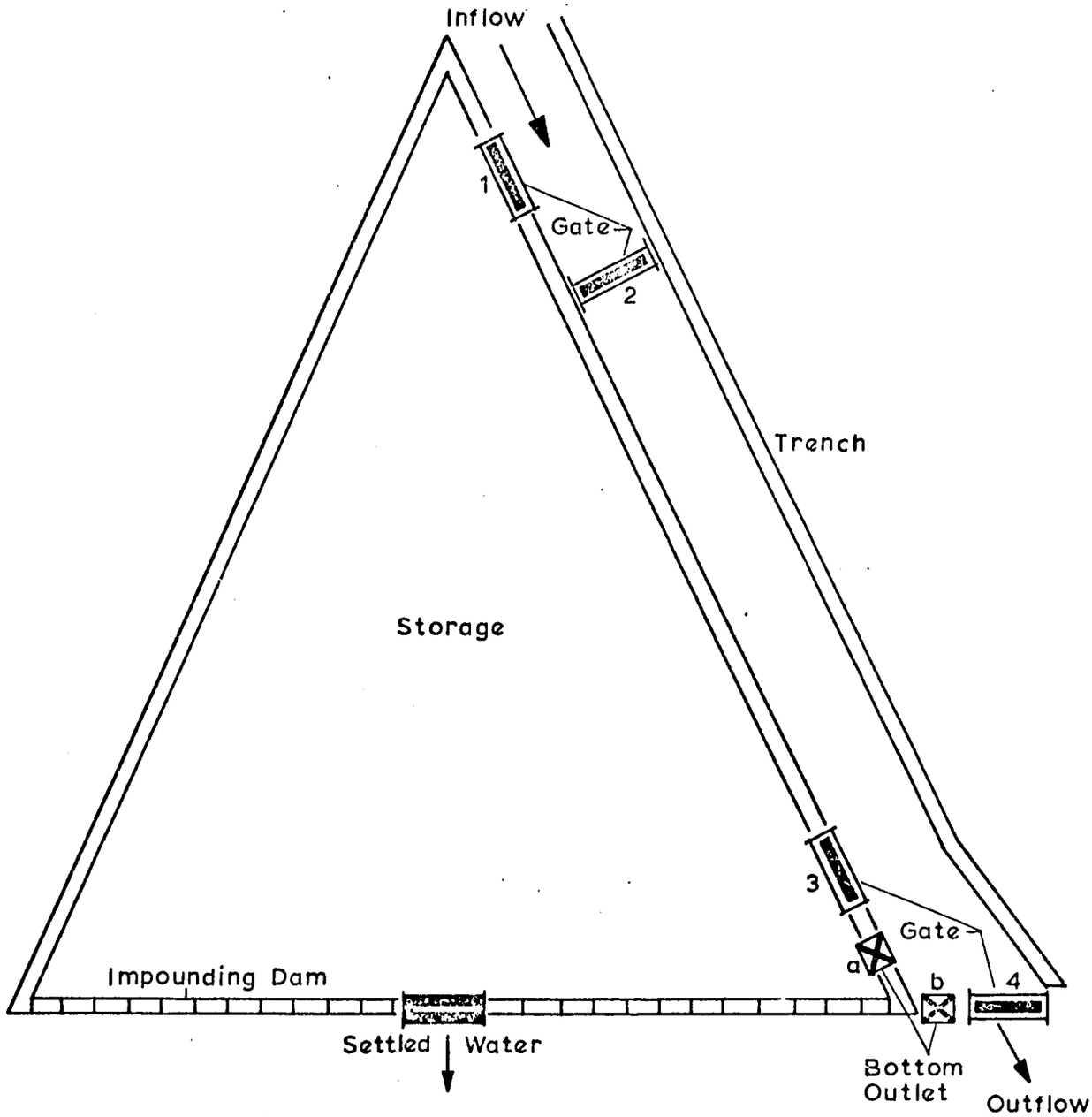
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone. 070 - 60 42 51, telegr.: worldwater the hague, telex: 33604

Title: Raw water quality control

Country:

Characteristics: Storage tank with bypass

Principle/Description: Equalizing the quality of raw water in a reservoir by bypassing the inflow through gate 2 and 4 in periods of bad quality (monsoons, etc.)



Reference: Schmidt, Dr. Kh., Dortmunder Stadtwerke A.G., 5841 Geisecke/Ruhr, West Germany

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

Title: Tube well in river bed

Country: Sri Lanka

Characteristics:

Principle/Description:

3" diameter well screens were driven to a depth of 8 ft into the river bed and connected to a 4" suction line. Pumps are housed 500 ft away to avoid damage by floods. The flow can be reversed for backwashing. Operates satisfactorily during 8 - 10 years. Clogging afterwards probably due to infrequent backwashing.

Reference: Kulasingham D.S., P.O. Box 1434, Colombo 7, Sri Lanka

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33001

Title: Subsurface river flow as resource

Country: Madagascar

Characteristics:

Principle/Description:

River which flows through the town could not be used for water supply because there is not enough water in the river during the dry season. A test showed a permanent flow existing in the sand deposists in the river bed. This underflow was intercepted by building a concrete basin dug in the river bed. To increase the permeability of the sand a pack of gravel was put around the basin. The water enters the basin through circular holes in the walls. The basin is connected by an 8" diameter pipe to a 3,5 foot diameter concrete pipe pumping well at the bank of the river. A screen is attached to the pipe inside the basin. A pumping test yielded 80 cubic meters per hour with a drawdown of only 2 feet.

Reference: Rarafy, C.A., Tanarive

Remarks: Reported by Prof. P. Straub, University of Minnesota, Minneapolis Minnesota 55455, U.S.A.

who international reference centre for community water supply

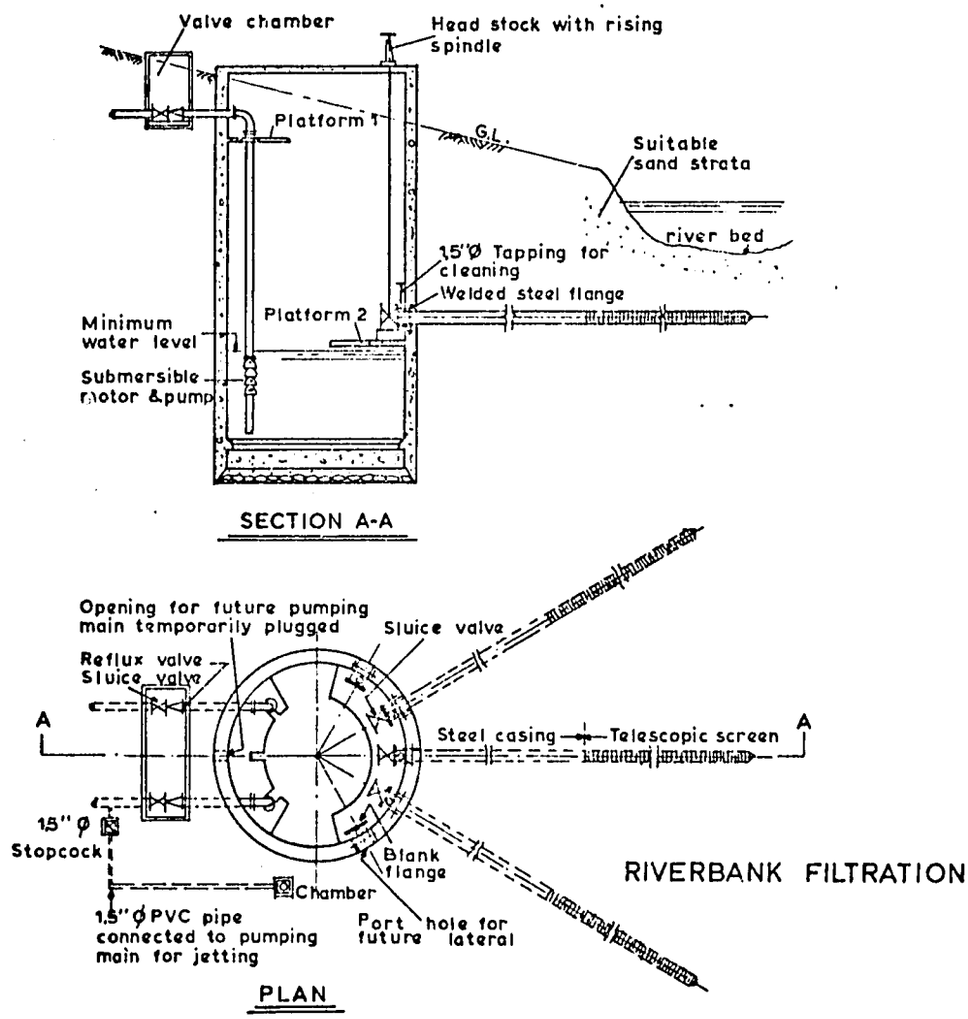
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 89 42 51, telegr.: worldwater the hague, telex: 33604

Title: Bank filtration with Ranney type wells

Country: Sri Lanka

Characteristics: Riverbank as filter

Principle/Description: Basic idea is to utilize the sand bed on the river bank as a filtering medium and avoid all treatment steps except disinfection If the naturally occurring sand strata is unsuitable, a suitably sized sand layer can be laid above the laterals. Backwashing through flexible polythene tube in the pipes. Capacities up to 250 cu.m/hr.



Reference: Amirtharajah, A., National Water Supply & Drainage Board, Ratmalana, Sri Lanka

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

Title: Ranney Wells

Country: Hungary

Characteristics: using steel tube as a well

Principle/Description:

Wells on the banks of a river or lake. Material of the shaft is a 15 mm thick steel tube with a diameter of 2.2 meters. Special equipment is used to sink the tube. The bottom of the tube gets a reinforced concrete seal. Filtering pipes (generally 10) are bored horizontally and connected with the collecting tube. The capacity of the well, depending on the local geohydrologic circumstances, is 4000 to 15000 m^3/day.

Reference: György Füresz, Metropolitan Water Works of Budapest, Budapest,V., Károlyi M.u. 12. (reported by Murawshi, T.)

Remarks:

who international reference centre for community water supply

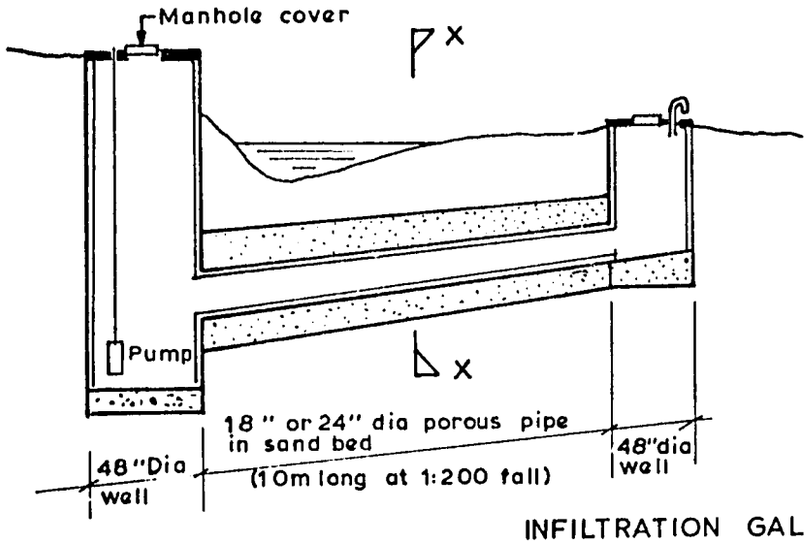
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

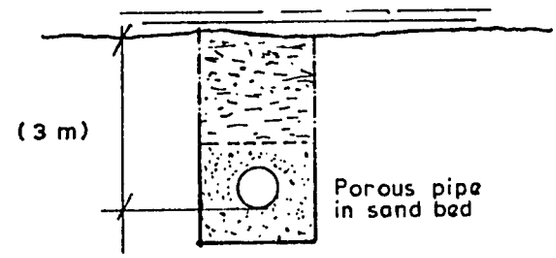
Title: Infiltration Gallery

Country: Zambia

Characteristics: Filtration of subsurface water; precast concrete rings for inspection wells.

Principle/Description: Porous pipes are laid just sufficiently below the natural ground water level. Two inspection wells made of precast concrete rings (Ø 900 mm) at either end of a 1200 mm wide and 10 meters long, 3 meters deep trench. The 450 mm to 600 mm dia porous pipes are totally surrounded with filter sand. Trench to be dug in sandy soils, at a gentle slope.





SECTION XX

INFILTRATION GALLERY

Reference: Uplap, P.L., Works Department, Building Branch, P.O. Box 967, Lusaka, Zambia

Remarks:

who international reference centre for community water supply

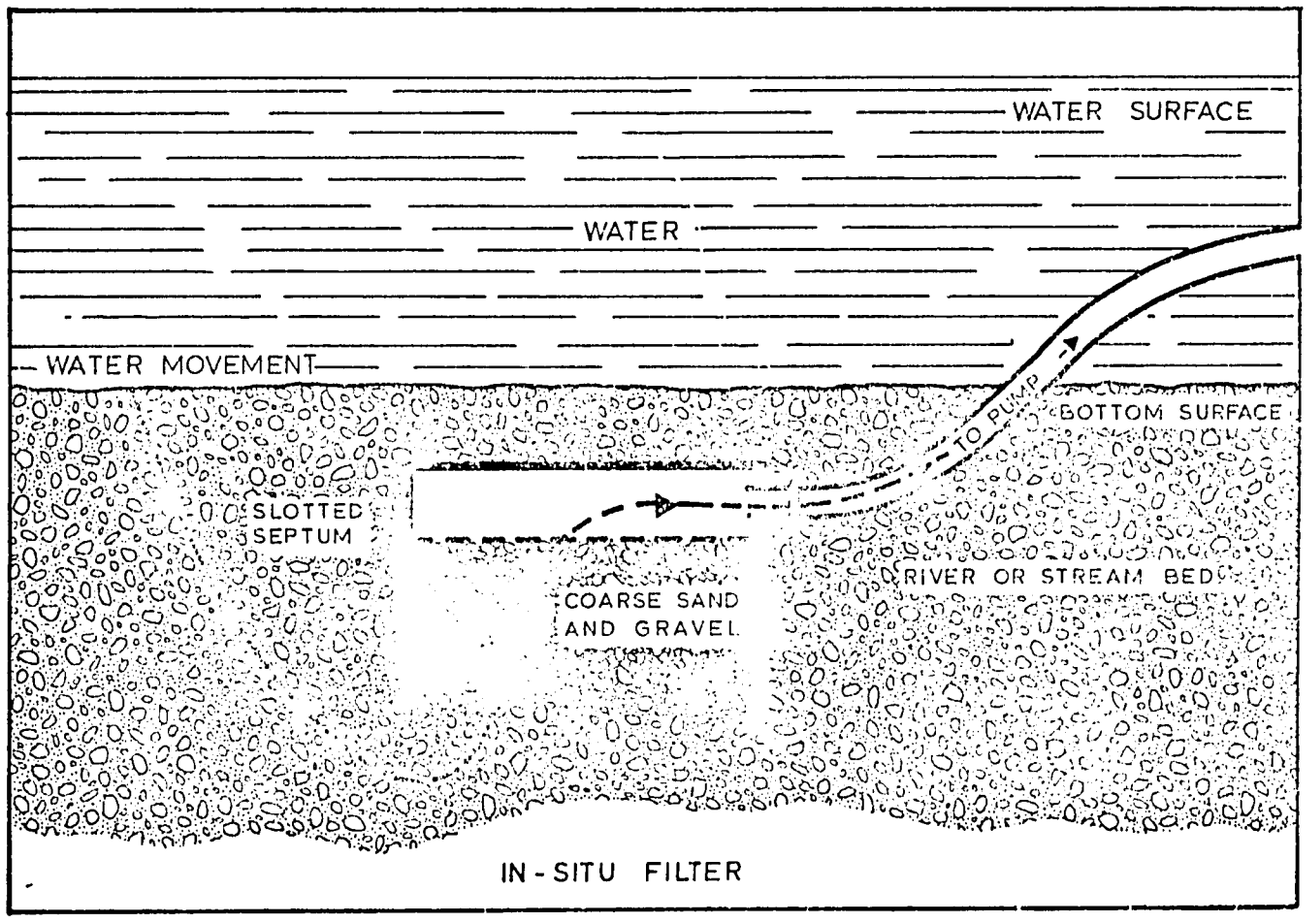
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

Title: In situ sand filter

Country:

Characteristics:

Principle/Description: A plastic slotted box (60 x 60 cm) is placed in the river bottom. Water is drawn by hand or other pump with the river bottom serving as filter.



Reference: Cansdale, G., Skegness Lincs. PE25IBD, United Kingdom

Remarks:

who international reference centre for community water supply

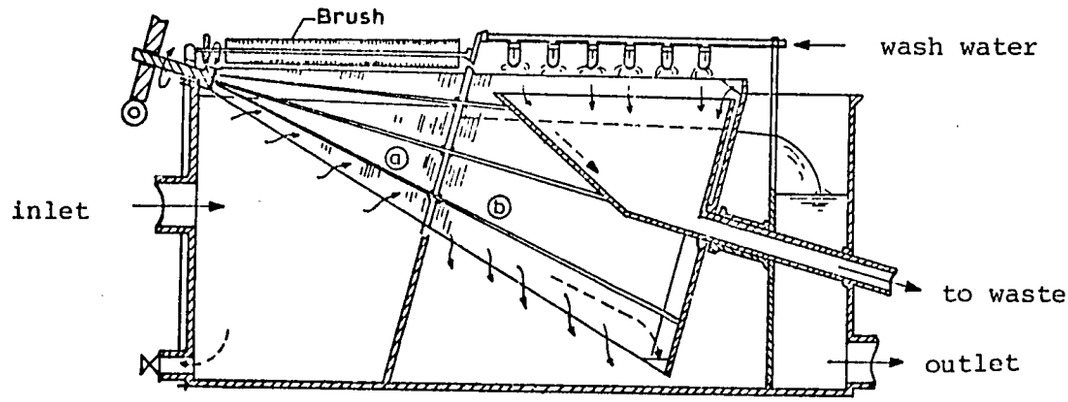
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

Title: Rotary filter

Country: Japan

Characteristics:

Principle/description:



ⓐ Strainer (made of bamboo)

ⓑ Micro-strainer

Reference: Saburo Abe, Suido-kiko K.K., 3-7, Yaesu, Chuo-ku, Tokyo, Japan

Remarks:

300 WATER TREATMENT

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

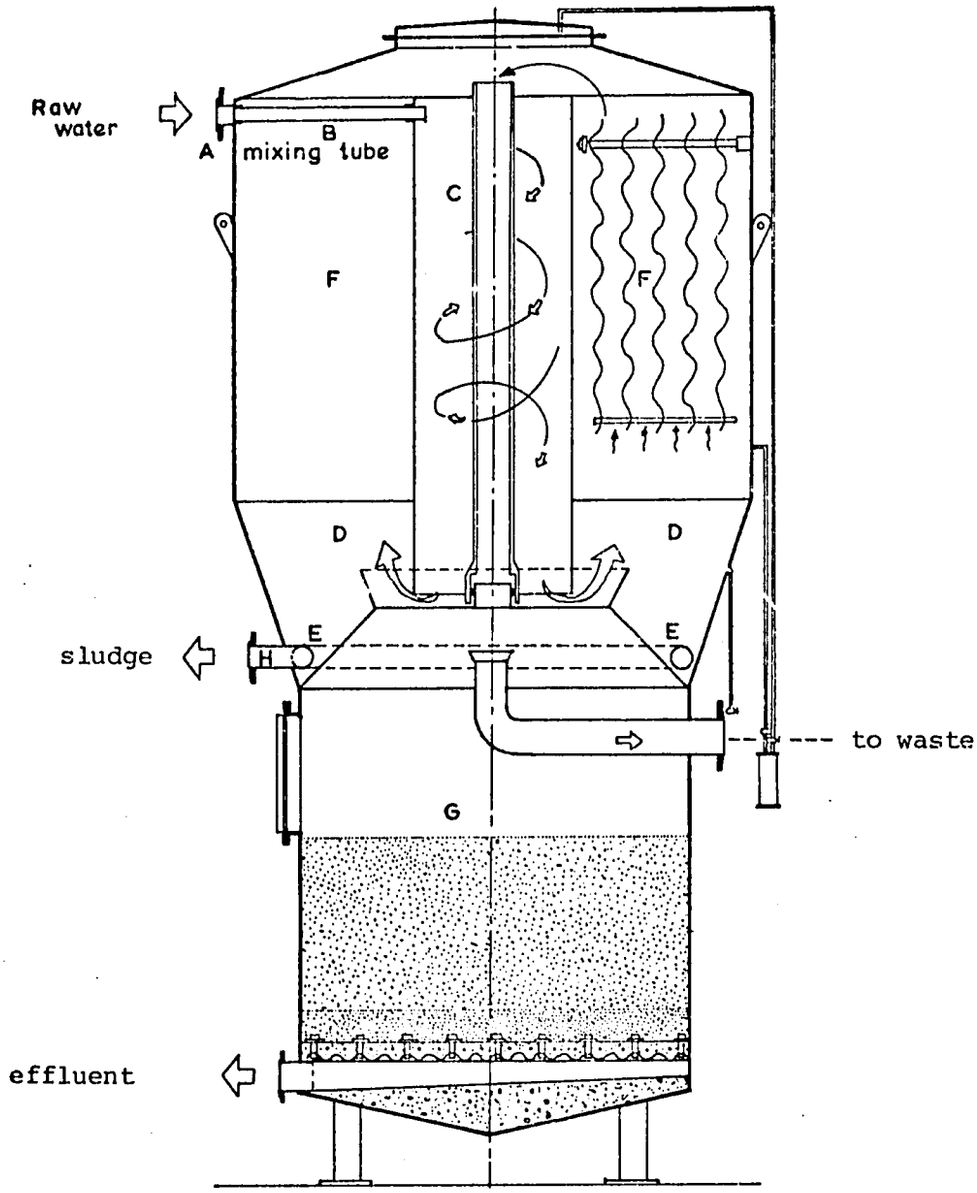
Title: Compact Water Treatment Plant

Country: Uruguay

Characteristics: Application in villages

Principle/Description:

Compact treatment plant with mixing tube (B), heliocoidal hydraulic flocculator(C sludge blanket zone and vertical corrugated plate settler (F) in a combined tank on top of a rapid sand filter(G).



Reference: Schkolnik, P. Planta Compacta de Tratamiento de Agua, XIV· AIDIS Congress, Mexico, 1974

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

Title: Cyclofloc clarification process

Country: Hungary

Characteristics:

Principle/Description:

In a sludge blanket clarifier coagulated water flows upward through a bed of earlier formed flocs. In the Cyclofloc process quartzsand of a granular fraction of 40 to 100 microns is added to increase the concentration and the weight of the flocs. The process is enhanced by the addition of chain polymer polyelektrolytes. The quartz sand particles increase the frequency of the collision of the particles per unit of time. This way it influences advantageously the structure of the flocs and their settlement.

After settling, the sand containing mud is continuously removed from the settling basin and is subsequently separated by hydrocyclones. The regenerated sand is then recycled in closed circuit into the system, with a minimum of loss.

This process is favourable both economically and technologically. The fluidized sludge-blanket enables three or four times higher flow velocities than the conventional method and ensures a permanently high quality of clarified water.

Reference: Mrs. József Bozzay, Metropolitan Water Works of Budapest, Budapest V., Károlyi M.u. 12.

Remarks:

who international reference centre for community water supply

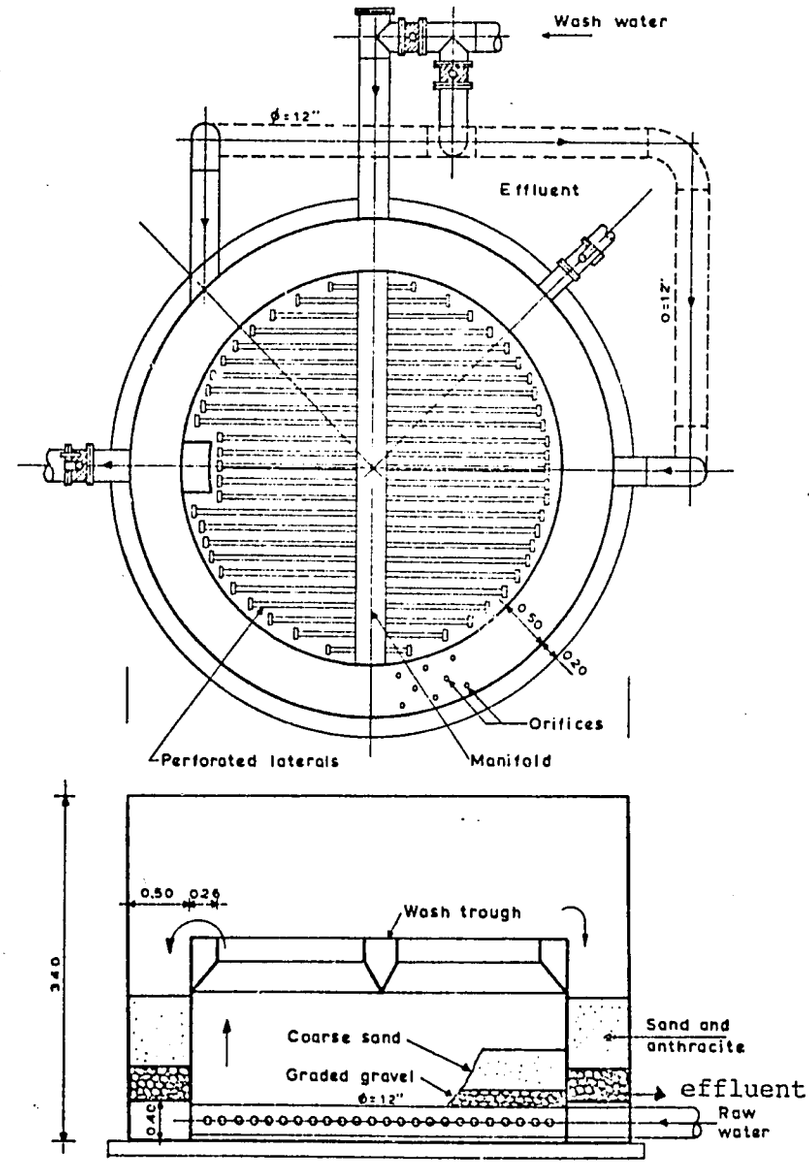
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33604

Title:	Compact water treatment plant
Country:	Venezuela
Characteristics:	Upflow contact filter and downflow polishing filter

Principle/Description:

In the central zone of a steel circular tank,(5 meter diameter and 3.40 meter depth) all the treatment processes take place; upward flow, mixing, flocculation and separation of flocs take place. Rest turbidity is reduced in the surrounding downflow filters.

The unit consists of a central upflow contact clarifier and surrounding polishing filters. In the central filter flocculation and separation of flocs take place. Rest turbidity is removed in the downflow filters.



Reference: Sanchez, G., INOS, Edificio La Paz, Avenida Andrés Bello, Caracas, Venezuela

Remarks:

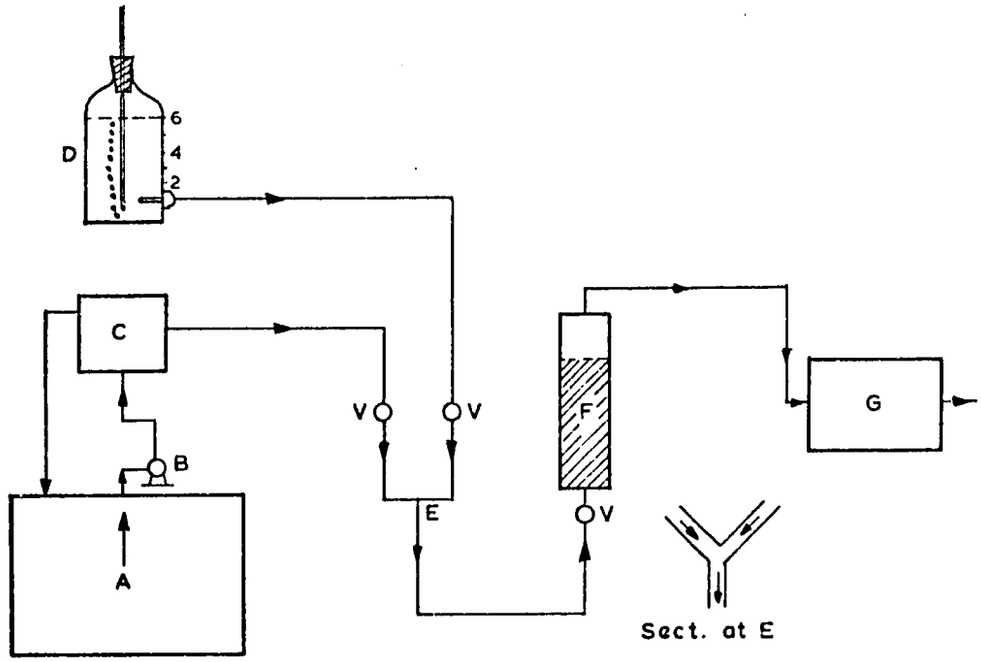
who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33604

Title:	Expanded sand bed flocculator
Country:	India
Characteristics:	Uniform agitation

Principle/Description:

In a simple colomn (F) through which raw water with the required alum dose is allowed to pass in upflow, the velocity of water is so adjusted that the expansion is about 6 to 10 percent. This avoids clogging of the sand column. The sand contributes to uniform agitation in the flocculation process.



A = Main reservoir for suspension.
B = Pump.
C = Constant head tank.
D = Alum bottle.
E = 'Y' junction.
F = Expanded sand column.
G = Sedimentation tank
V = Valve.

Reference: Bhole, A.G., Visvesvaraya Regional College of Engineering, Nagpur (440 - 911), India

Remarks: experimental

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 09 42 51, telegr.: worldwater the hague, telex: 33604

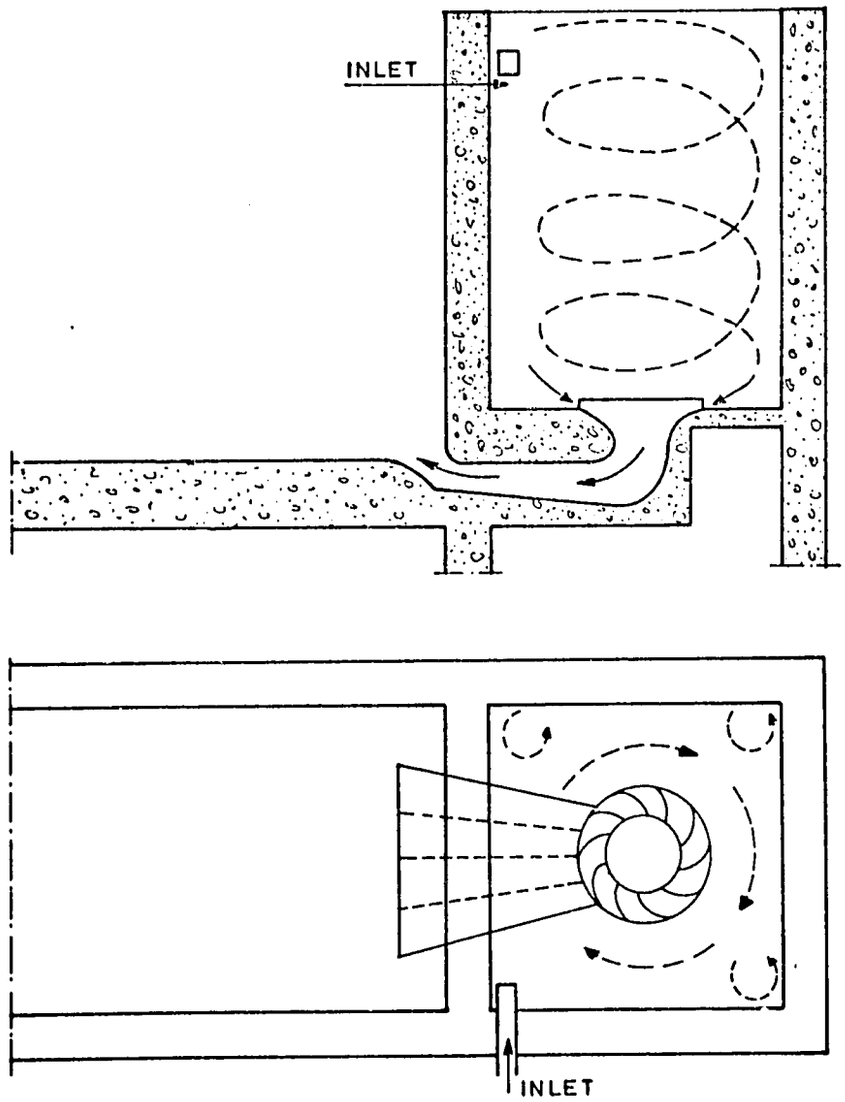
Title: Hydraulic Flocculator

Country: Argentina

Characteristics: for small villages

Principle/Description:

Tangential entrance of the raw water and coagulant in the upper zone, leaving the flocculation chamber through curved guiding vanes (similar to the Francis turbine) and a central bottom opening to the sedimentation tank.



Reference: Carcedo, Eng. M., Centro de Ingenieria Sanitaria, Avda. Pellegrino 250, Rosario (SFE) Argentina

Remarks:

who international reference centre for community water supply

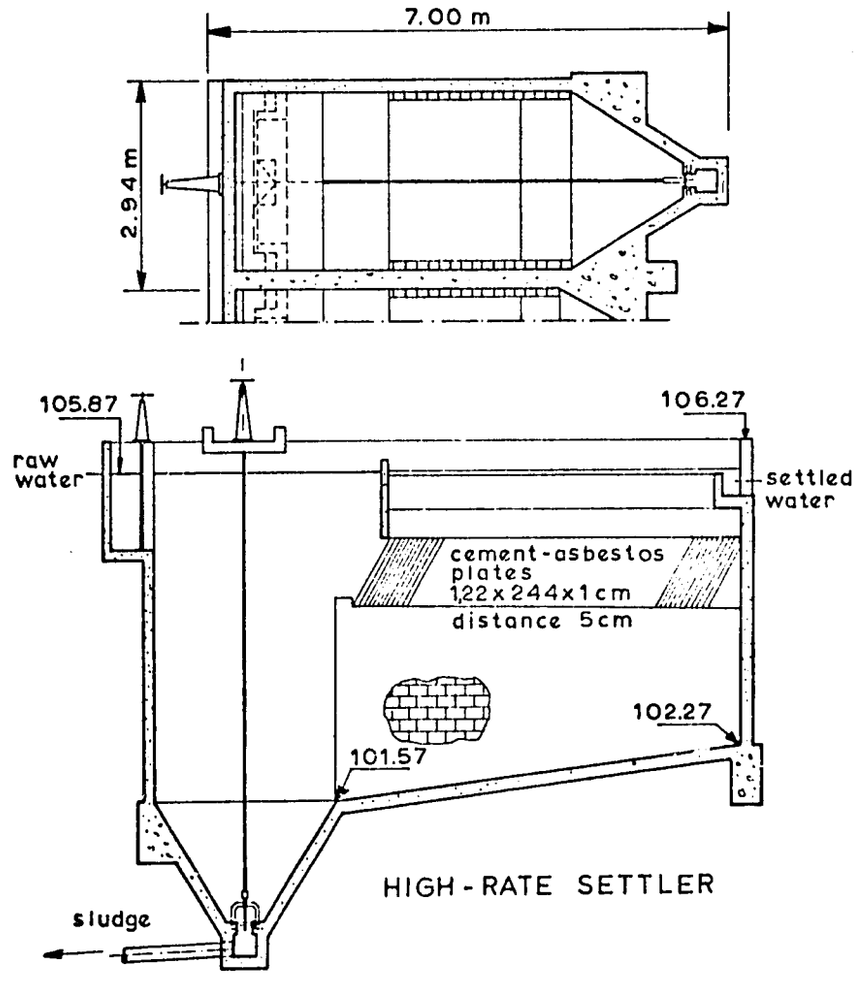
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

Title: High rate (plate) settler

Country: Peru

Characteristics: Use of local material

Principle/Description: Increased capacity of settling by inserting inclined plates and enlarging the settling area.



HIGH-RATE SETTLER

Reference: Centro Panamericano de Ingenieria Sanitaria y Ciencias del Ambiente (CEPIS), Calle Los Pinos 256, Peru, Lima.

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: n.w. hayenstraat 6, voorburg (the hague)
telephone: 070 - 09 42 51, telegr.: worldwater the hague, telex: 33604

Title: Basket alum feeder

Country: Jamaica

Characteristics: for emergency

Principle/Description: Alum lumps are put in a basket and dipped in a channel ahead of sedimentation basin at periods of high turbidity. Dosing is in relation to depth of immersion of the basket.

Reference: Reid, R., Sanitary Engineer

Remarks: PAHO

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

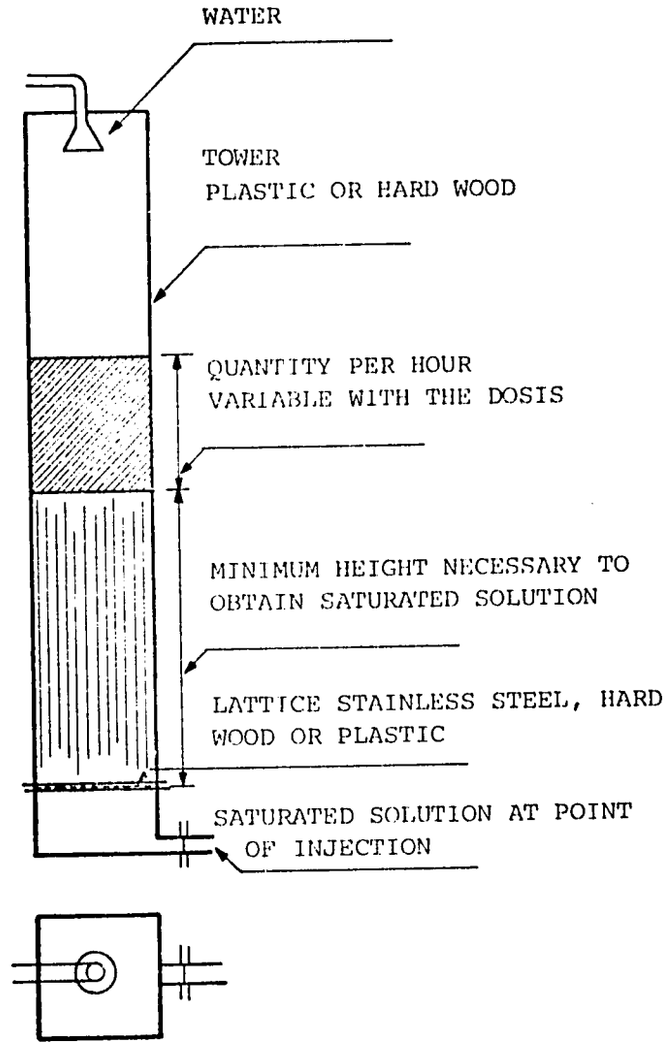
Title: Dosing Tower

Country: Argentina

Characteristics:

Principle/Description:

Preparing saturated solutions by spraying water in a packed bed of alum lumps.



Reference: Carcedo, Eng. M., Centro de Ingenieria Sanitaria, Avda. Pellegrino 250, Rosario (SFE) Argentina

Remarks:

who international reference centre for community water supply

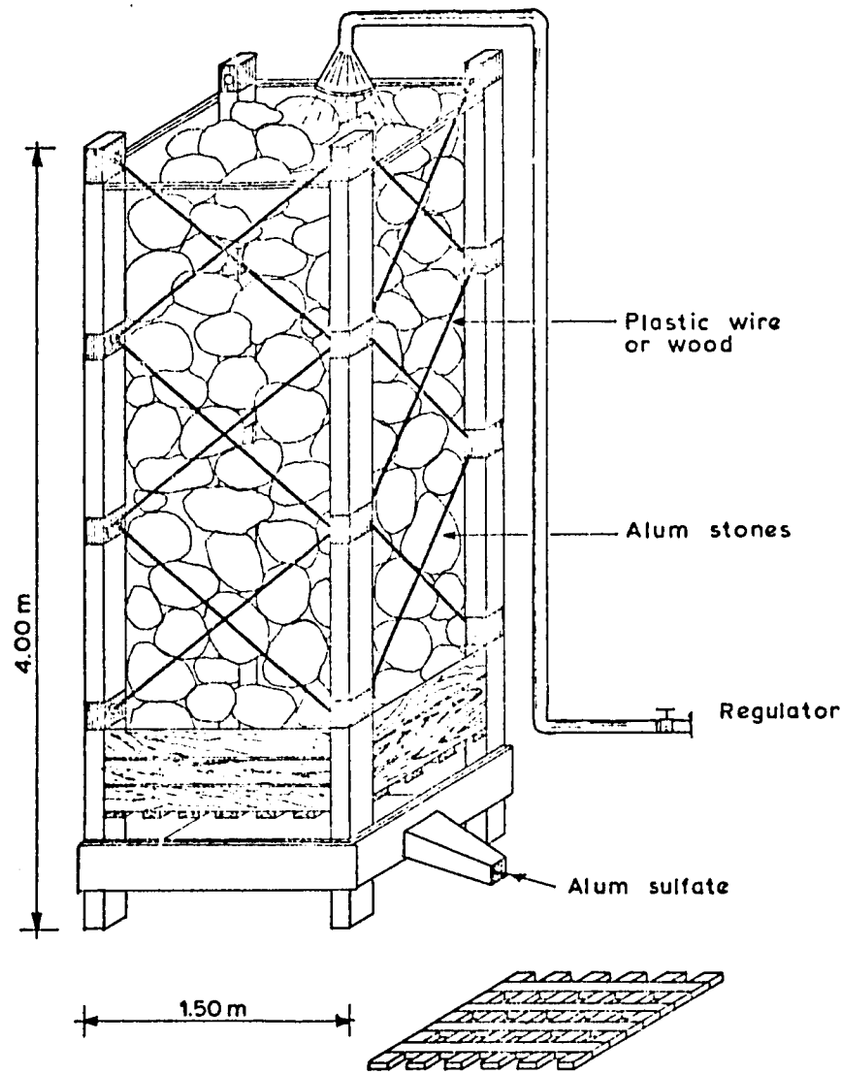
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 89 42 51, telegr.: worldwater the hague, telex: 33604

Title: Alum dissolving tower

Country: Chile

Characteristics: Simple wooden construction

Principle/Description: Wooden tower of about 4m in height, with a shower on top. When the shower is opened, a saturated solution of alum sulfate is obtained at the bottom after a few minutes. Dosing by regulating the amount of water added.



Wooden false bottom

Reference: Rosenfeld, B., Casilla 5068, Quito, Ecuador

Remarks:

who international reference centre for community water supply

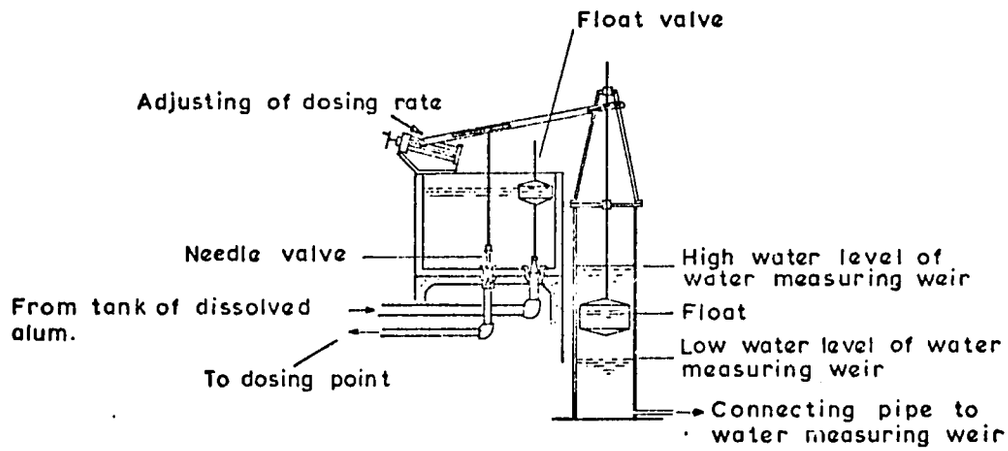
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 0, voorburg (the hague)
telephone: 070 - 89 42 51, telegr.: worldwater the hague, telex: 33604

Title: Alum doser

Country: Japan

Characteristics: Float operated needle valve

Principle/Description:



ALUM DOSING APPARATUS

Reference: Ishibashi, Prof. T., Department of Sanitary Engineering University of Tokyo, 7-3-1 Nongo, Bunkyo-Ku, Tokyo 113, Japan

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

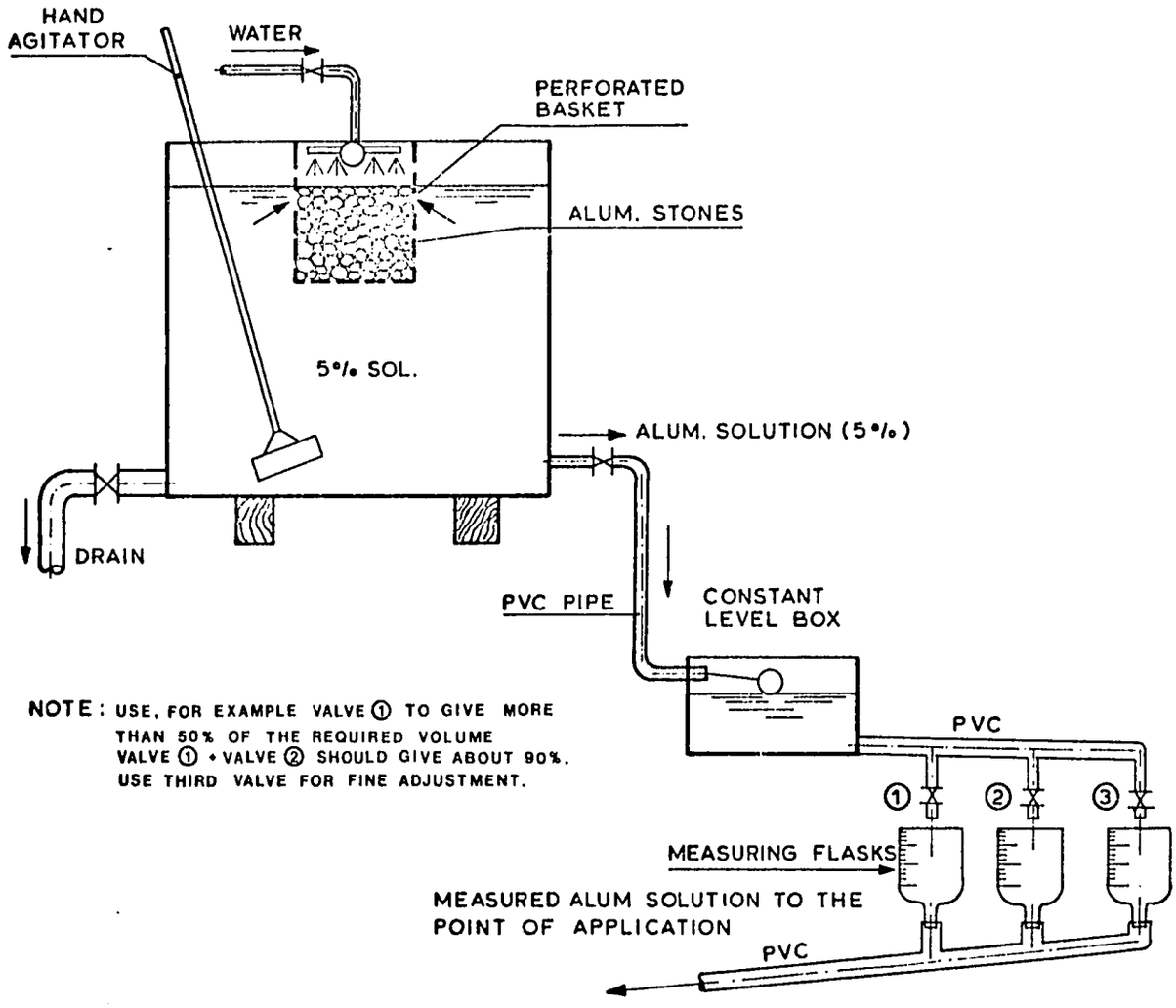
Title: Alum dosing device

Country: Brazil

Characteristics:

Principle/Description:

Dosing accuracy is obtained by using 3 valves for high, medium and fine adjustment.



Reference: Prof. J.M. de Azevedo Netto, University of Sao Paulo, Brazil

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 89 42 51, telegr.: worldwater the hague, telex: 33604

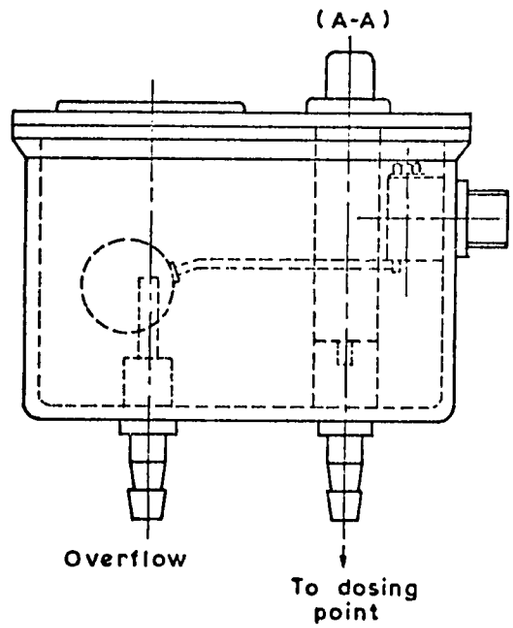
Title: Chemical Feeder

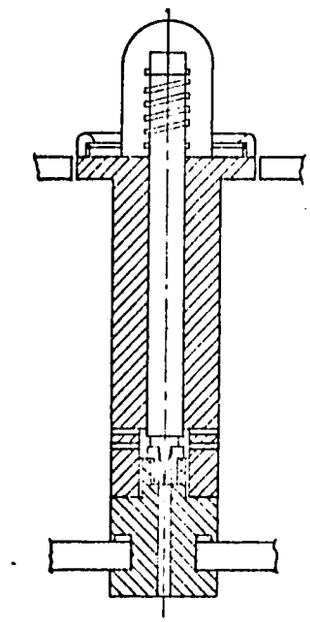
Country: Japan

Characteristics: Variable feed

Principle/Description:

Constant level in the tank is secured with a float valve and overflow. The needle valve opening can be adjusted to vary the dosage.





Needle valve (A-A)

Reference: Yoichi Iwasaki, Suido-kiko K.K., 3-7 Yaesu, Chuo-ku, Tokyo, Japan

Remarks:

who international reference centre for community water supply

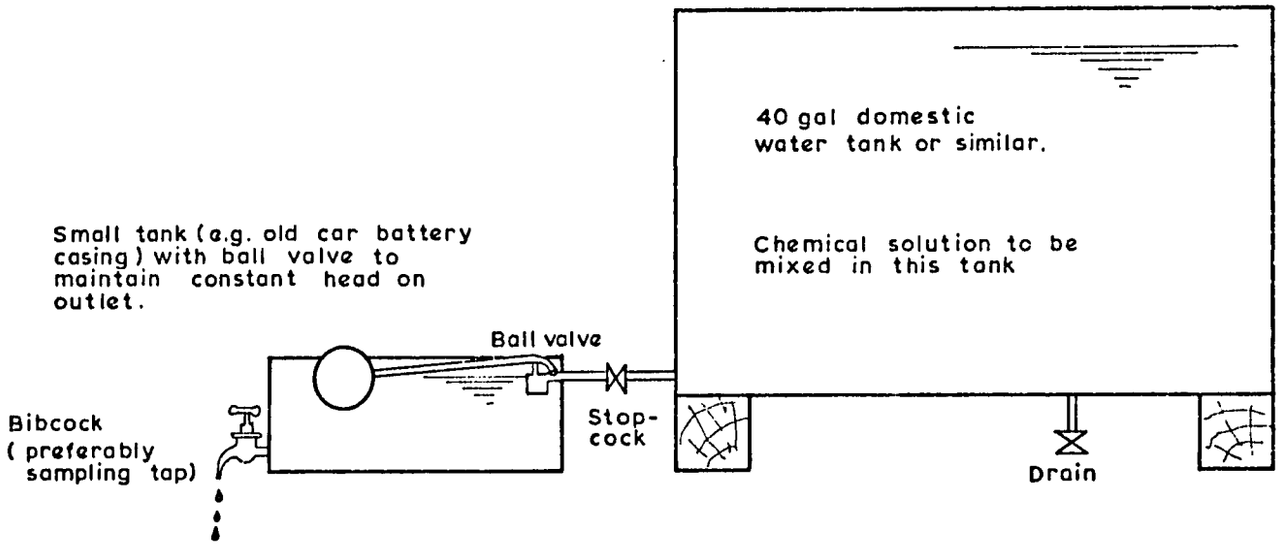
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33004

Title: Variable rate doser

Country: Kenya /Japan

Characteristics: Constant level tank with bibcock

Principle/Description: Dosing rate can be set by adjusting the outlet tap. This doser can be used for Alum or other chemicals but if they are corrosive, the pipework and valves must be made of plastic and the solution tank lined. A multiple point doser can be made by replacing the small tank with a long trough, fitted with several taps.



Rate of flow of chemical solution measured with measuring cylinder or jug and stopwatch and adjusted by Bibcock.

Reference:- Scott Wilson Kirkpatrick & Partners, Scott House, Basing View, Basingstoke, Hants RG21 2J6, U.K.
- Masayoshi Oki, Himeji Water Supply Bureau, 23-2, Yashiro, Himeji City, Japan

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: n/w havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

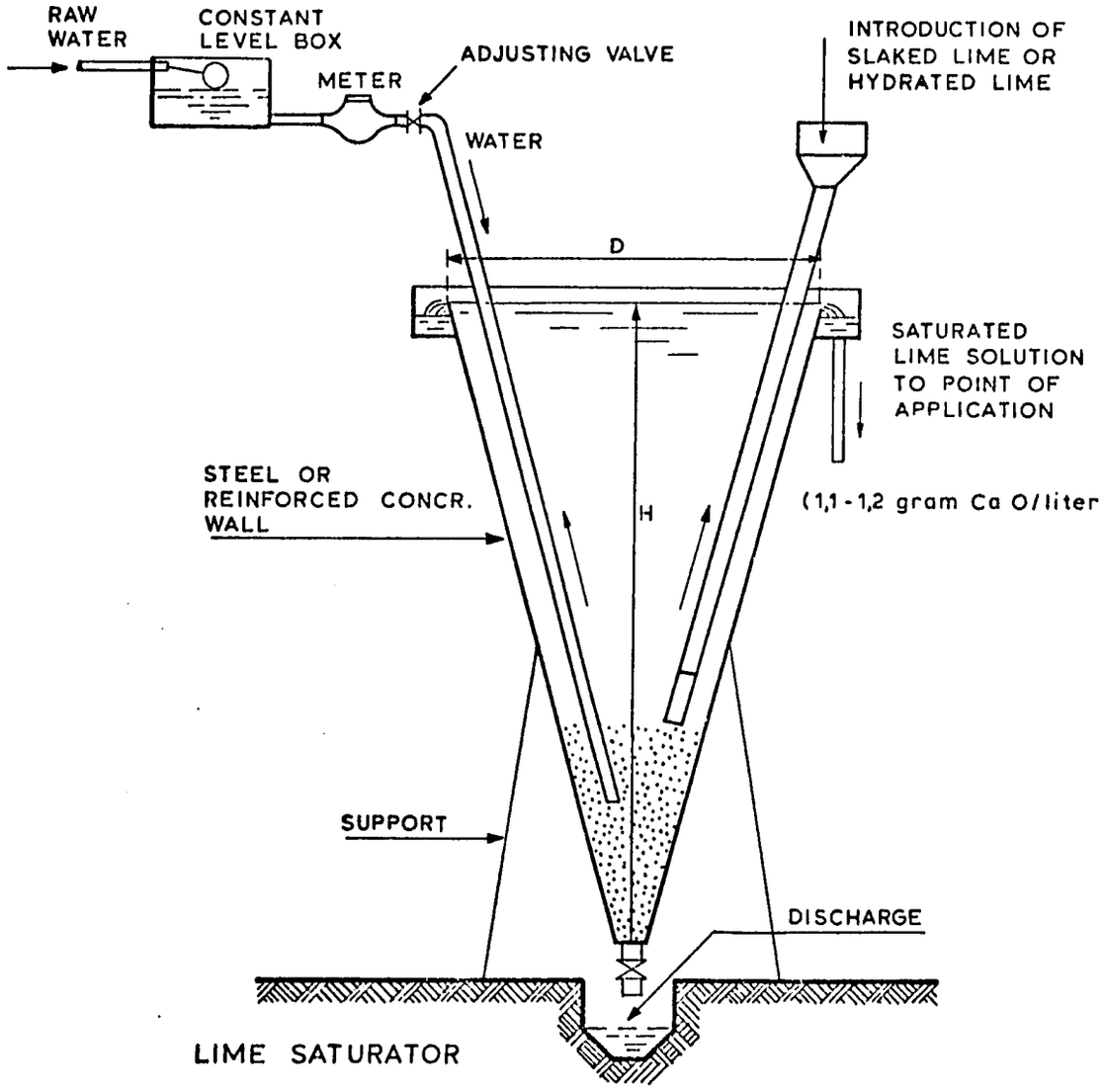
Title: Lime saturator

Country: Brazil

Characteristics:

Principle/Description:

Dosing of lime as a saturated solution. Impurities in the lime settle down as a sludge which is discharged from the tank.



Reference: Prof. J.M. de Azevedo Netto, University of Sao Paulo, Brazil

Remarks:

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telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33604

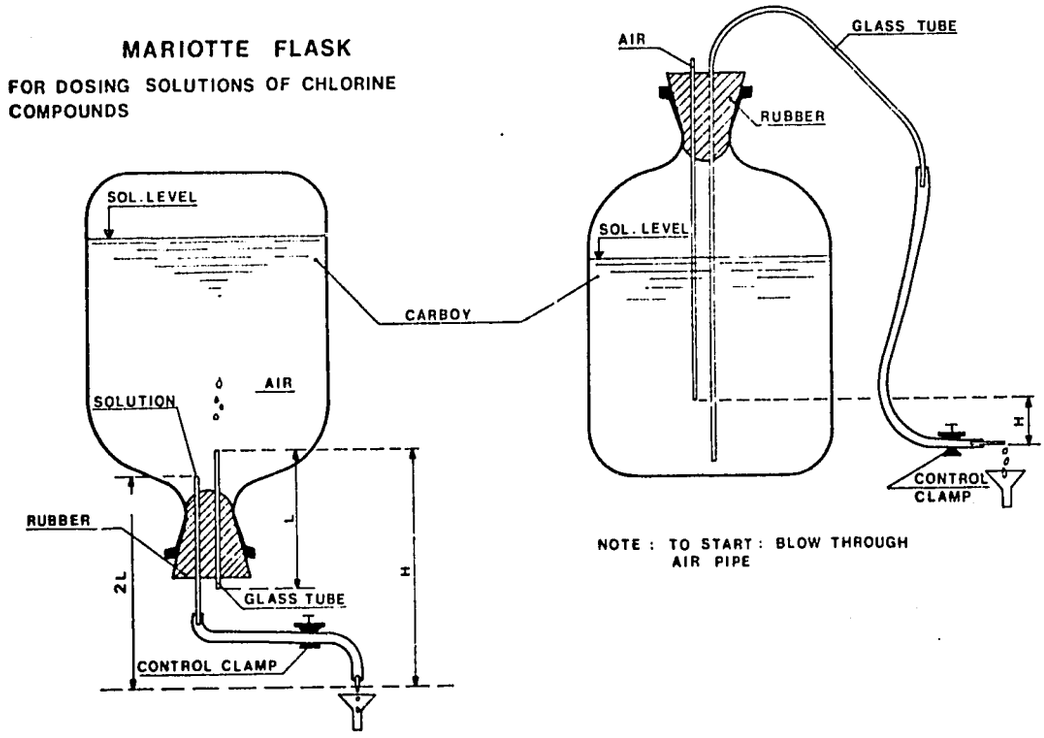
Title: Solution feeder

Country: Brazil

Characteristics: from laboratory glass ware

Principle/Description:

Solution feeding device with a constant head. Air is automatically sucked in by the lowering level of the liquid keeping the head constant at H.



Reference: Prof. J.M. de Azevedo Netto, University of Sao Paulo, Brazil

Remarks:

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office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

Title: Coagulant from bauxite waste

Country: Indonesia

Characteristics:

Principle/Description: Bauxite tailing is discarded in great quantities as a waste product at bauxite mines (bauxite is a raw material for aluminum production), A typical analysis is: Al_2O_3 34.9%, Fe_2O_3 19.4 %, TiO_2 1,4 % SiO_2 22,7 %.
Digestion with sulfuric acid gives a product containing 15.5 % of a mixture of aluminum and ferric sulfate (both well-known coagulants).
(Commercial aluminum sulfate contains 15-17% Al_2O_3) By not separating the insolubles (8,1 %), a cake is obtained which is easy to break and dissolve.
In laboratory experiments the ferric aluminum cake compares favourably to commercial alum as a coagulant in water treatment
In the treatment process the insoluble matter is removed together with the precipitated colloids

Reference: Bandung Institute of Technology, Chemical Engineering Department, Bandung, Indonesia

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 09 42 51, telegr.: worldwater the hague, telex: 33604

Title: Installations for producing sodium hypochlorite of 1 to 100 kg active chlorine per 24 hours capacity

Country: USSR

Characteristics:

Principle/Description:

The installations are intended for obtaining sodium hypochlorite by direct electrolysis of a sodium chloride solution at the place of application in order to disinfect drinking water and sewage. The installations are of 1,5,25 and 100 kg/24 hours active chlorine capacity and can be advised for the application in villages, worker's settlements, individual objects. The installations use graphite electrodes and are simple, reliable and safe in exploitation. Cumbersome transport of chlorine becomes unnecessary.

Reference: Small installations for purification and disinfection of drinking water and sewage " Moscow, 1974, D.T.sci. S.A. Shubert, Director Research Institute for Community Water Supply and Water Treatment K.D. Pamfilov, Academy of Municipal Economy

Moscow 123373, Volokolamskoye Shosse 87, USSR (in Russian)

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

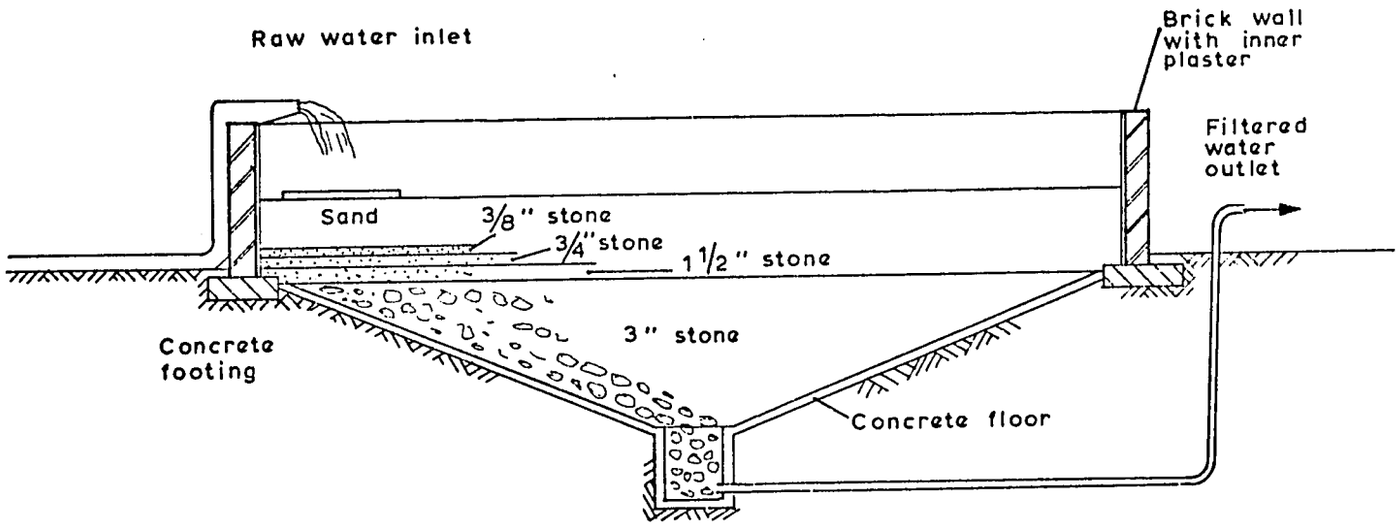
Title: Simple slow sand filter

Country: Lesotho

Characteristics: Gravel underdrain

Principle/Description:

Local construction of a slow sand filter with a simplified understrain system and circular brick walls. Materials used: brick, sand, stone, cement.



SLOW SAND FILTER

Reference: Suphi, H.S., WHO Sanitary Engineer, P.O. Box 108, Katmandu, Nepal

Remarks: Whole structure can be constructed with limited skilled labour.

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

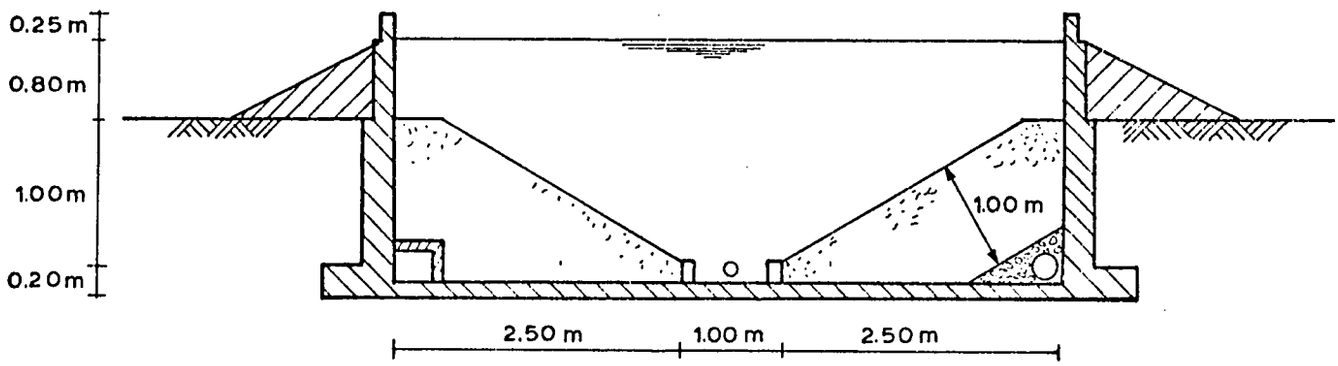
Title: Slow Sand Filter

Country: -

Characteristics: Inclined bed for easy cleaning

Principle/Description:

Proposed construction of a circular slow sand filter with an inclined sand bed surface. Cleaning should be done by long rakes, operated from the side, with the central drain open.



ALTERNATIVE PRECAST POROUS CONCRETE FILTERED WATER COLLECTOR

SUMP AND DRAIN TO REMOVE SEDIMENT WASH WATER

FILTERED WATER COLLECTOR IN GRAVEL BED

ESTIMATED CAPACITY
ABOUT 100 cu METRES PER DAY
FOR 2000 PEOPLE

Reference: Wood, W.E., "Hillcroft" Duton Hill, Great Dunmow, Essex, United Kingdom

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

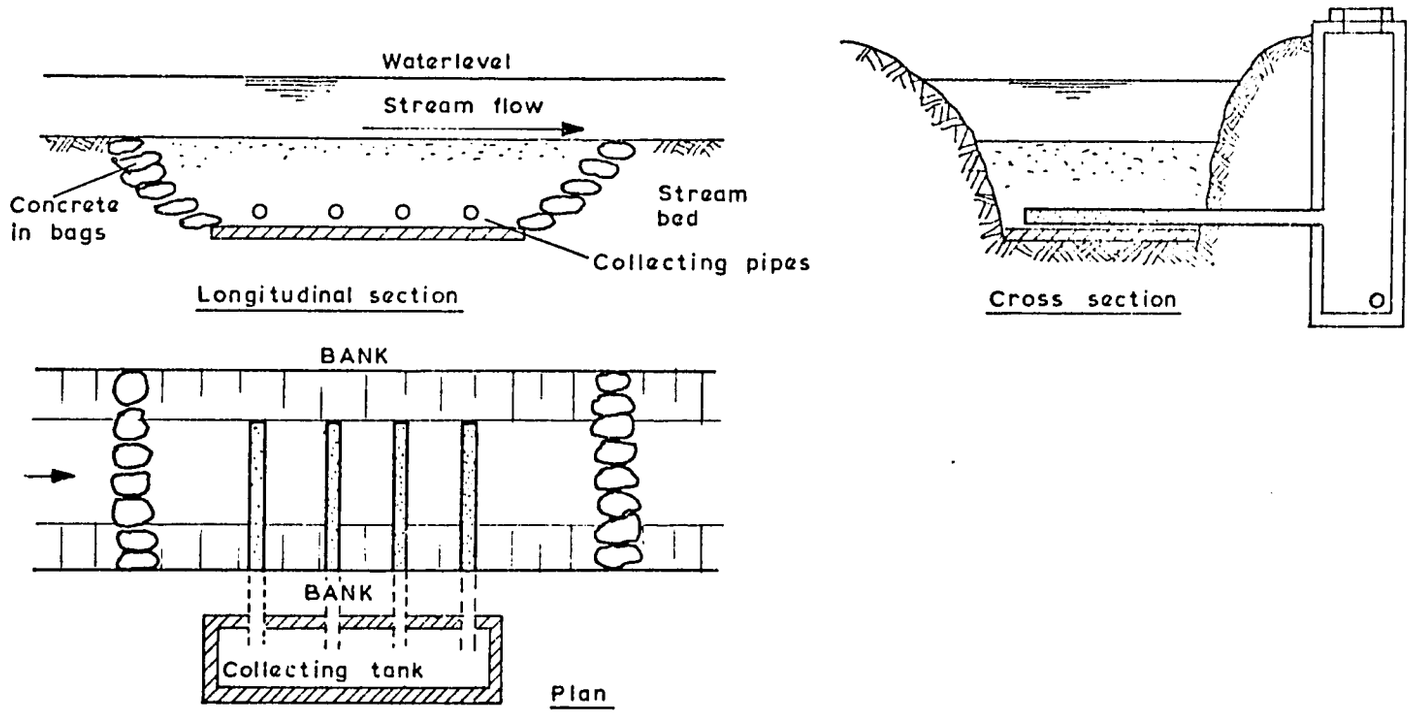
Title: River bed filtration

Country:

Characteristics:

Principle/Description:

Porous or perforated pipes are laid in an excavation in a stream bed and covered with coarse sand to the original stream bed level. The excavation is lined with concrete filled bags. The water filters into the pipes and abstracted from the collecting sand.



RIVERBED FILTER

Reference: Wood, W.E., "Hillcroft" Duton Hill, Great Dunmow, Essex, United Kingdom

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33004

Title: Household Filter

Country: Argentina

Characteristics: Wooden construction

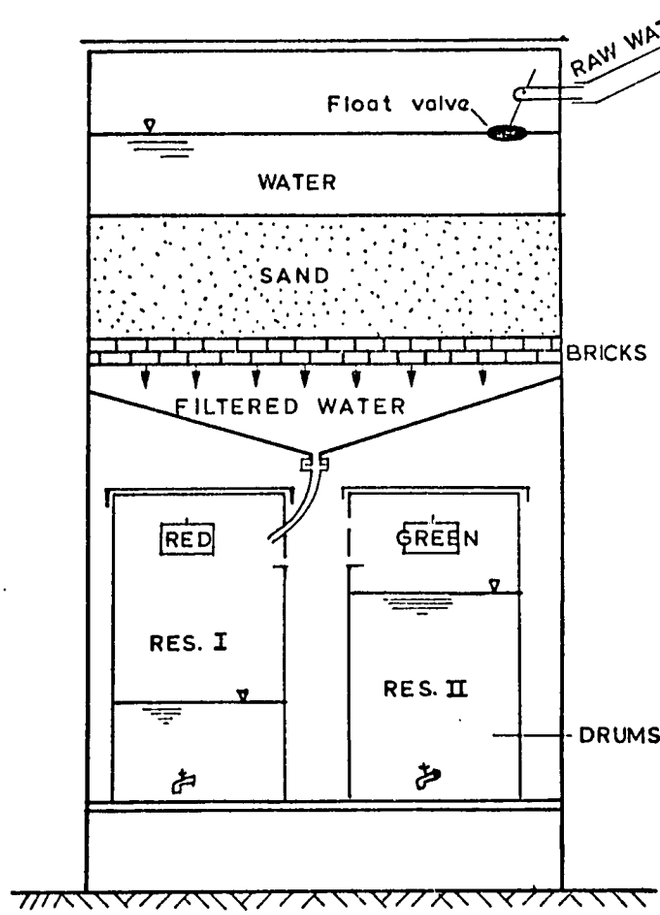
Principle/Description:

Wooden filter

Capacity: 10 persons x 100 lpd: 42 l/h

Chlorination: with hypochlorite

Sand size: Ø 0.30 mm. (sieve must be provided to the users)



Velocity: 0.1 m/h

Surface: 0.42 m^2

Volume: 0.42 m^3

Det. time: 10 hrs.

Cost $25.-

Reference: Gueller, S. Barrio Ferre M.35 Dto3., Corrientes, Argentine

Remarks:

who international reference centre for community water supply

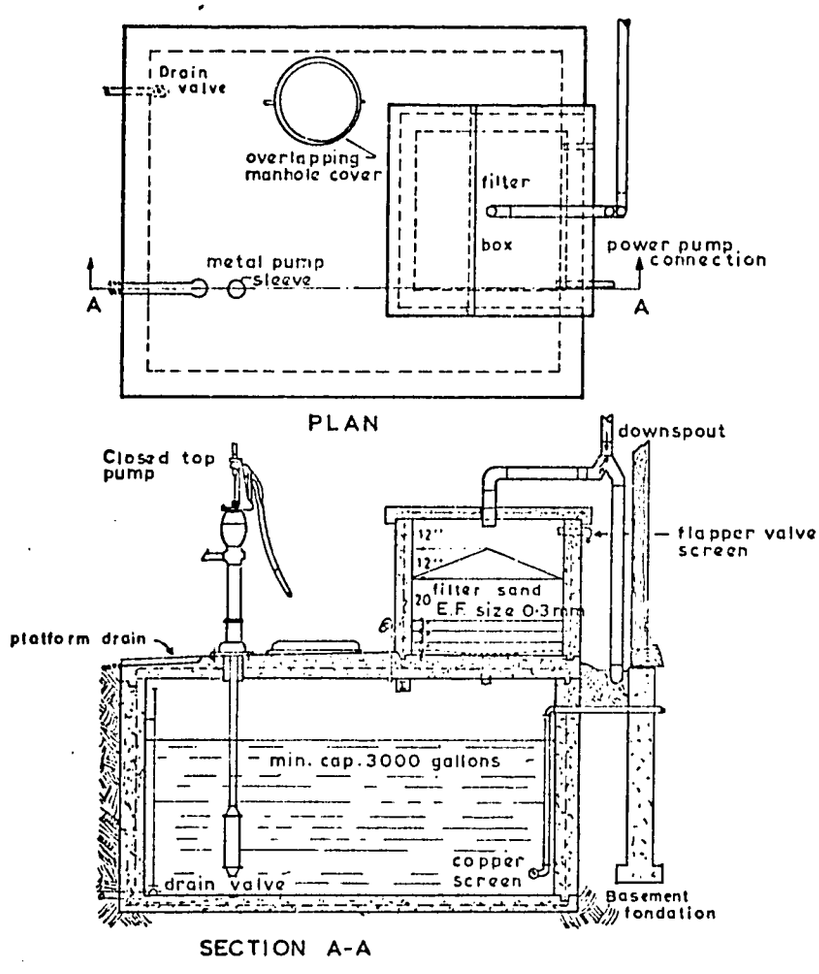
postal address: p.o. box 140, laidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 63 42 51, telegr.: worldwater the hague, telex: 33604

Title: Individual water supply system

Country: USA

Characteristics: Household supply

Principle/Description: Rainwater from a roof catchment is filtered, and flows to an underground tank . Supply by handpump



CISTERN WITH SAND FILTER

Reference: "Individual water supply systems", recommendations of the Joint Committee on Rural Sanitation, U.S. Dept. of Health, Education and Welfare.

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33601

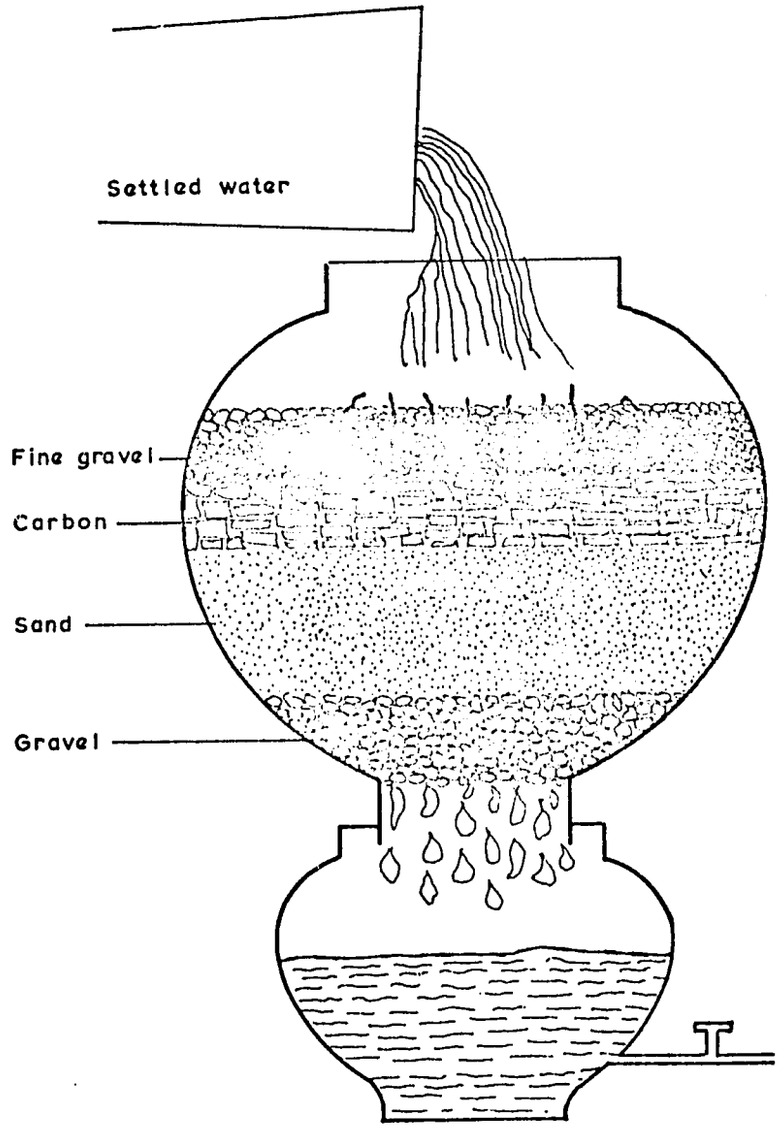
Title: Pot filtration (Canari filter)

Country: Guinea

Characteristics: Household filter (local earthenware)

Principle/Description:

The water is filtered in this locally made household filter and should be boiled before drinking.



Reference: Dabo, M. T., Sanitary Engineer
B. P. 81, Service Nationale de Prevention, Conakry, Guinee

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

Title: Intermittent water filter

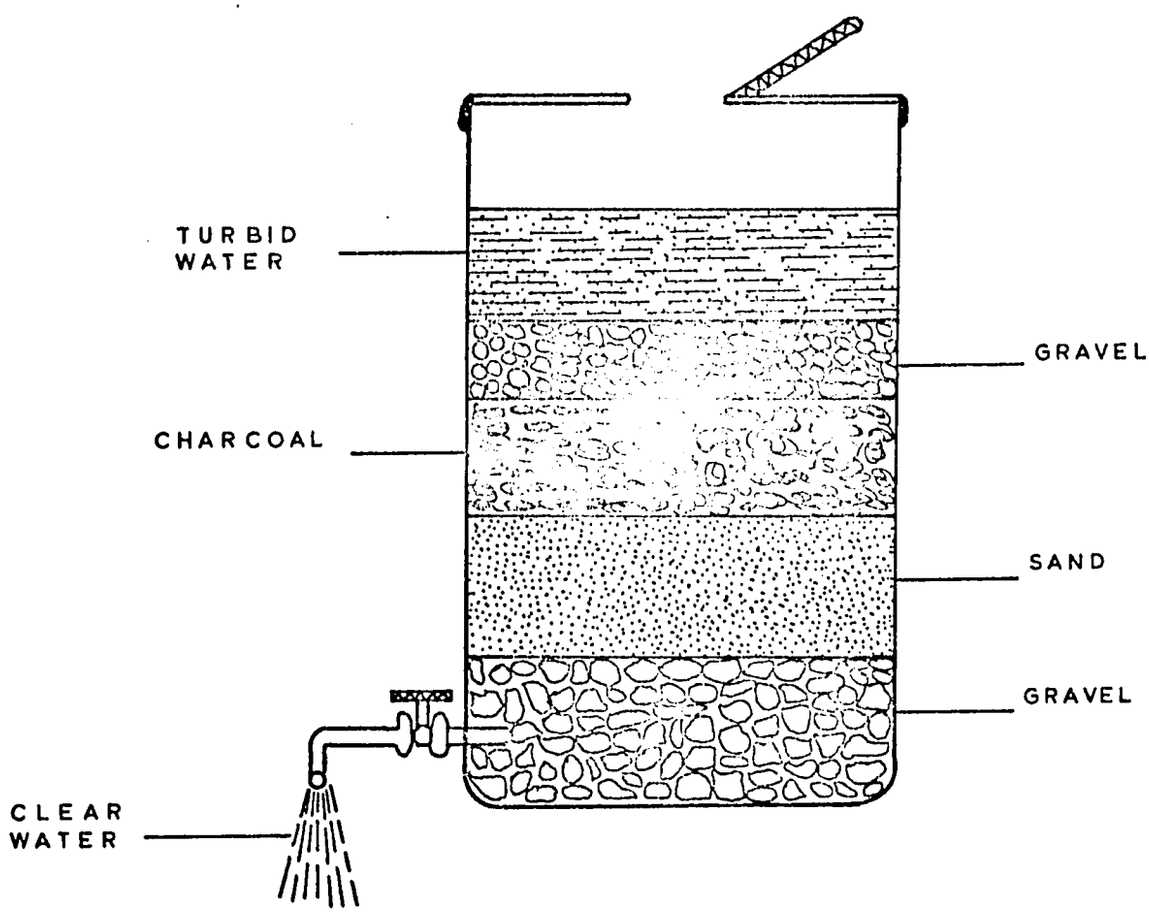
Country: Iran

Characteristics: Simple construction

Principle/Description:

For this household filter a galvanized iron drum, fitted with a tap is used. The filterbed consists of layers of gravel charcoal, sand and gravel. Preliminary tests have shown removal of suspended matter, odour, color, taste, bacteria, fungi, protozoa and algae from polluted surface waters.

Addition of a few drops chlorine solution to the filtered water is advised.



Reference: Merchant, Prof.Dr. N.M., Dept. of Community Medicine, Pahlavi University, Shiraz, Iran

Remarks: cost (1975) US$6,- - US$15,-

who international reference centre for community water supply

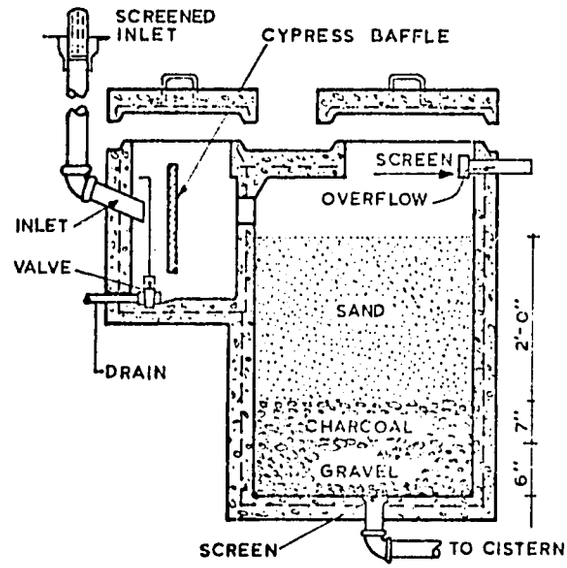
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33604

Title: Small filter unit

Country: U.S.A.

Characteristics: for clarifying rainwater

Principle/Description: Rainwater is filtered through a sand-charcoal gravel filter before flowing into a cistern. The surface of the sand is scraped off if clogging occurs.



Reference: Safe water for the farm, Farmer's Bulletin no. 1978
U.S. Dept. of Agriculture. Reported by Mood, Prof. E.W., USA

Remarks:

who international reference centre for community water supply

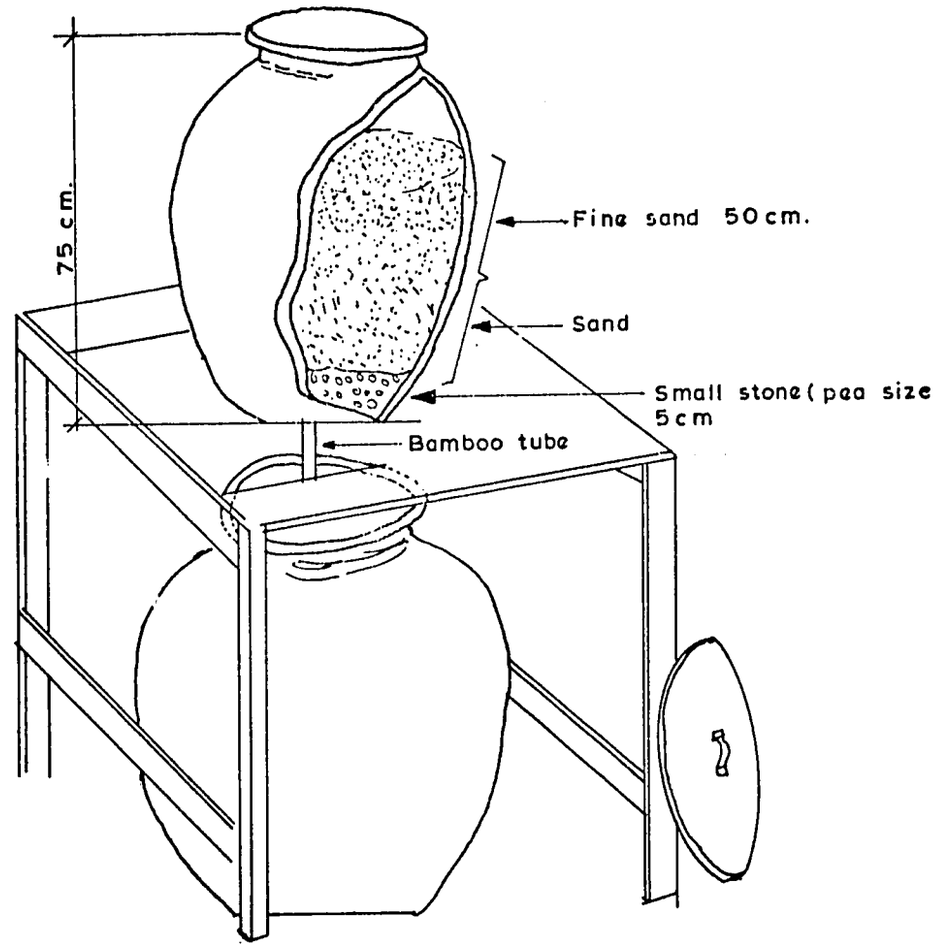
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 89 42 51, telegr.: worldwater the hague, telex: 33604

Title: Household sand filter

Country: Nigeria

Characteristics: local construction

Principle/Description: Earthenware pots 60 cm dia and 75 cm high give a capacity of 1 litre per minute. The water should be disinfected or boiled.



Reference: Chatiketu, S., WHO, P.O. Box 765, Kano, Nigeria

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

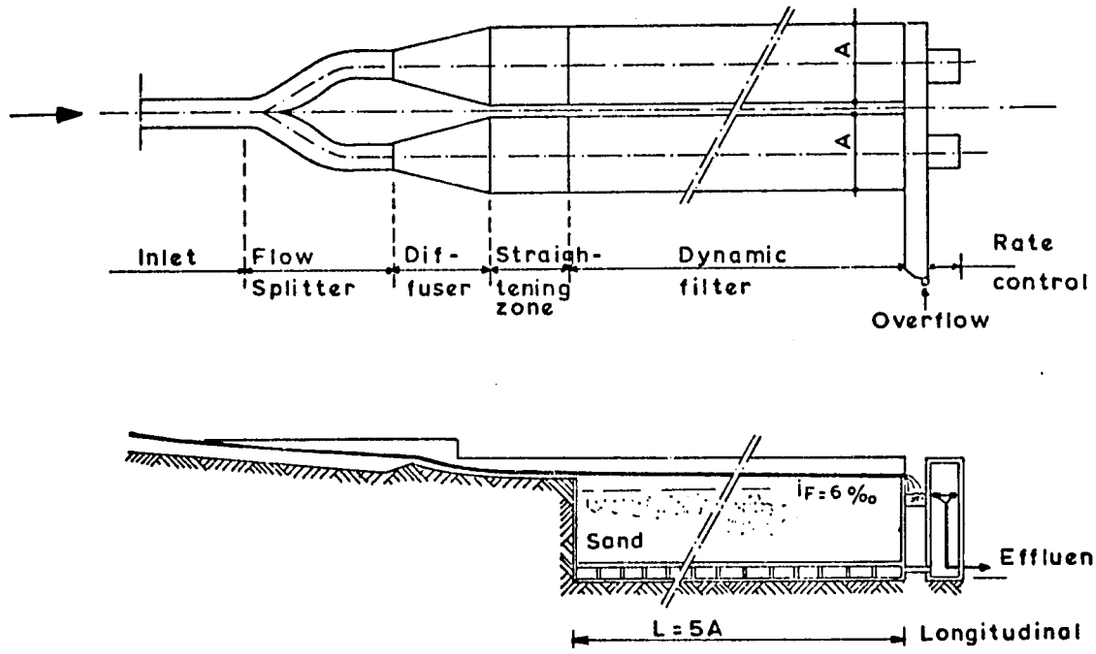
Title: Dynamic Filter

Country: Argentina

Characteristics:

Principle/Description: This is a low rate filter in which only 10% of the flow passes the sand layer and 90% is wasted while cleaning the surface. Compared to slow sand filtration turbidities greater than 50 J.T.U. can be applied. No data on bacterial removal.

Applicable in areas where water is abundant.



DYNAMIC FILTER

Reference: Filtros Dinamicos

Servicio Nacional de agua potable rural, Buenos Aires, 1970

Remarks:

who international reference centre for community water supply

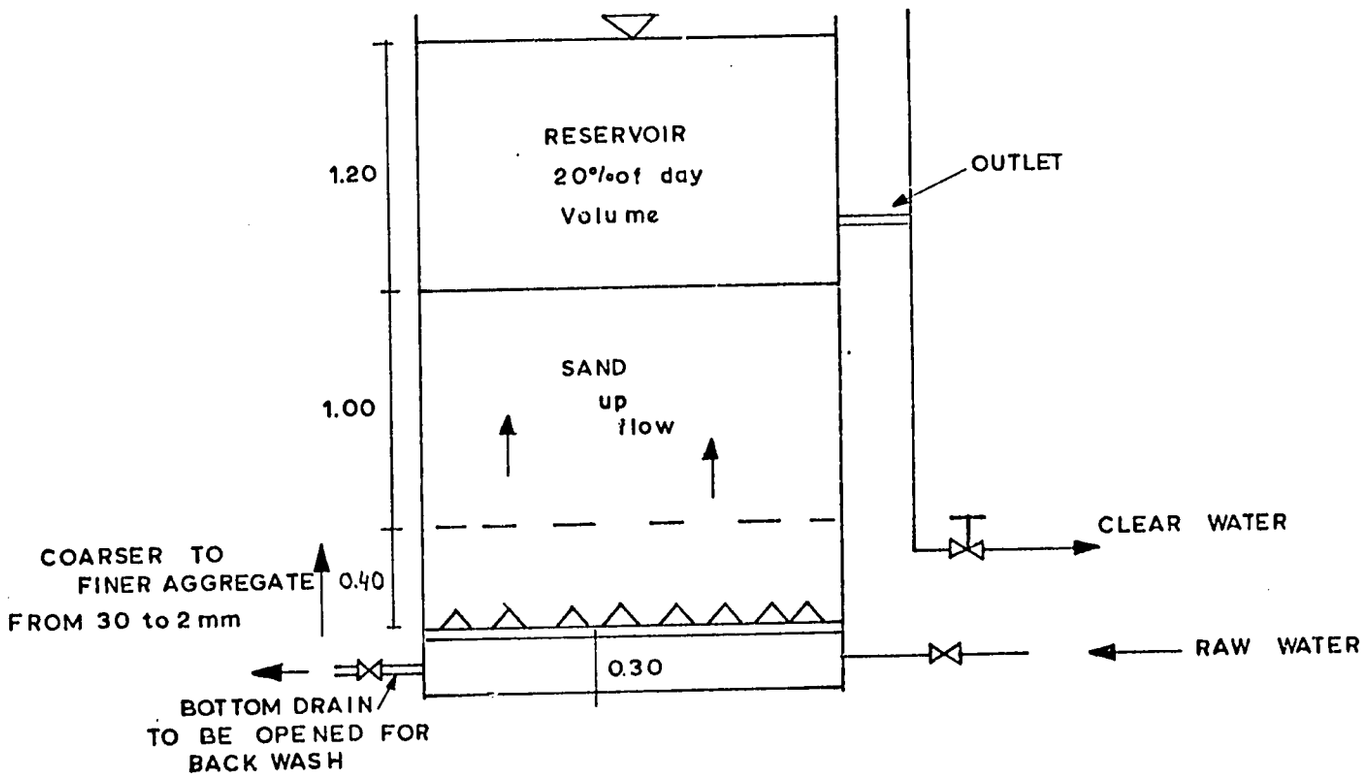
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33664

Title: Low rate upflow filter

Country: Costa Rica

Characteristics:

Principle/Description: Upflow filtration, through a coarse to fine aggregate media. (from 30 mm to 2 mm) and 1.00 m of sand, (0.3 mm effective size and 1.8 - 2.00 uniformity coefficient). Filter bed is backwashed by opening a bottom drain. The 1.20 m column of filtered water located at the top, serves as a storage, holding 20% of the day's need.



CAPACITY : $3 \div 10$ $m^3 / m^2 / d$

Reference: Cordero, O.

Remarks: cost: $350.- per square meter of filter structures (reinforced concrete)

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33004

Title: Surface water treatment

Country: India

Characteristics: Low cost

Principle/Description:

The water in the 0.50 mgd treatment plant in Ramtek, Nagpur is aerated, mixed with alum in a baffled channel; it then has to pass a gravel prefilter in upflow and a gravity flow dual media filter. In the dual media filter crushed coconut shell of 1,4 to 2 mm is used instead of anthracite as a top layer on a fine sand bed. No sedimentation is required. Good quality of the water is reported at cost savings of 25 to 50% of the cost of a conventional unit.

Reference: Kardile, J.N., Journal of the I.W.W.A., Vol. VI, no. 1 January-March 1974, pp. 53-59.

Remarks: reported by Mr. S.T. Khare, Bombay

who international reference centre for community water supply

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office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

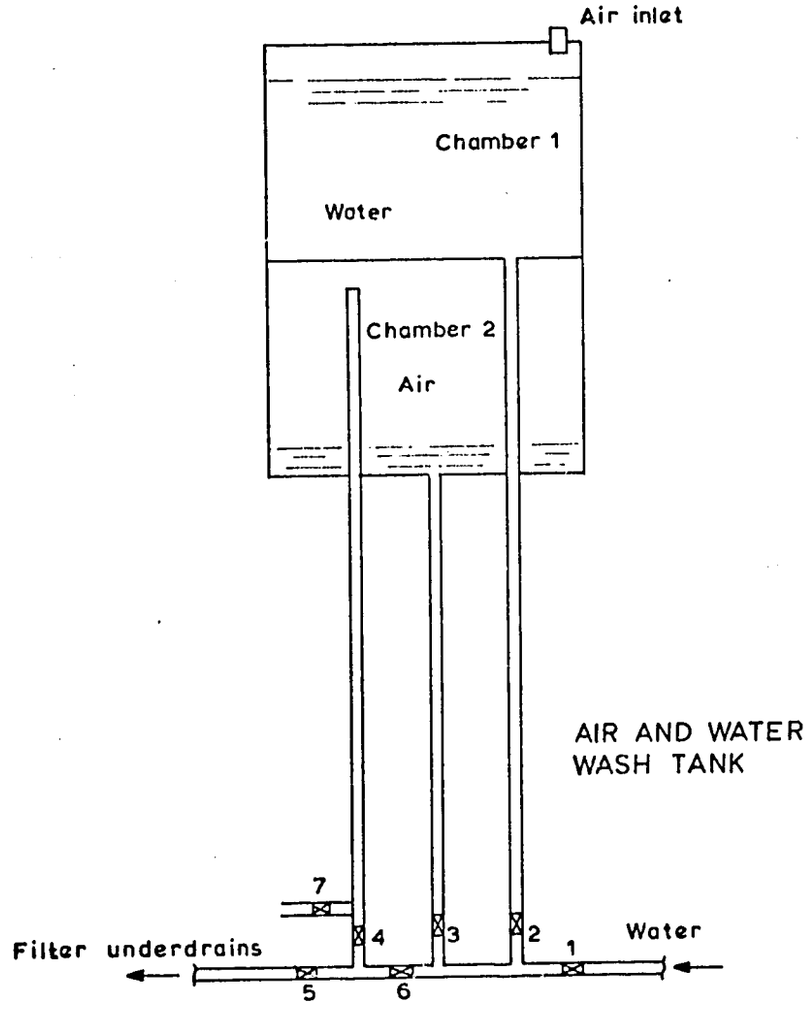
Title: Air and Water wash tank

Country: India

Characteristics: No air compressor required

Principle/Description:

Backwashing of a filter starts with allowing water from chamber 1 to flow into chamber 2. Air in chamber 2 is displaced to scrub the filter. Next the water in chamber 2 is allowed to backwash the filter.



Reference: Sen, Professor R.N., Indian Institute of Technology, Kharagpur - 2 (W.B.) India

Remarks:

who international reference centre for community water supply

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office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33604

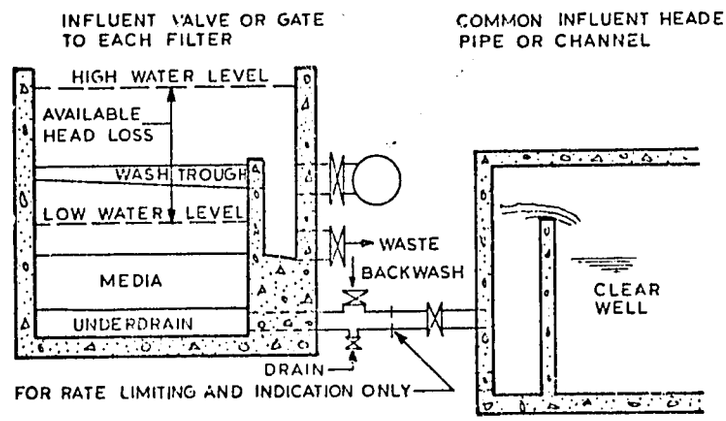
Title: Variable declining rate filtration

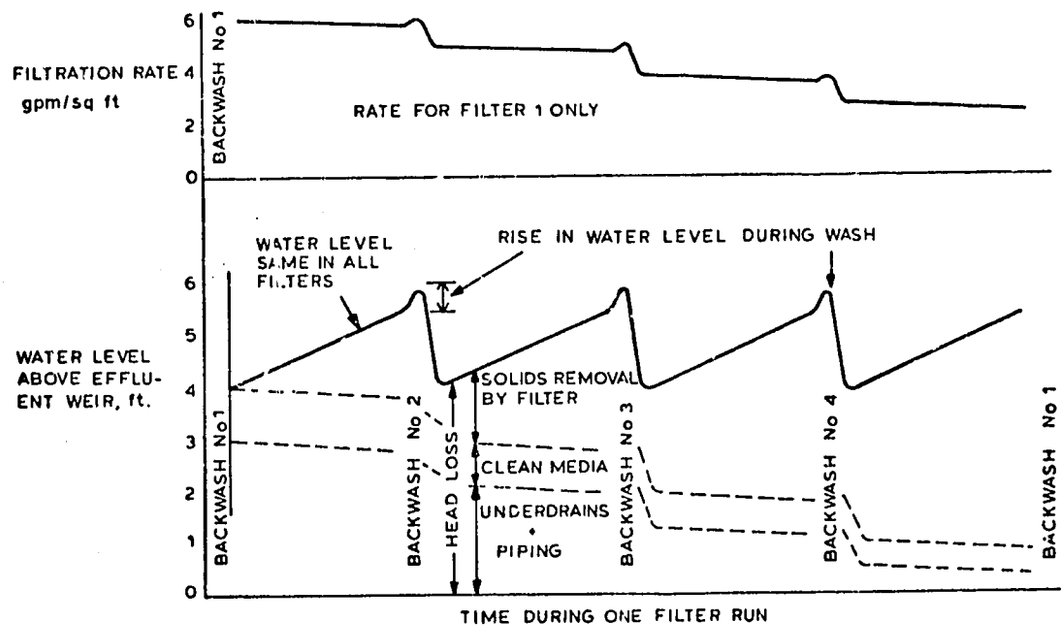
Country: U. S. A.

Characteristics: no rate controllers.

Principle/Description:

Common influent pipe under the water level, which remains the same in all filters. This level rises gradually with clogging filters. The filter longest in service is backwashed and when put back in service, this filter operates at highest flow rate and the water level on all filters declines to a new equilibrium. For the individual filter the operation shows a gradually declining rate.





Reference: Cleasby, Prof. J. L., Iowa State University, Ames, Iowa 50010, U.S.A.

Remarks:

who international reference centre for community water supply

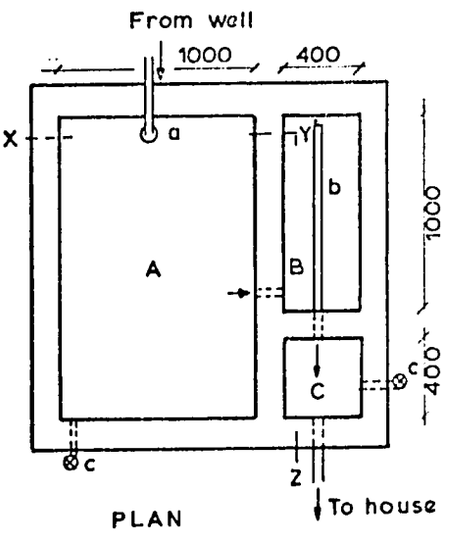
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

Title: Roof tank for iron removal

Country: India

Characteristics:

Principle/Description: A roof tank (1-2 day's capacity, 1 m depth) is divided into detention, filtration and clear water storage compartments. Pumped water is sprayed over the storage tank. When clear water is drawn off, water level in last compartment falls below water level over sand bed and induces filtration. Filter area 1 m^2/2500 litres/day; sand depth 30 cm and 6 mm gravel bed 8 cm thick. Iron removal from 3-5 mg/l in influent to 0-0.2 mg/l in effluent.



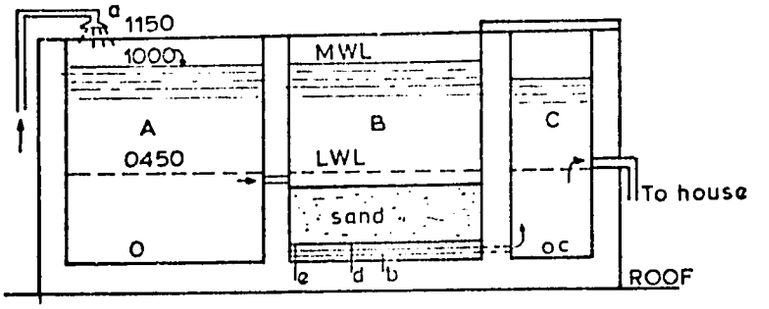
PLAN

REFERENCE:

A-Detention Zone
B-Filter
C-Clear Water Storage

a-Spray Aerator
b-Filter Underdrain
c-Scour
d-Gravel
e-Nylon Mesh

NOTE : All dimensions in mm.



SECTION THROUGH XYZ

Reference: Raman, A., TWAD Board, Chepauk, Madras 5, India 600005

Remarks: Sandaramoorthy c.s. J.J.W.W.A. vol. V, No. 4, 1973

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

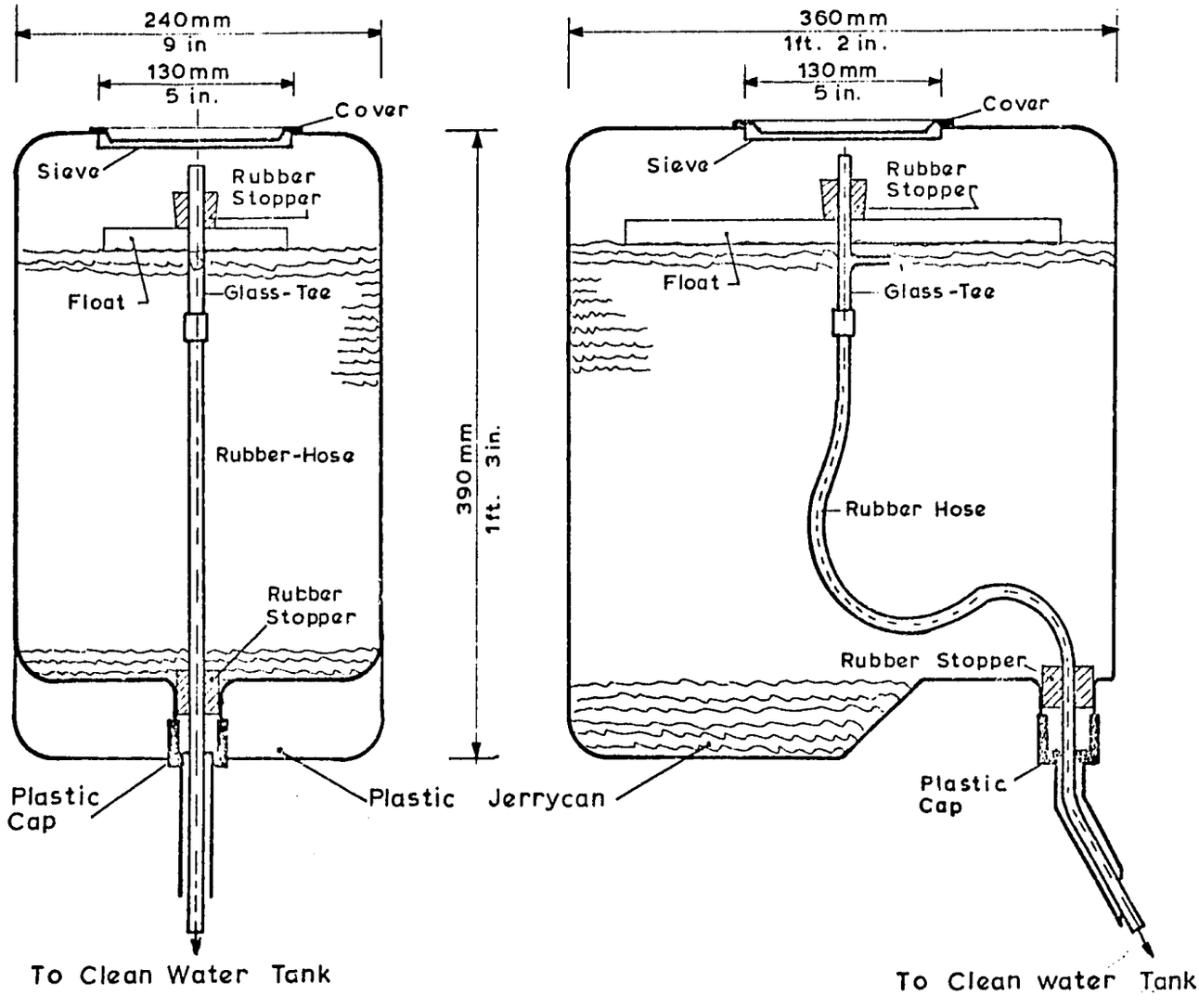
Title: Chlorinator

Country:

Characteristics:

Principle/Description:

A constant level is maintained above the glass T. The solution should freely flow (not sucked) through the orifice to maintain the constant head.



PLASTIC JERRYCAN CHLORINATOR

Reference: Fisher, B.W.M., P.O. Box M142, Accra, Ghana

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 89 42 51, telegr.: worldwater the hague, telex: 32604

Title: Chlorination pot

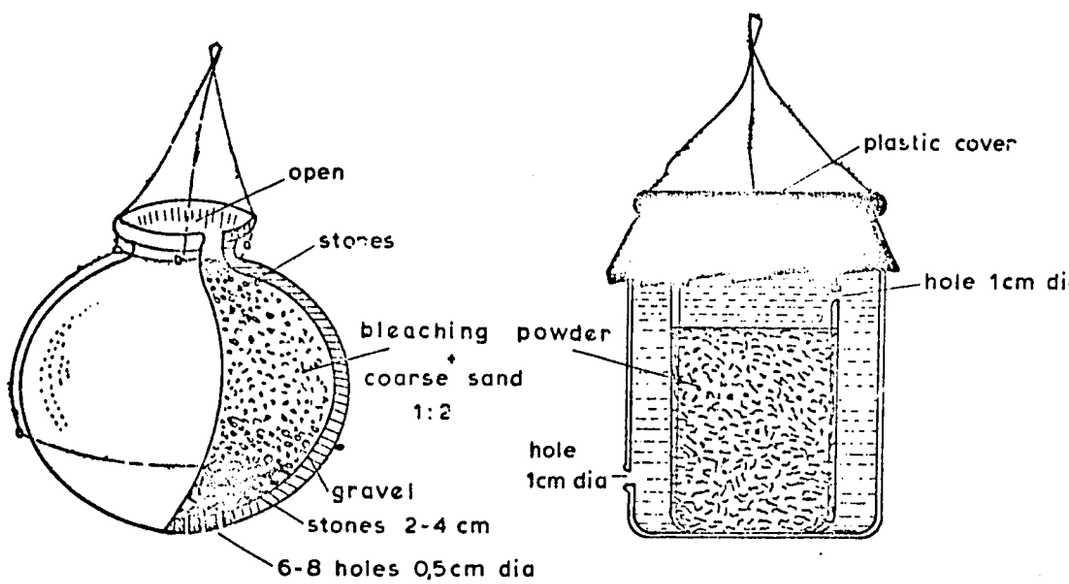
Country: India

Characteristics: simple well disinfection device

Principle/Description:

A pot containg a mixture of 1,5 kg. bleaching powder and 3 kg. of coarse sand is lowered in the well to about 1 m. below water level. For community wells of 9 - 13 cu m. contents and daily draw-off of 900 - 1300 liters for 40 - 60 people, a single pot suffices to give adequate chlorination (0,2 - 1.0 ppm residual) for 10 - 15 days. For household wells of half the capacity, a double pot gives 0.15 - 0.50 ppm chlorine residual for 2-3 weeks.

Addition of some sodium hexametaphosphate keeps the mixture soft and prolongs the chlorination period.



CHLORINATION POT

Reference: National Environmental Engineering Research Institute, Nagpur, India. 20

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33604

Title: Drip feed chlorinator

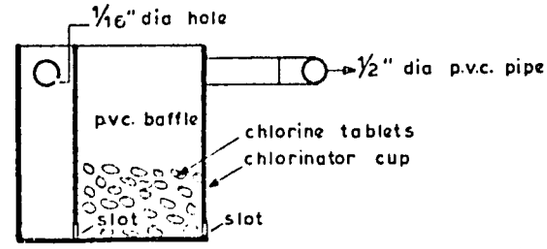
Country: Jamaica

Characteristics: Plastic

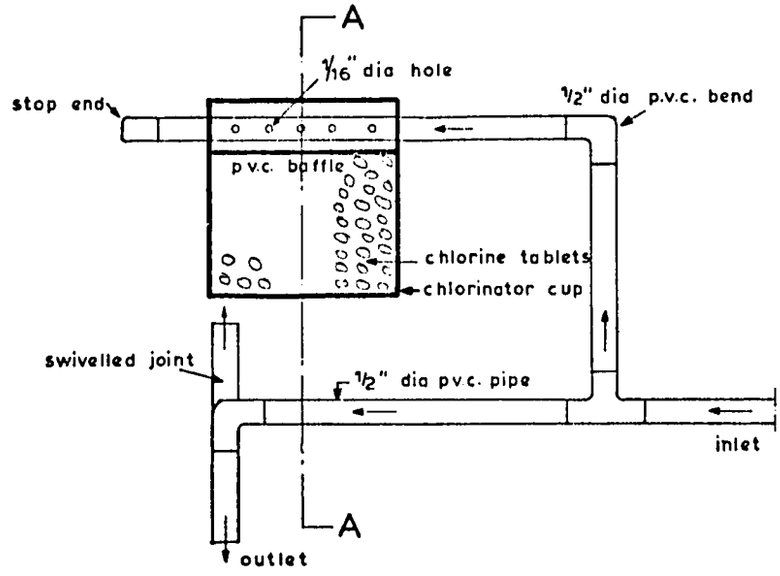
Principle/Description:

Chlorine tablets are dissolved at the bottom of a cup and replace accordingly.

A swing arm can be used to control the amount of water led into the chlorinator.



SECTION A A



Reference: Reid, R., P.O. Box 384, Kingston 5, Jamaica

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw hoevenstraat 6, voorburg (the hague)
telephone: 070 - 09 42 51, telegr.: worldwater the hague, telex: 33604

Title:	Hypochlorinator
Country:	Brazil
Characteristics:	Emergency construction

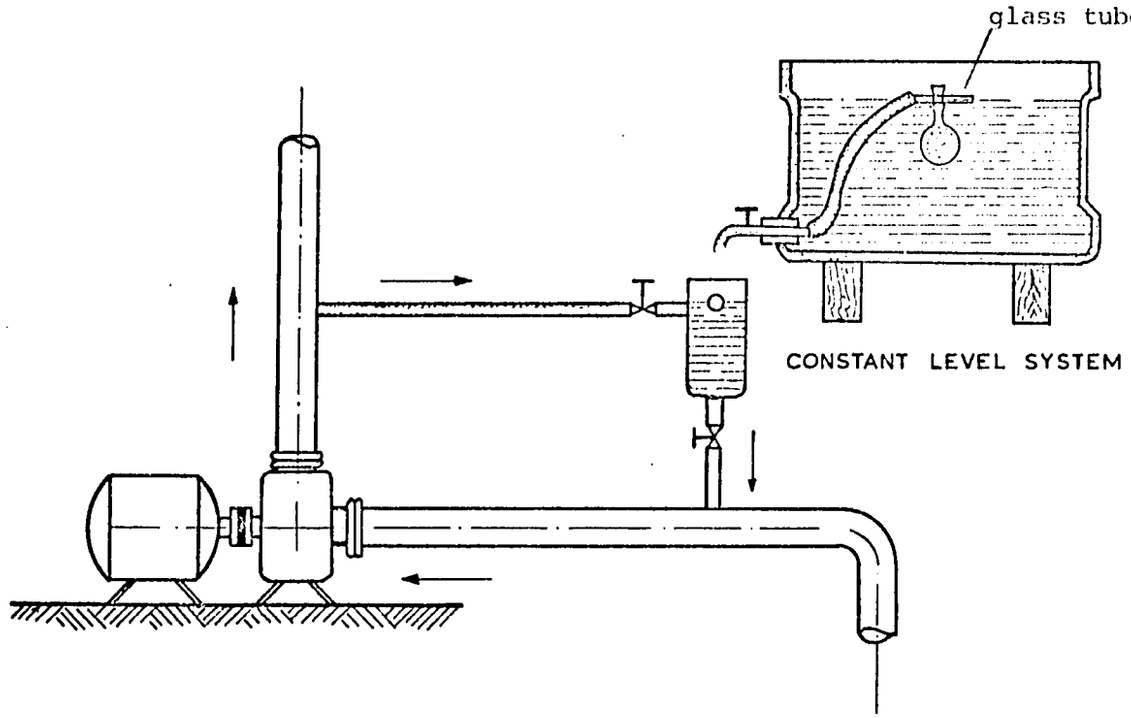
Principle/Description:

material: asbestos cement reservoir - rubber hose, glass tube

constant dosing of a hypochlorite solution by arranging a constant head of liquid above the open rubber hose, a flask (weighted with gravel) serves as a float.

The dose can be changed by:

1. changing the opening of the Hoffmann tweezer
2. changing the concentration of the solution



Reference:	Rossin, A.C., CETESB, Av.Prof. Frederico Hermann, Jr. 345 Alto de Pinheiros 05459-Sao Paulo S.P., Brazil
Remarks:	total cost (1975) US$12.-

who international reference centre for community water supply

postal address: p.o. box 140, [illegible], the netherlands
office address: new [illegible]
telephone: 070 - [illegible], telegr.: [illegible], telex: 33694

Title: Hypochlorinator

Country: Brazil

Characteristics: suction by hydroejector with rotameter

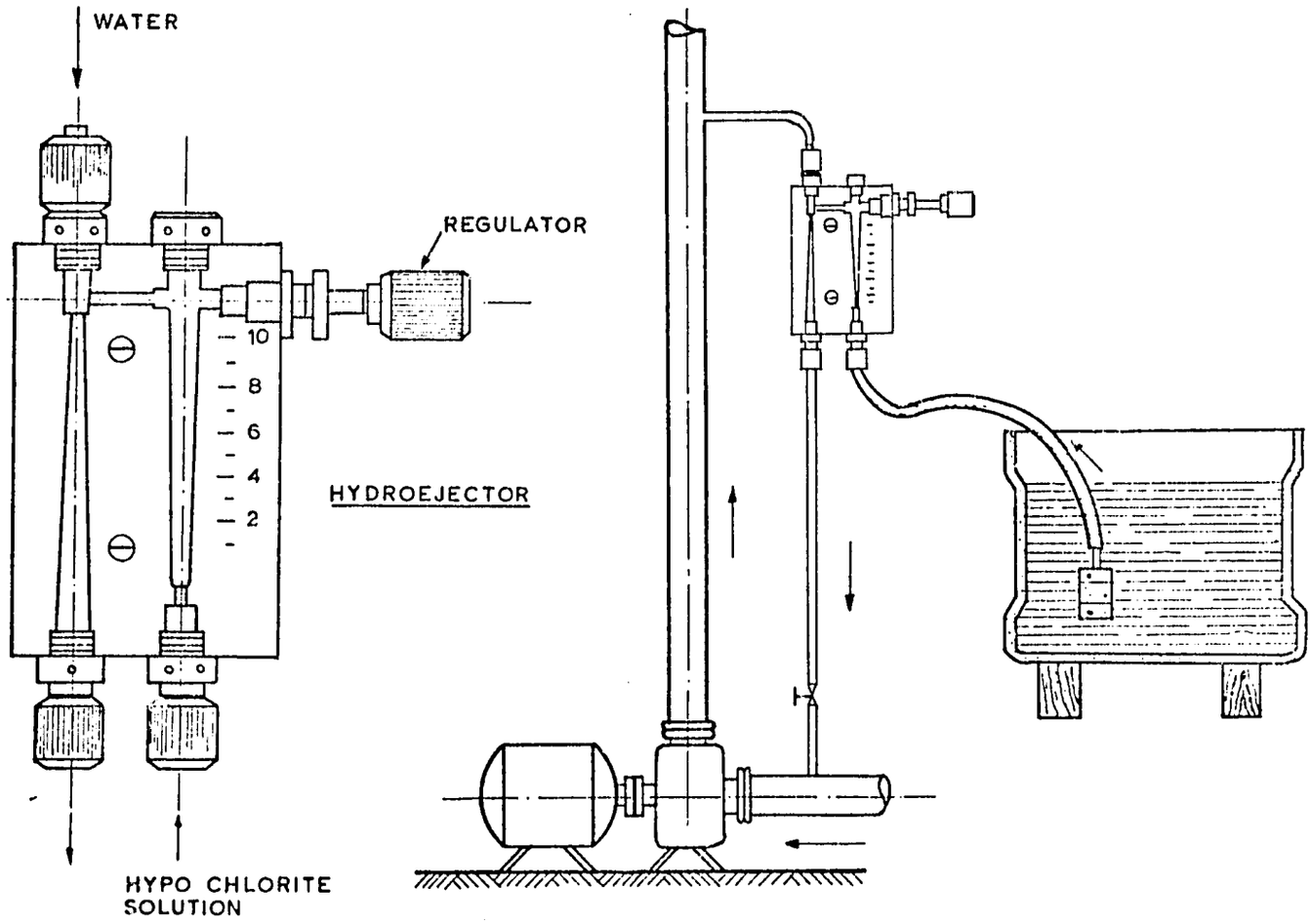
Principle/Description:

material: glass or acrylate

ejector: the hypochlorite is introduced in the water by the suction created in the ejector

The dose can be changed by:

1. changing the concentration of the solution
2. reducing the flow of the water in the ejector and so reducing the vacuum
3. the regulator of the rotameter



Reference: Rossin, A.C., CETESB, Av.Prof. Frederico Hermann Jr.,345 Alto de Pinheiros 05450-Sao Paulo S.P., Brazil

Remarks: total cost - acrilic equipment US$120.-
glass equipment without regulator knob US$10.-

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

Title: Chlorinator

Country: Brazil

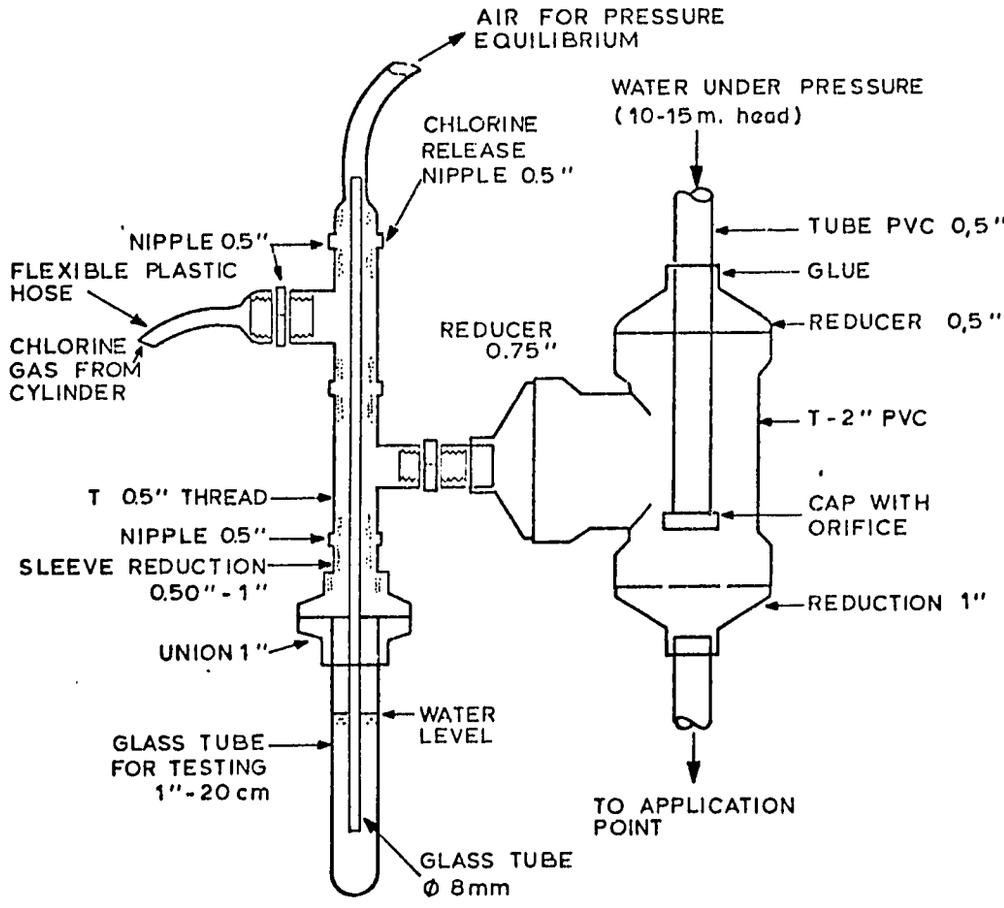
Characteristics: Gas feed with ejector

Principle/Description: The chlorine gas is introduced in the water by the suction created in the ejector. The dose can be changed by:

1. reducing the chlorine flow by an auxiliary valve fixed at the cylinder
2. reducing the water flow in the ejector

capacity: feed up to 3 kg chlorine/hour , material: plastic and glass, Cost: $15,-

Air can be sucked in the system when pressure drops.



Reference: Rossin, A.C., CETESB, Prof. Frederico Hermann Jr. 345, Alto de Pinheiros 05459-Sao Paulo, SP, Brazil

Remarks: total cost: (1975) US$15.-

who international reference centre for community water supply

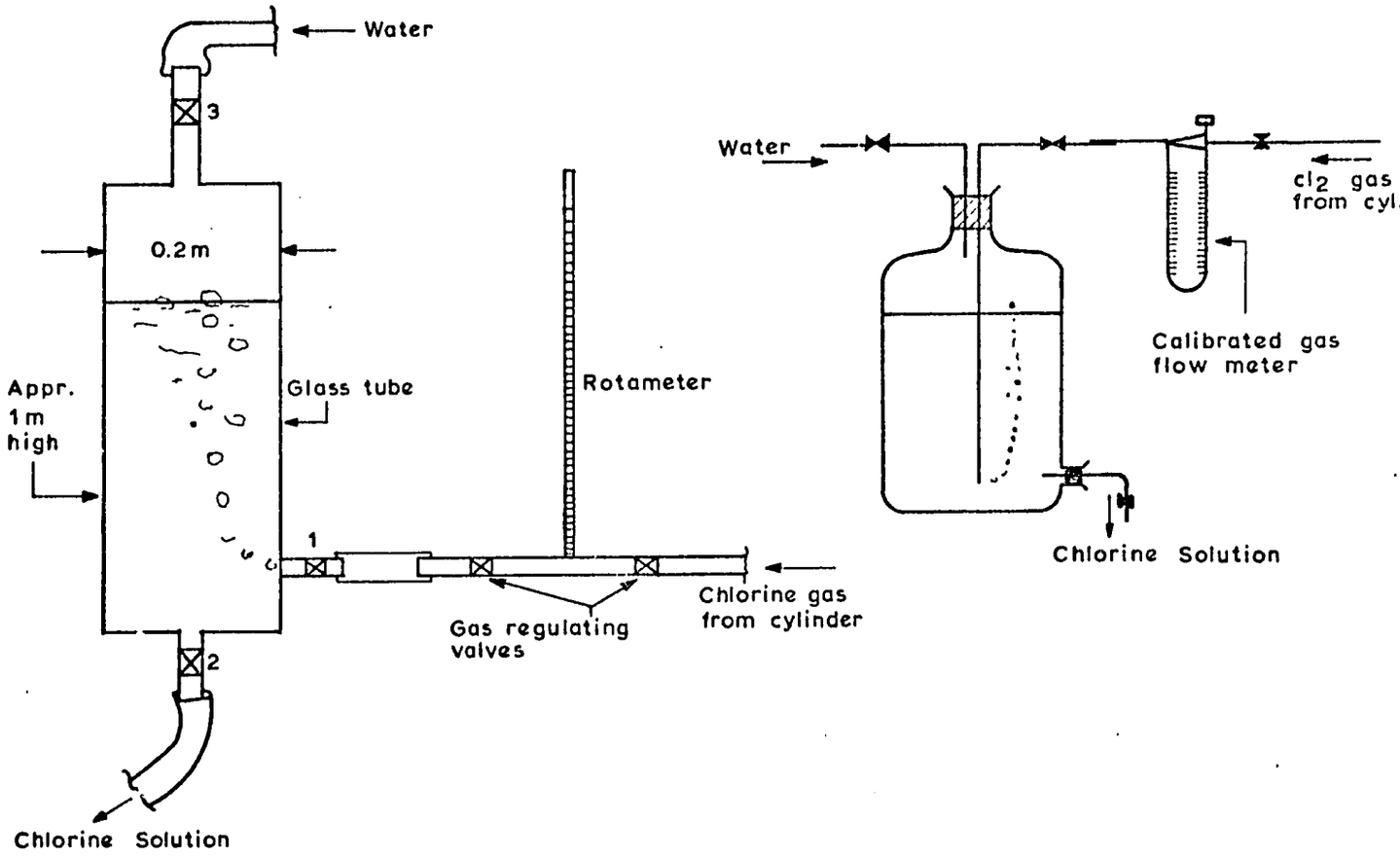
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 09 42 51, telegr.: worldwater the hague, telex: 33604

Title: Simple chlorination unit

Country: India

Characteristics:

Principle/Description: Counter current absorption unit



SIMPLE CHLORINATION UNIT

LABORATORY ACCESSORY FOR CHLORINE DOSE

Reference: Sen, Prof. R.V.
Indian Institute of Technology, Kharagpur-2 (WB), India

Remarks:

who international reference centre for community water supply

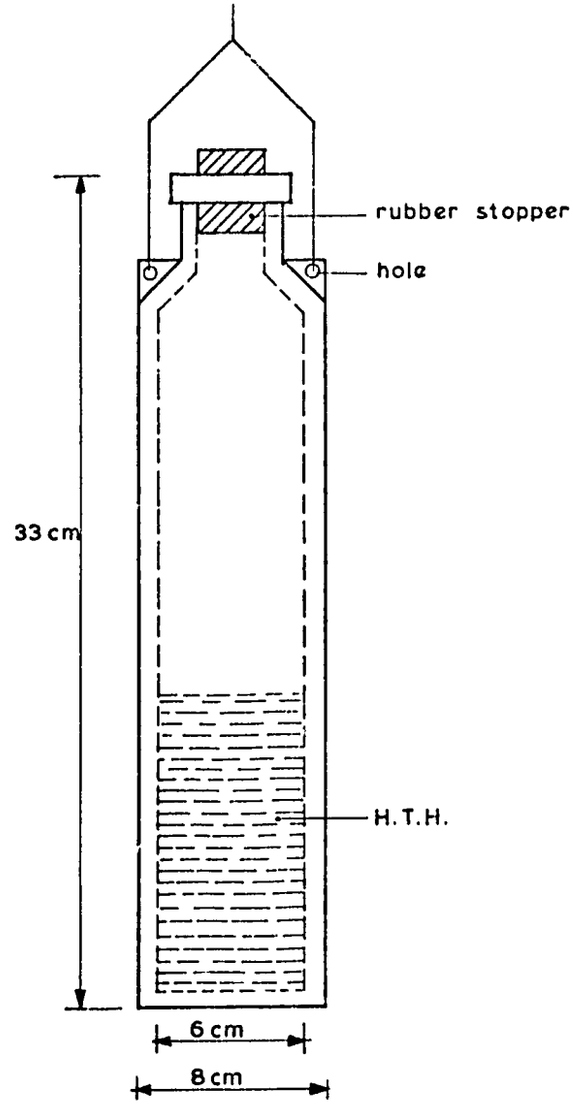
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33604

Title: Hypochlorinator

Country: Taiwan

Characteristics:

Principle/Description: Carrier is made of clay in which some charcoal is mixed and then ignited at about 600-700°C. When the carbon is burned, there is some porosity in the clay carrier. When the HTH (50% available chlorine) solution fills the carrier, it gives a 0.5 mg/l of chlorine to the well water. The carrier is suitable for disinfecting open dug wells and storage tanks.



Reference: Lo, M.C.,
Taiwan Institute of Environmental Sanitation,
161 Kun Yang Street, Nan Kong District
Taipei, Taiwan.

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

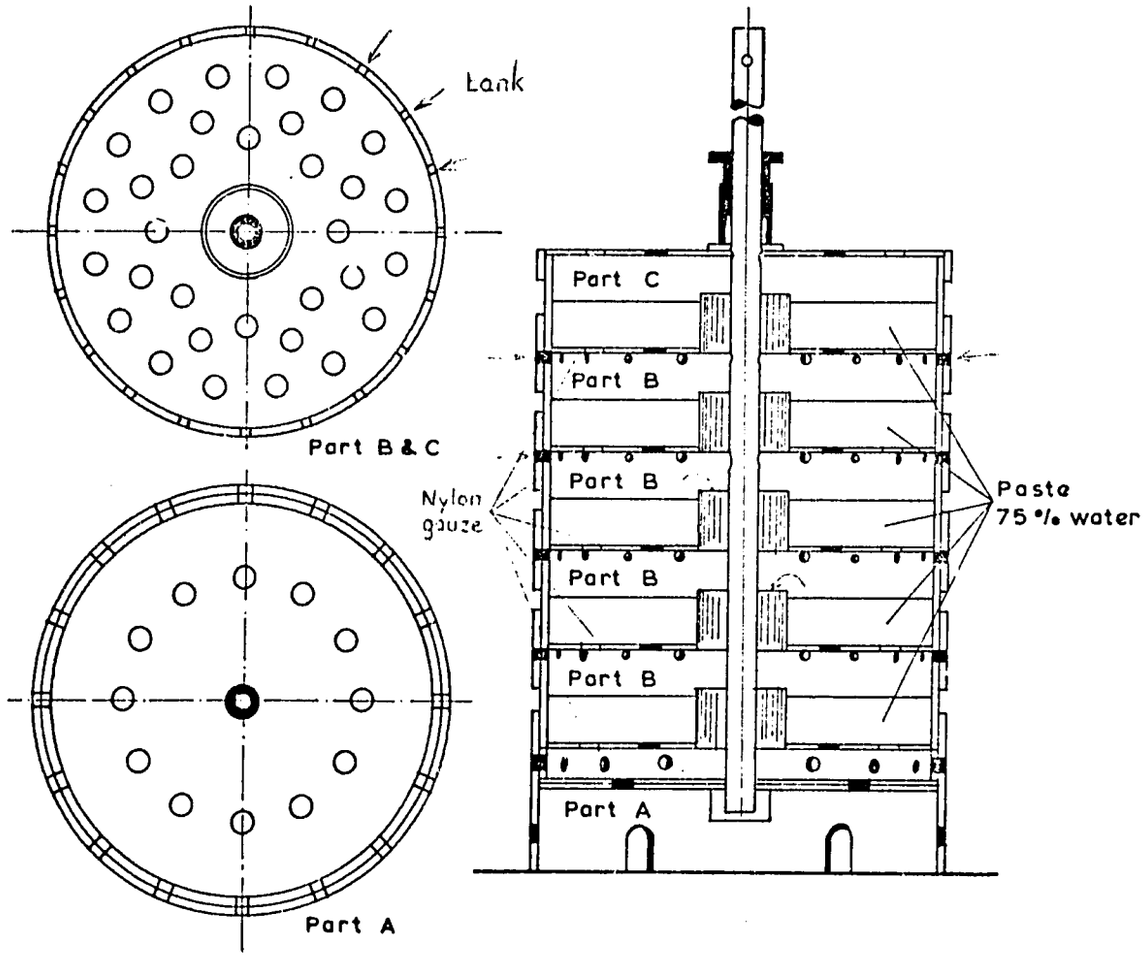
Title: Diffusion hypochlorinator

Country: Peru

Characteristics: for open wells

Principle/Description:

Improved type of diffusion chlorinator. Device consists of a stack of perforated trays, charged with Ca. Hypochlorite, which is lowered in the well. The dense solution flows downward in the well through a central opening.



Reference: Ruiz Altuna, C.E., Hipochlorador de flujo-difusion automatico Xth Inter-american Congress of Sanitary Engineers, El Salvador, December 1966.

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

Title: Floating bowl chlorinator

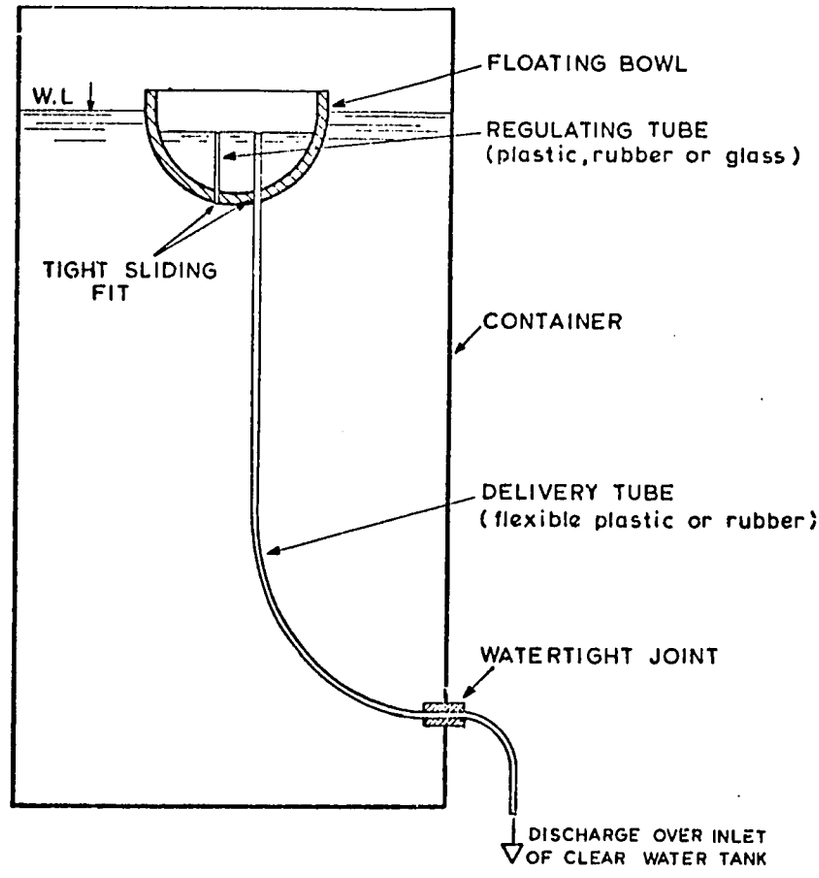
Country:

Characteristics: Constant head

Principle/Description:

The Container may be an ordinary domestic dustbin, or oil drum having a minimum capacity of about 100 litres. The bowl may be any vessel and should be so weighted that it will contain about 75 mm depth of solution.

The regulating and delivery tubes are adjusted to such a level that the solution enters into the bowl and flows down the delivery tube at the desired rate. The rate may be adjusted by varying the levels of the regulating and delivery tubes.



Reference:

- Carey, H. N., Sir Frederick Snow & Partners, Ross House 144 Southwark Street, London SE1 0S2, U. K.
- Uplap, P.L. Buildings Branch, P.O. Box 967, Lusaka, Zambia

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33604

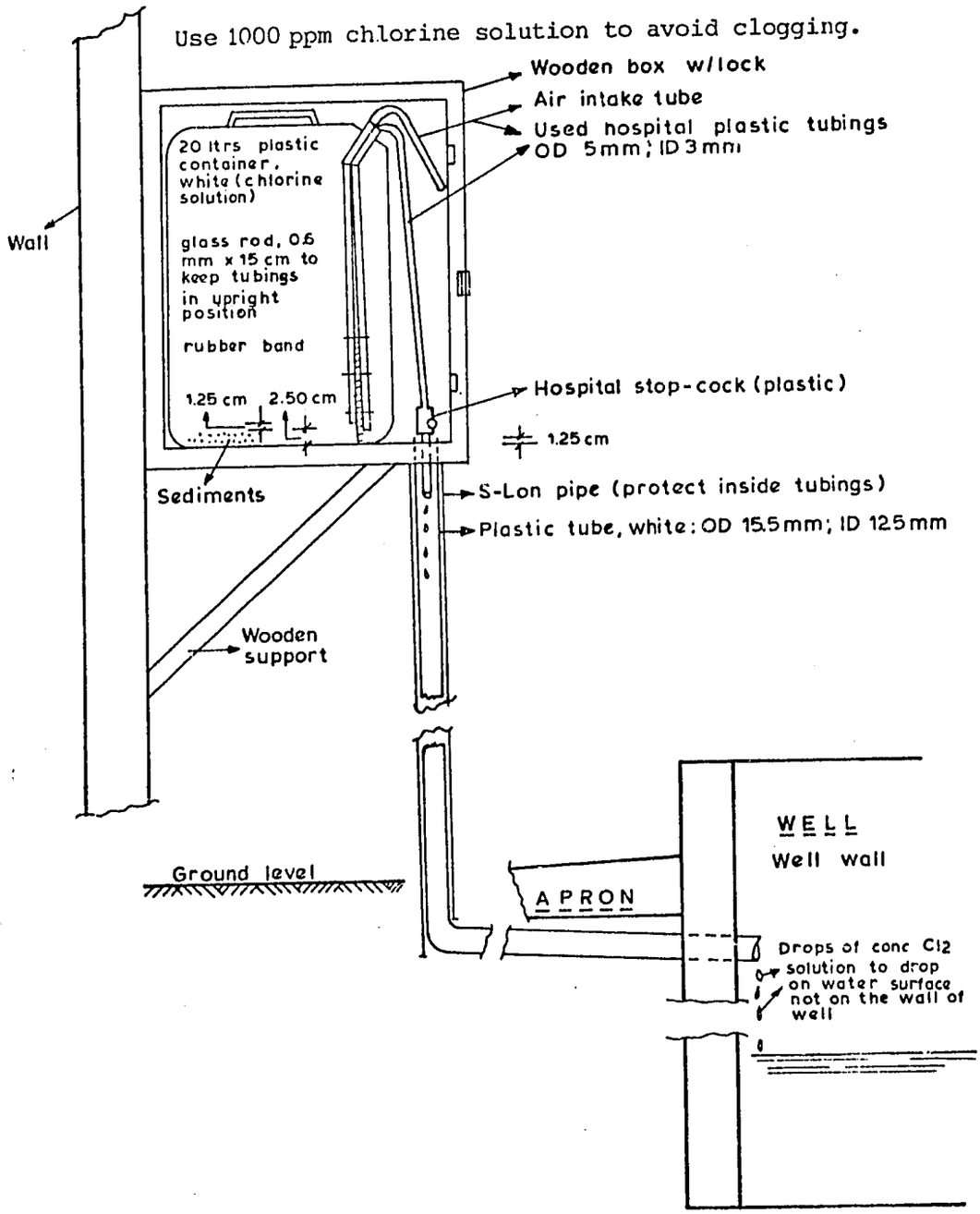
Title: Simple Method Chlorinator

Country: Maldives

Characteristics:

Principle/Description:

Use 1000 ppm chlorine solution to avoid clogging.



Reference: Hassan Maniku, MWSA, Malè, Maldives

Remarks: total costs (1975) approximately $61.40

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

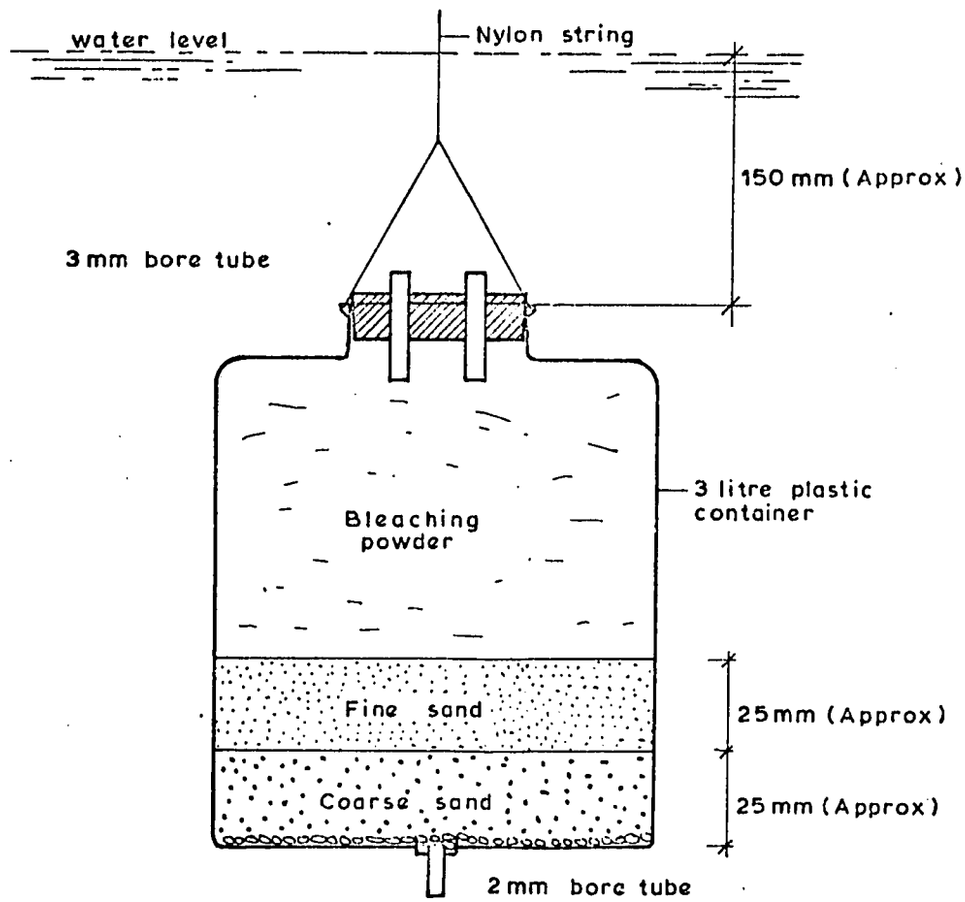
Title: Hypochlorinator

Country: Tanzania

Characteristics: Use of Plastic Container

Principle/Description:

Chlorination of open wells.



Reference: Shrivastava, L. P. "Report on Non-piped water supply sources in Dar-es-Salaam, Referred in "Master of Engg. Thesis, University of Jabulpur, India

Remarks: total cost (1975) T.Shs. 43 (U.S.$6.00)

the international reference centre for community water supply

address: p.o. box 140, leidschendam, the netherlands
address: nw havenstraat 6, voorburg (the hague)
phone: 070 - 89 42 51, telegr.: worldwater the hague, telex: 33004

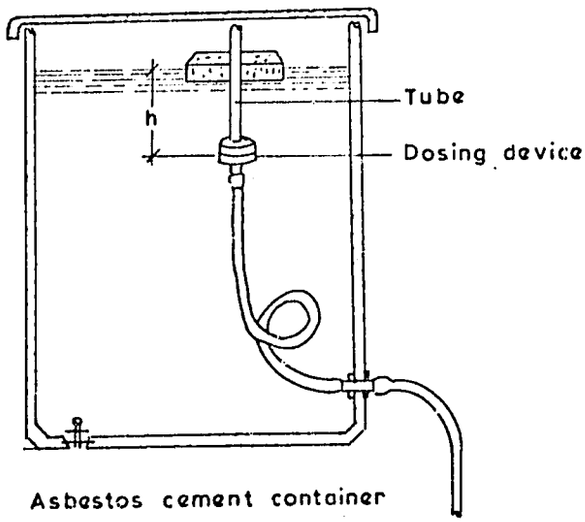
Title: Hypo-chlorinator

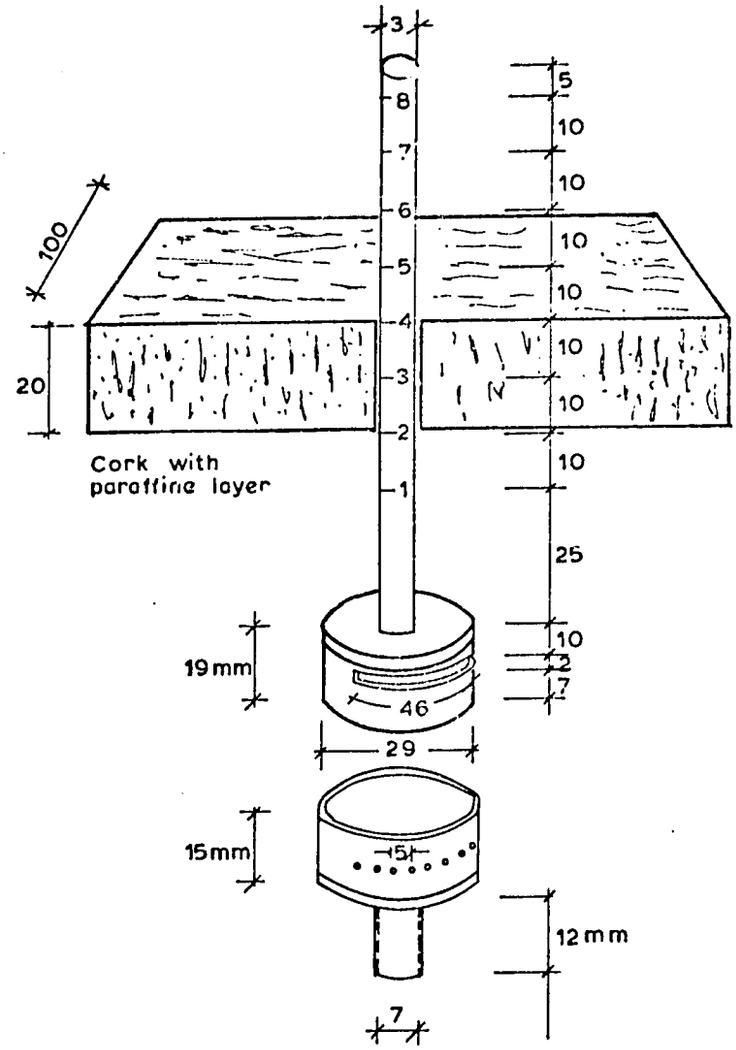
Country: Venezuela/Peru

Characteristics:

Principle/Description:

Discharge is determined by the number of open orifices uncovered by the slit. The head can also be varied by adjusting the float.





DETAIL ; Material: silver

Reference: Ing. Luis C. Bowilla, G. Venezuela, reported by Dante Munoż, M.T. de Alvear 684 - 40P Buenos Aires

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 09 42 51, telegr.: worldwater the hague, telex: 33604

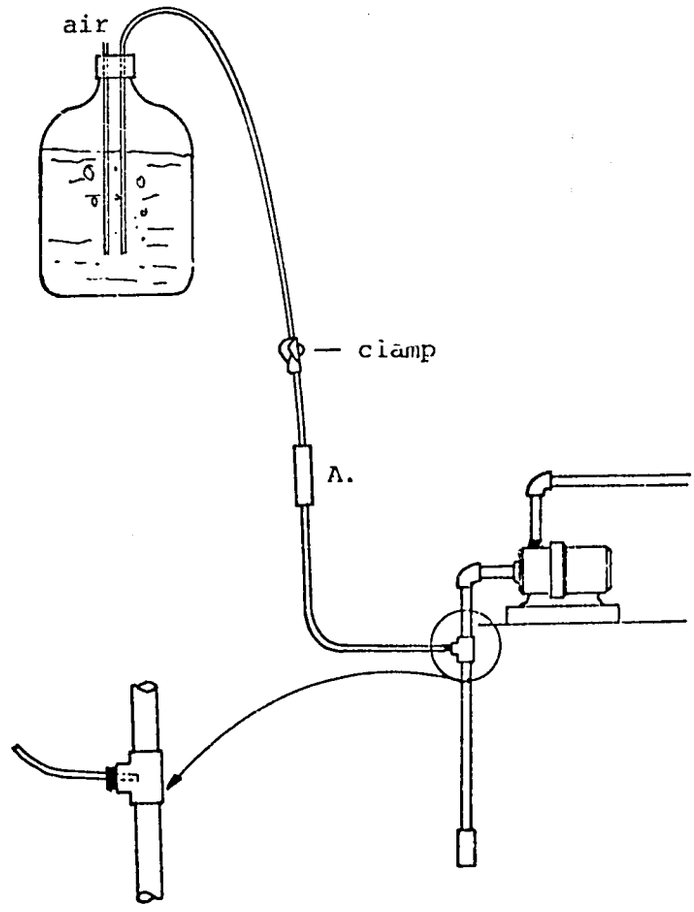
Title: Solution feeder

Country: Peru

Characteristics:

Principle/Description:

A solution feeder is connected to the suction line of a pump. A. is a buret indicating the dosage.



Reference: Lopez, D.C. Manual para la desinfección de aguas mediante la cloración. Ministry of Health, Peru

Remarks: reported by H. Weitzenfeld PAHO, El Salvador

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33604

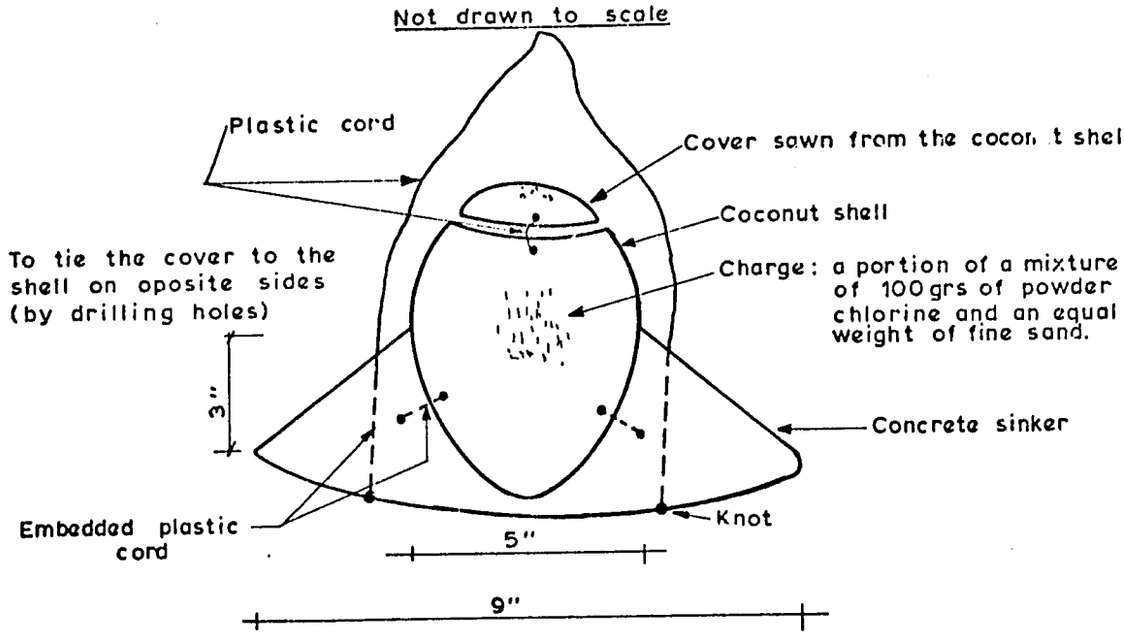
Title: Diffusion method chlorinator

Country: Maldives

Characteristics: Local construction

Principle/Description: Each coconut shell is charged with a mixture of calcium hypochlorite powder (25-30% chlorine) and an equal weight of fine sand. Chlorine residual of well water varies and depends on volume of water in the well, and rate of water withdrawal.
For a big well two or three devices may be needed.

COCONUT SHELL CHLORINATOR
(Diffusion method)



NOTE: One coconut shell chlorinator is used to one regular size well otherwise if the well is big two to three chlorinators are used

Reference: Hassan Maniku, Manager, Ministry of Health
MWSA, Malè, Maldives

Remarks: cost approx. (1975) US$1.50

who international reference centre for community water supply

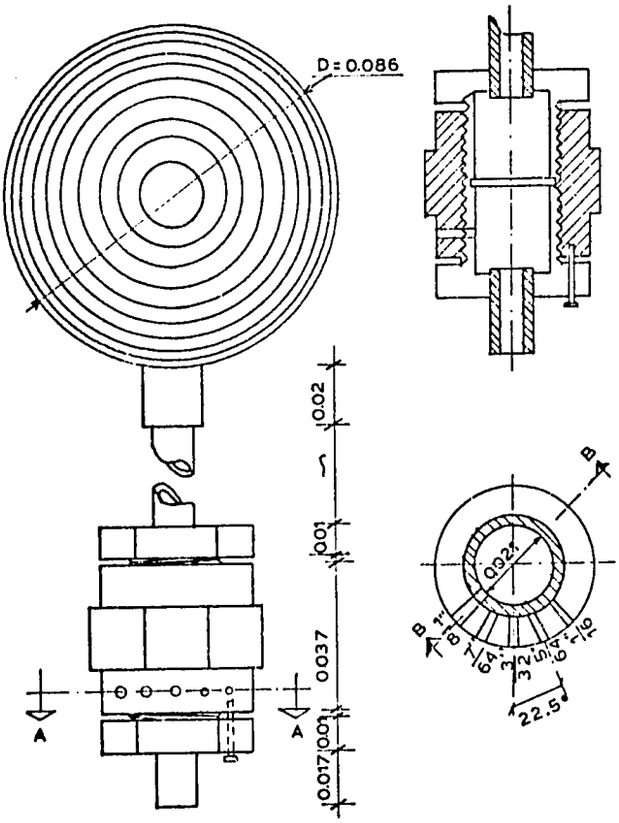
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33004

Title: Drip chlorinator type S.A.S.

Country: Venezuela

Characteristics: Constant head as the device drops with the lowering liquid level

Principle/Description: Dosage of chlorine solution depends on orifice size selected.



Reference: Ravelo, S.A., Economica Variante del Clorador de goteo tipo S.A.A. y comparador de cloro S.A.S.

Remarks: Xth Interamerican Congress of Sanitary Engineers, San Salvador.

who international reference centre for community water supply

postal address: p.o. box 140, leidschenam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 61, telegr.: worldwater the hague, telex: 33001

Title: Chlorinator

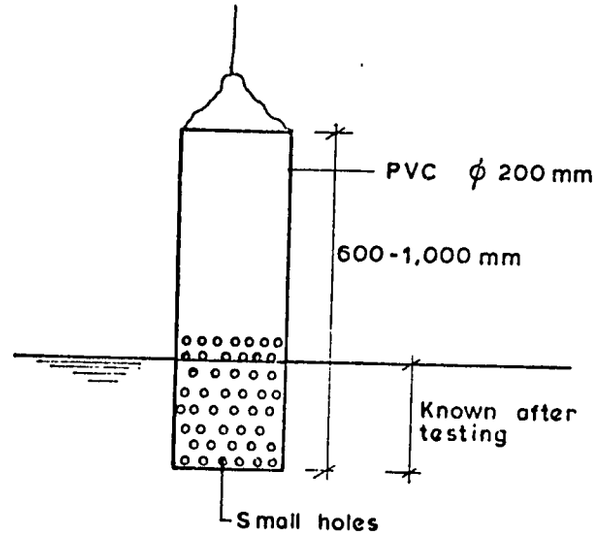
Country: Japan

Characteristics: Simple, use of PVC pipe

Principle/Description:

Prechlorination for removal of manganese. Placed in the intake well of the purification plant.

Chemical used: Calcium Hypochlorite (solid)



Reference: Masayoshi Oki, Himeji Water Supply Bureau, 23-2, Yashiro, Himeji City, Japan

Remarks:

who international reference centre for community water supply

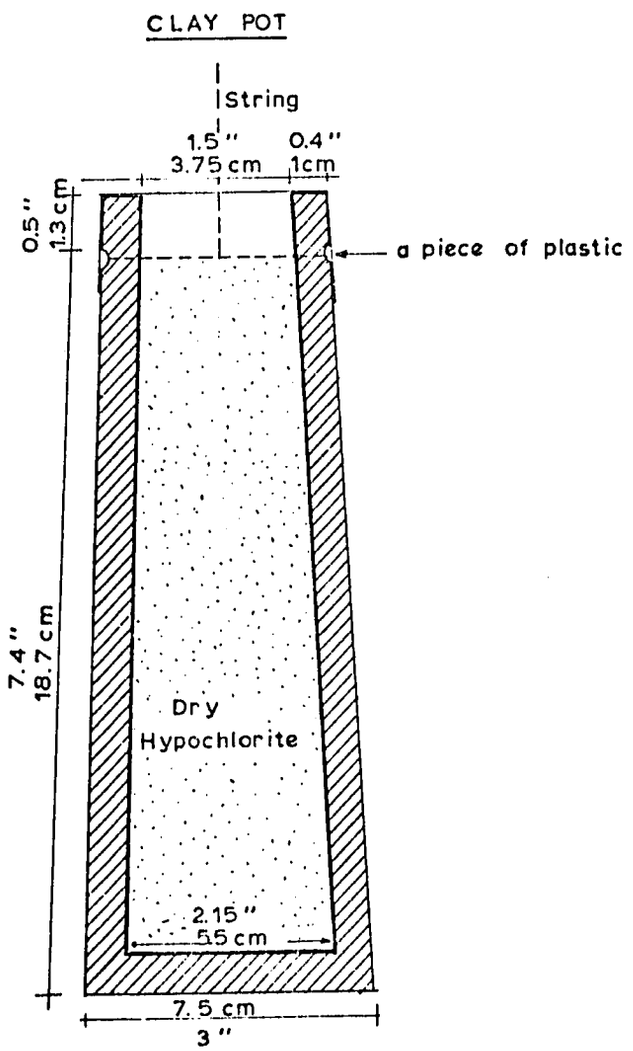
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw hoevenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 61, telegr.: worldwater the hague, telex: 32304

Title: Clay pot hypochlorinator

Country: Kenya

Characteristics: Local construction

Principle/Description: Material: one part of clay to two parts of ash from rice husks. The pot should be baked in an oven. The pot is filled with dry hypochlorite and hung in the water. The concentration of chlorine in the water can be decreased by rubbing the pot with wax candle and closing off part of the porous wall.



Reference: Chatiketu, S., WHO Sanitarian, N1E SHS-05, P.O. Box 765, Kano, Nigeria

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

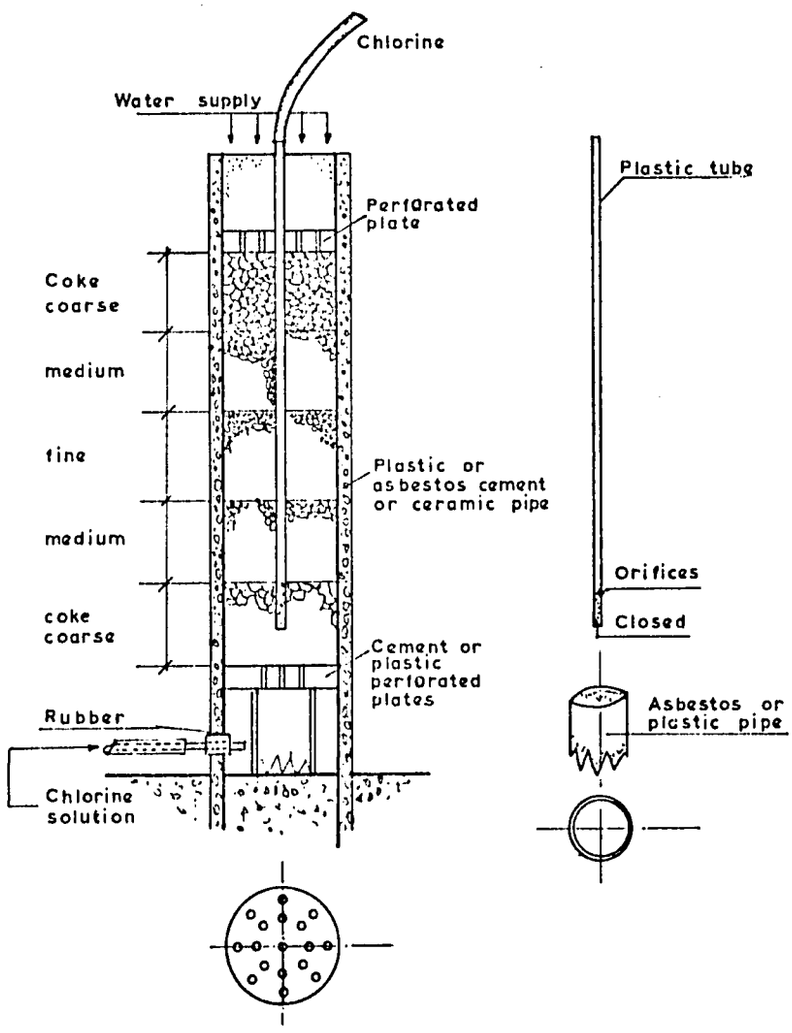
Title: Chlorine Absorption tower

Country: Brazil

Characteristics: Local construction

Principle/Description: The chlorine gas passes through the absorption column in counter current to a water stream forming a disinfection solution used for prechlorination in water treatment or for chlorination in waste water treatment. The dose can be changed by reducing the chlorine flow by the auxilary valve of the cylinder.

Operation difficulties: water flow may not be constant
maximum chlorine feed capacity is 3 kg chlorine/hour



Reference: Rossin, A.C., CETESB, Prof. Frederico Hermann Jr. 235, Alto de Pinheiros 05459 Sao Paulo SP, Brazil

Remarks: cost (1975) US$15.-

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw haver straat 6, voorburg (the hague)
telephone: 070 - 63 42 51, telegr.: worldwater the hague, telex: 33601

Title: Chloro suctioner and injector

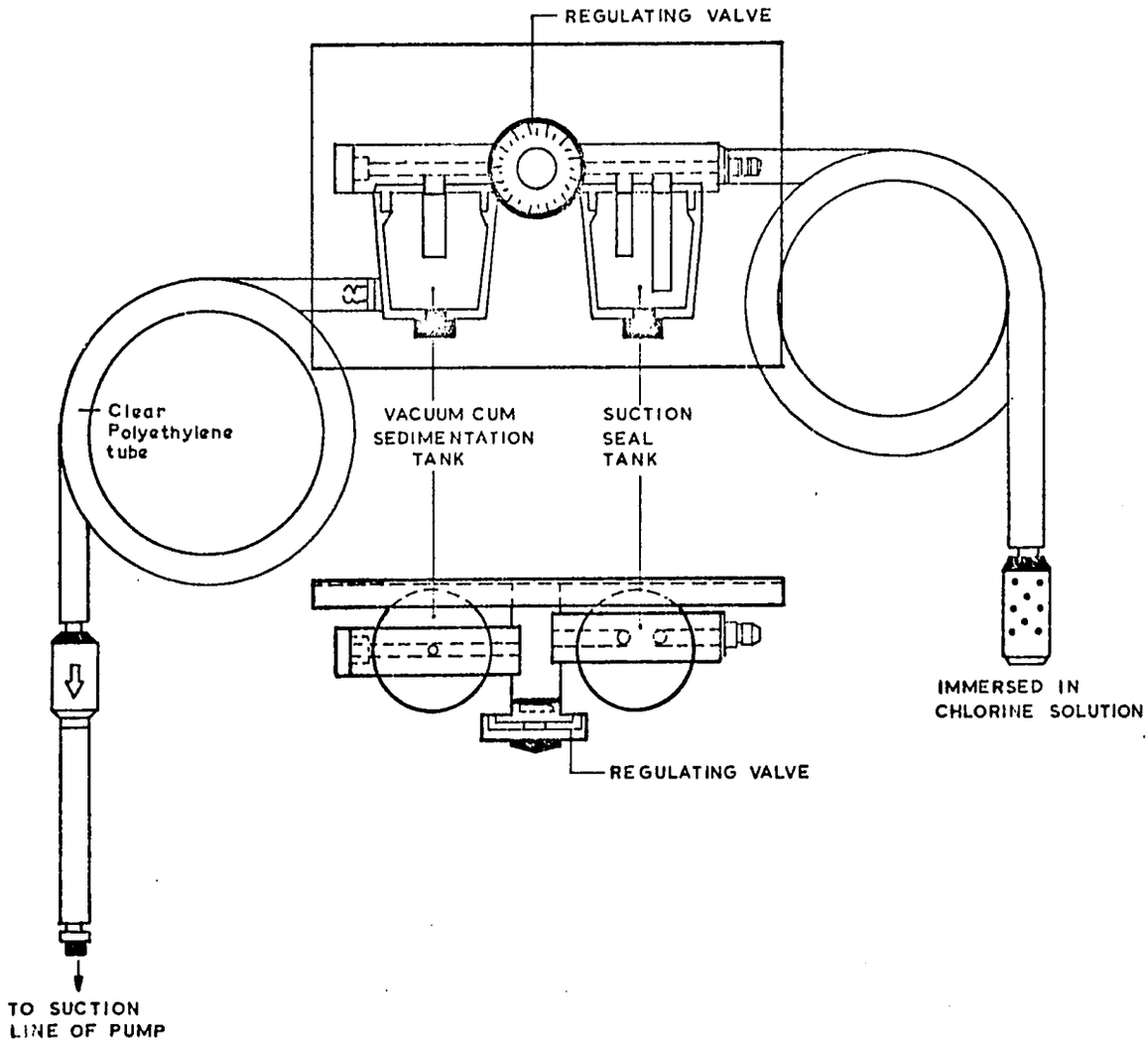
Country: Sri Lanka

Characteristics: in suction line of pump

Principle/Description: solution feeder, activated by suction of pumps

- self proportioning: automatic start and stop with flow
- no moving parts; activated by aspiration or vacuum
- no fine orifices to clog

Material: plastic



Reference: V.J. Emmanuel, WHO Sanitary Engineer
P.O. Box 8, Indonesia.

Remarks: approx. (1975) US$75.-

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 09 42 51, telegr.: worldwater the hague, telex: 33004

Title:	Packaged installations for drinking water purification of 100 to 800 m^2/24 h.
Country:	USSR
Characteristics:	standardized, compact

Principle/Description:

The installations are intended for the chemical physical treatment of surface water. Package units have a capacity of 100, 200, 400 and 800 m^3/24 hours. They can be used in villages, worker's settlements, houses. The installations are of a pumped type, and include a tube clarifier and filter. The installations are for indoor operation. The installation is compact, simple in exploitation and safe in operation.

Reference:	Small installations for purification and disinfection of drinking water and sewage, Moscow, 1974. D.T.sci. S.A. Shubert, Director Research Institute for Community Water Supply and Water Treatment
Remarks:	K.D. Pamfilov Academy of Municipal Economy. Moscow 123373, Volokolamskoye Shosse 87, USSR. (in Russian)

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33604

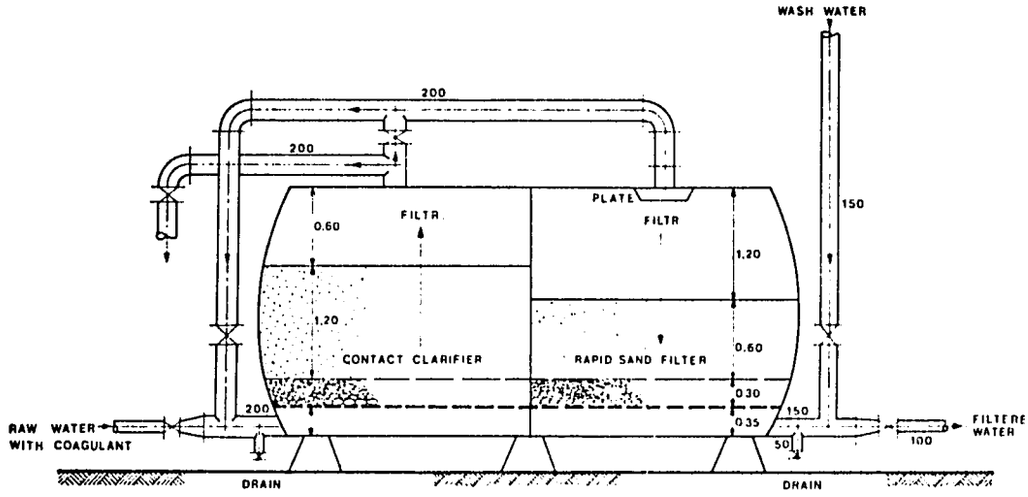
Title: Upflow downflow filter

Country: Brazil

Characteristics: Compact unit

Principle/Description:

Combination of upflow contact clarifier and downflow sand filter. Coagulation and floc removal take place in the coarse sand bed of the upflow filter. Rest turbidity is removed in the second filter.



Reference: Azevedo Netto, Prof. J.M. de, University of Sao Paulo, Brazil

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 5, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33904

Title: Two stage filter

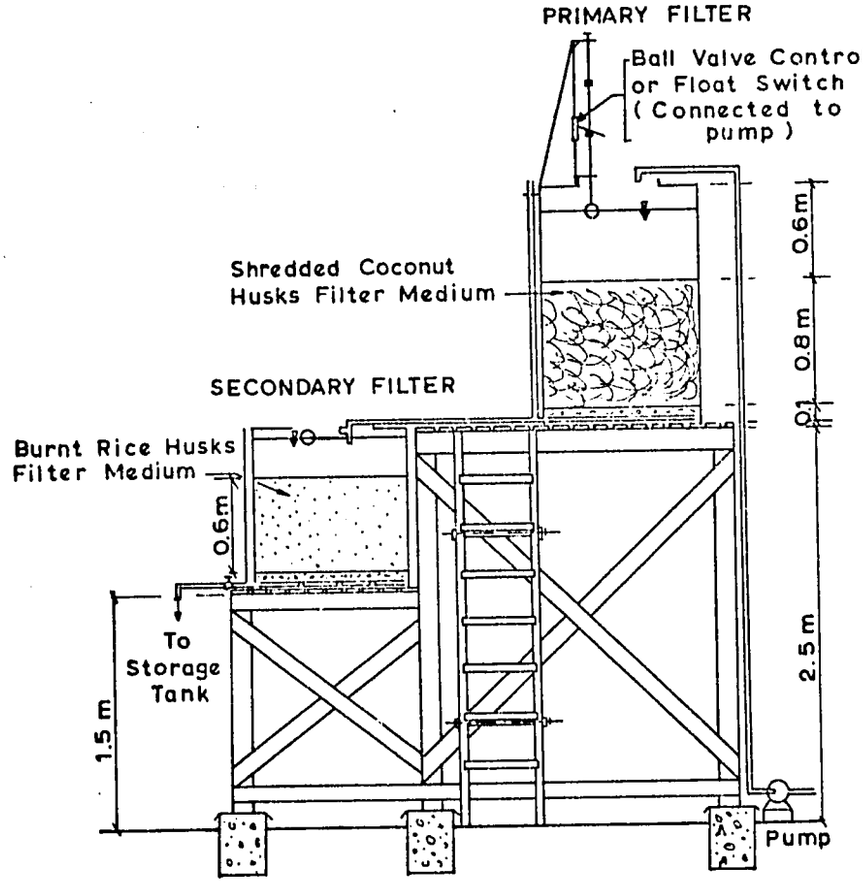
Country: Thailand

Characteristics: Innovative use of local materials

Principle/Description:

Low rate filter (1,25 $m^3/m^2/hr$) using coconut husk, and burnt rice husk as filter media for village supply. Reduction in turbidity, color and coliform reported.

Used coconut husk can be washed and reused; used burnt rice hisks can be discarded. Postchlorination is suggested.



TWO STAGE FILTER

Reference:- Asian Institute of Technology, P.O. Box 2754, Bangkok, Thailand
- Frankel, Dr. R.J., J.A.W.W.A., 1974, 2 , pp. 124 - 127.

Remarks:

400 WATER TRANSPORT AND USE

who international reference centre for community water supply

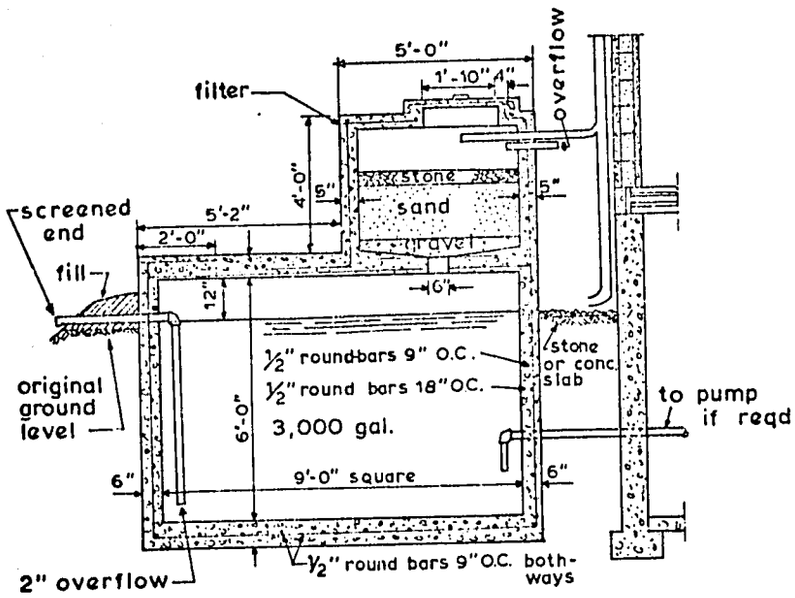
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33004

Title: Water storage structures

Country: U.S.A.

Characteristics: Combined with filter

Principle/Description:



Reference: "Concrete Structures for Farm"
Water Supply and Sewage Disposal, Portland Cement Association, 1940
Reported by Mood, Prof. E.W., U.S.A.

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw hayenstraat 6, voorburg (the hague)
tel. phone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33684

Title: Pedal drive for borehole pump

Country: England

Characteristics:

Principle/Description:

Construction utilizing bicycle parts is proposed. The pump is connected with a pedal drive operated by 1 or 2 men.

Reference: Wilson, S.S., Department of Engineering Science, Oxford University, Oxford OX1 3FJ, England

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

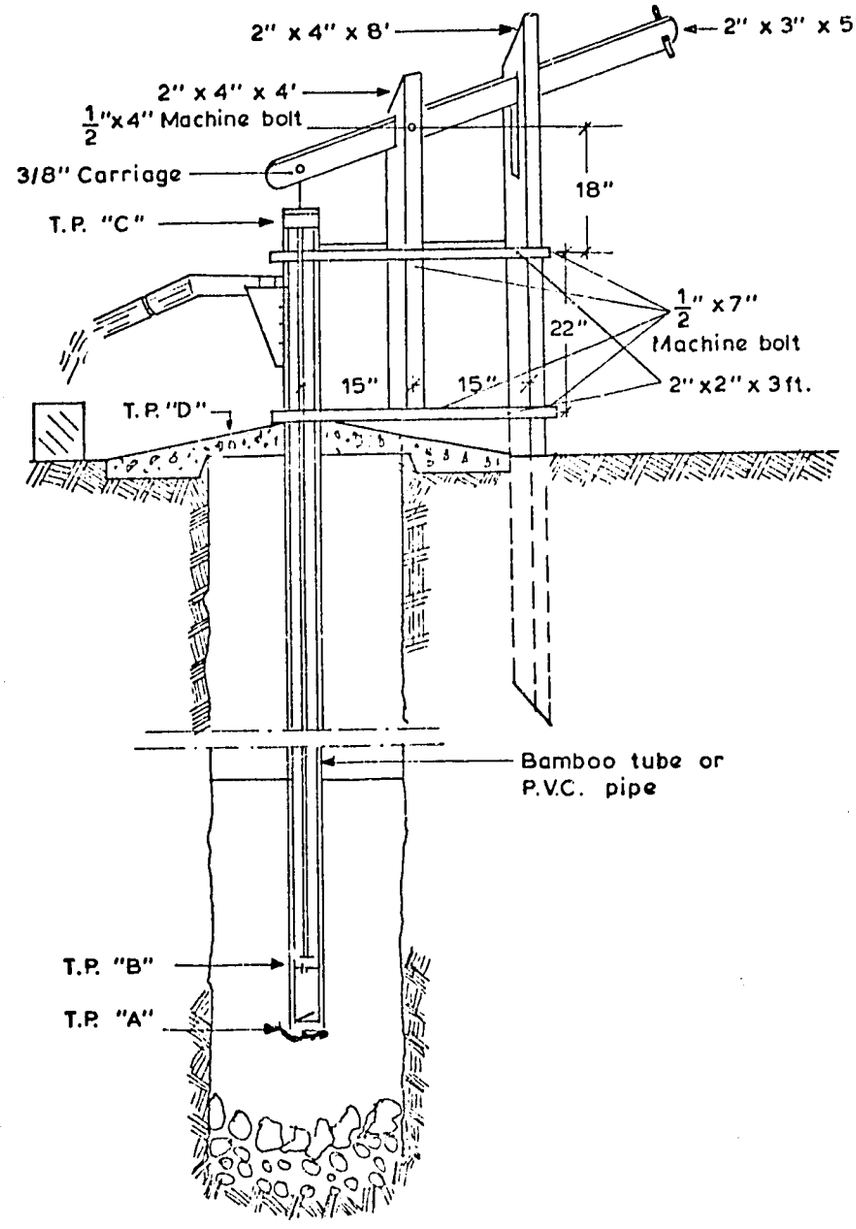
Title: Bamboo and PVC waterpump

Country: Nigeria

Characteristics:

Principle/Description:

The use of Bamboo or PVC pipe as pump tube, rubber gaskets (from old tyres) hard wood for piston, stand, handle are proposed.



Reference: Chatiketu, S., WHO Sanitarian, WHO, P.O. Box 765, Kano, Kano State, Nigeria

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw bovenstraat 6, voorburg (the hague)
telephone: 070 - 89 42 51, telegr.: worldwater the hague, telex: 33604

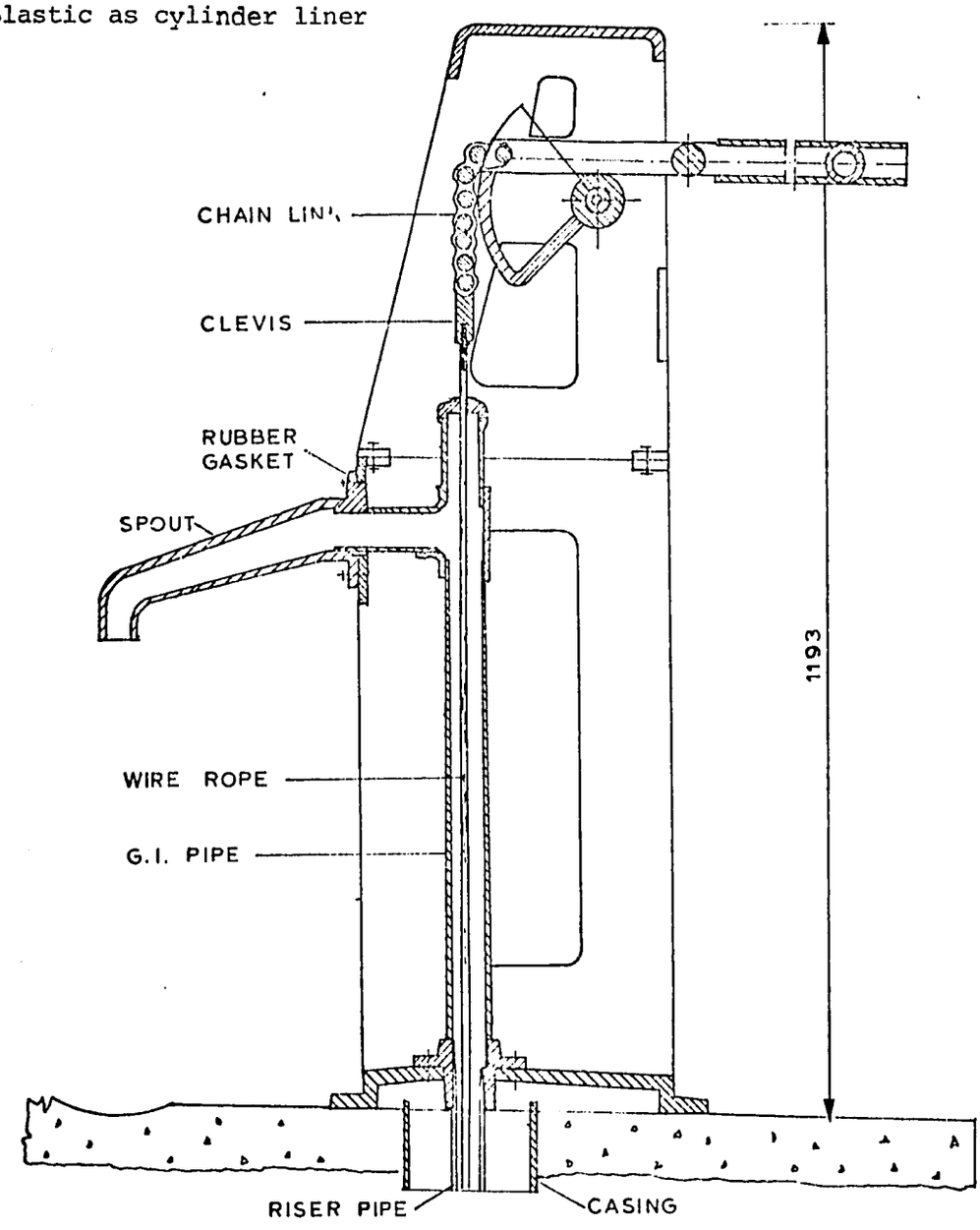
Title: Deep well handpump

Country: India

Characteristics: Plastic pump cylinder

Principle/Description:

Use of standard G.I. pipes and fittings and low-friction, high abrasion resistant plastic as cylinder liner



Reference: Emmanuel, V.J., WHO Sanitary Engineer, Indonesia

Remarks: cost approx. (1975) Indian Rs. 600.-

who international reference centre for community water supply

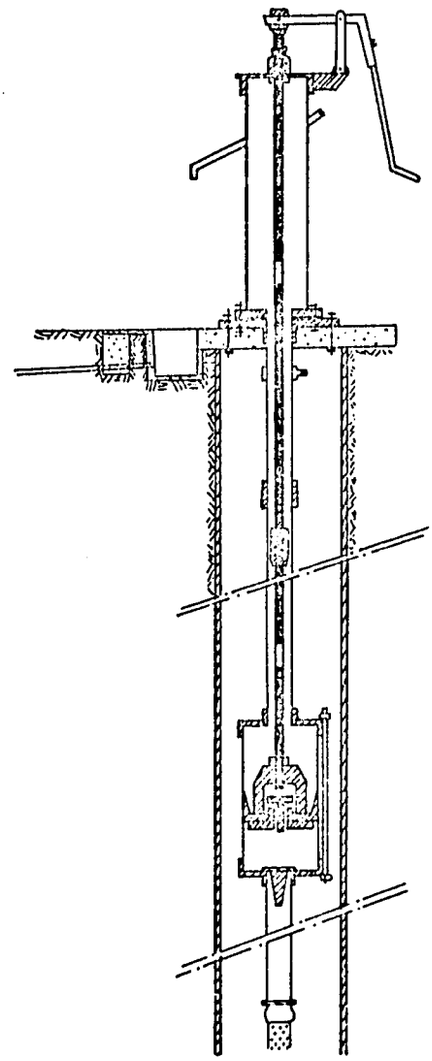
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 89 42 51, telegr.: worldwater the hague, telex: 33004

Title: Handpump (type Mandritsara)

Country: Madagascar

Characteristics: local production

Principle/Description: Deep well pump. Steel pump cylinder diam. 80 mm. Capacity 2000 l/hr. 4 Manweeks needed for production.



Reference: Maretto, Dr.Ing.D.
WHO, B.P. 362, Tanarive, Madagascar.

Remarks:

who international reference centre for community water supply

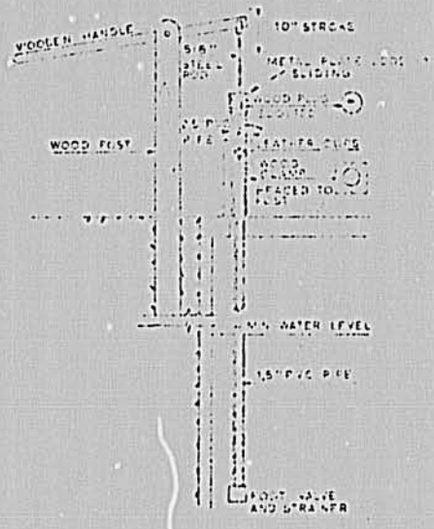
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

Title: Simple Handpump

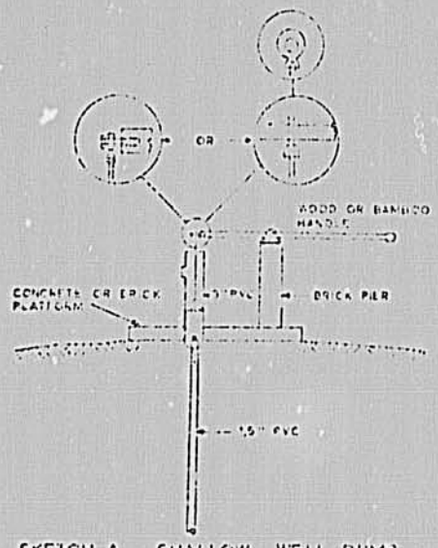
Country: Thailand

Characteristics: Use PVC cylinder

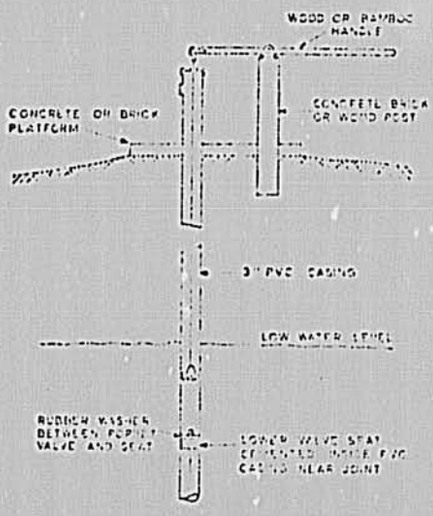
Principle/Description:



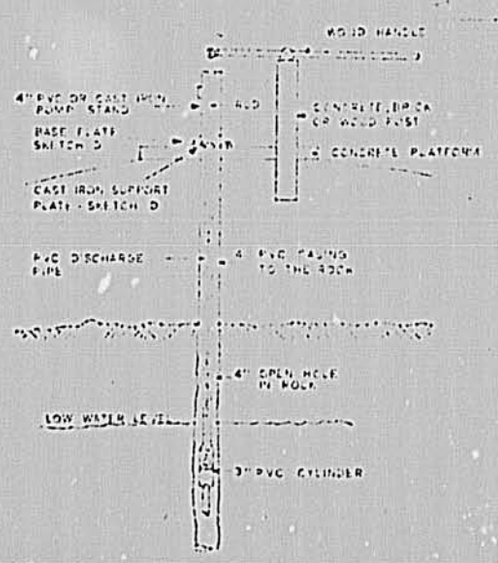
P.V.C HAND PUMP FOR SHALLOW VILLAGE WELLS , THAILAND



SKETCH A SHALLOW WELL PUMP



SKETCH B DEEP WELL PUMP



SKETCH C DEEP WELL PUMP-UNCASED HOLE IN ROCK

Reference: Spangler, C.D. 10212 Brookmore Drive, Silver Spring, Maryland 20901, U.S.A./ V.I.T.A., 3706 Rhode Island Avenue, Mt. Rainier, Maryland 20822, U.S.A.

Remarks:

who international reference centre for community water supply

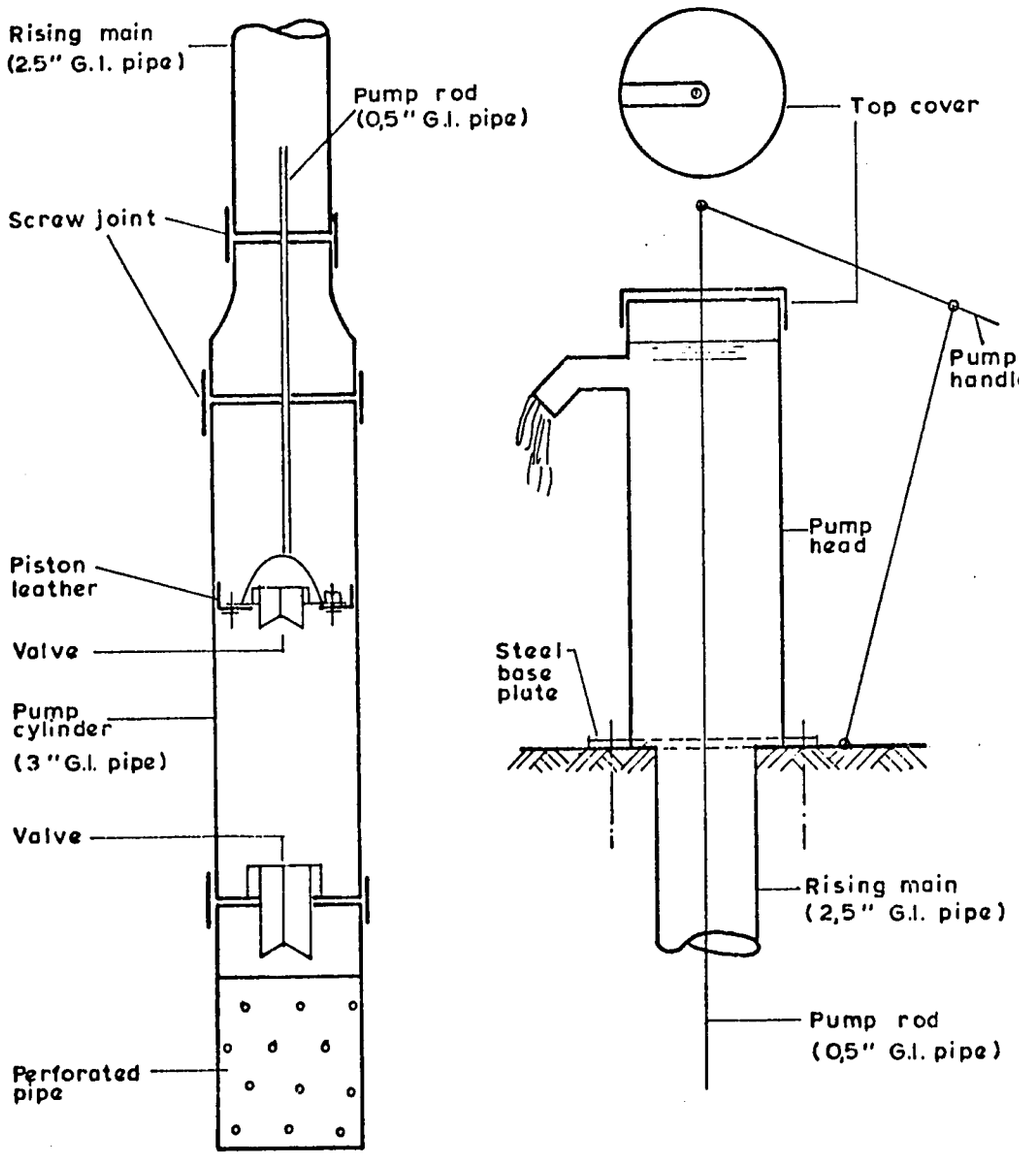
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33004

Title: Handpump

Country: Zambia

Characteristics: made of galvanised iron pipe

Principle/Description: Short piece (50 cm) of 75 mm diameter galvanised pipe is used. 12 mm diameter galvanised pipes used as pumprods



Reference: Suphi, H.S. WHO, P.O. Box 108, Kathmandu, Nepal

Remarks:

who international reference centre for community water supply

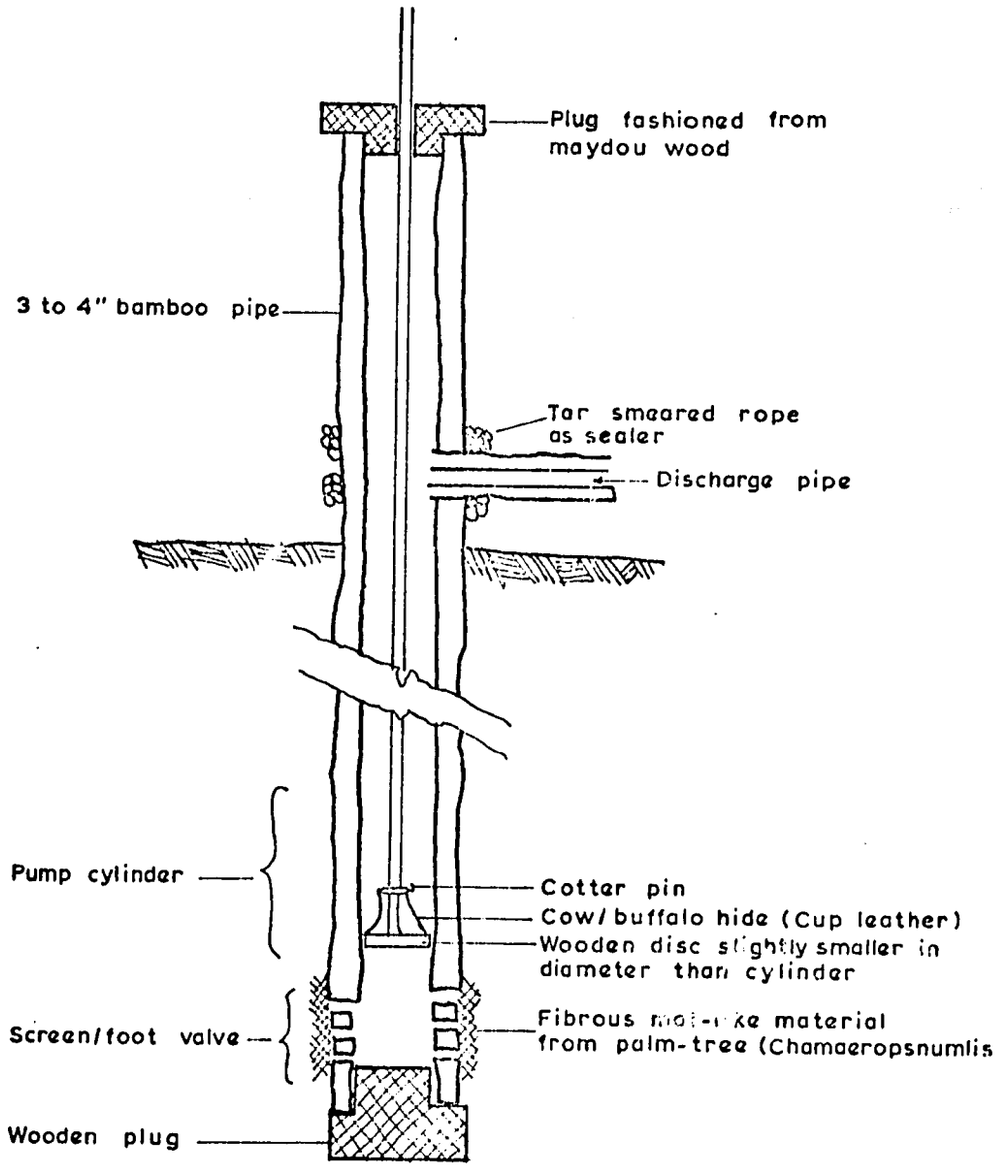
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 5, voorburg (the hague)
telephone: 070 - 89 42 51, telegr.: worldwater the hague, telex: 33604

Title: Bamboo Pump

Country: Laos

Characteristics: Use of local material

Principle/Description:



Reference: Hazbun, J.A., WHO, P.O. Box 343, Vientiane, Laos

Remarks:

who international reference centre for community water supply

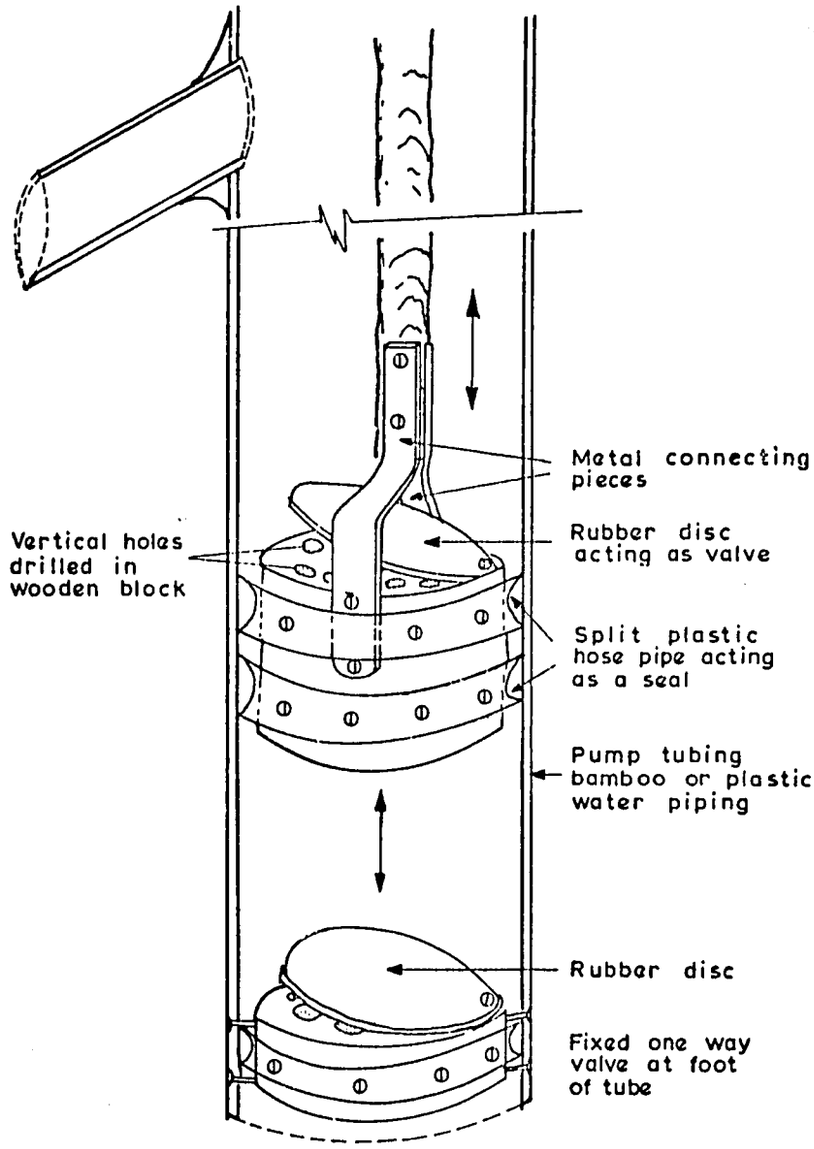
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

Title: Lift pump

Country: Laos

Characteristics: Hand made of local materials

Principle/Description:



Reference: Jolly, P.W., WHO, P.K. 235, Yenisehir, Ankara, Turkey

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

Title: Handpump "Jalna" type handpump

Country: India

Characteristics: Heavy duty pump

Principle/Description:

Designed to serve 100 families. For the steel topend mechanism use is made of sealed roller bearings, heavy duty guided chain. It is expected to have one or two years operation in a high usage area, before any maintenance would be required.

Reference: Sandberg,L., Sholapur Well Service, 860-59 South Sadar Bazar Civil Lines, Sholapur 3, India

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

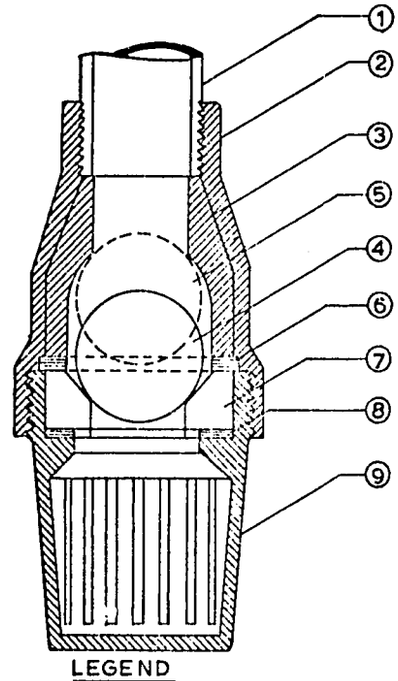
Title: Floating ball foot valve

Country: -

Characteristics: Plastic prototype

Principle/Description:

Improved efficiency because of easier opening of the valve by using a plastic ball.



LEGEND

① Pipe PVC or G.I.
② Upper valve body, HDP
③ Rips, upper valve body
④ Ball nylon (Comp. Sp.Wt. 3.5)
⑤ "Floating" position of ball
⑥ Valve seat retaining ring
⑦ Valve seat, syn. rubber
⑧ Valve seat retaining ring, HDP
⑨ Lower valve body & screen

Reference: Emmanual V.J., WHO Sanitary Engineer
P.O. Box 8, Jayapura, Irian Jaya, Indonesia

Remarks: approx. (1975) US$7.- - US$10.-

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

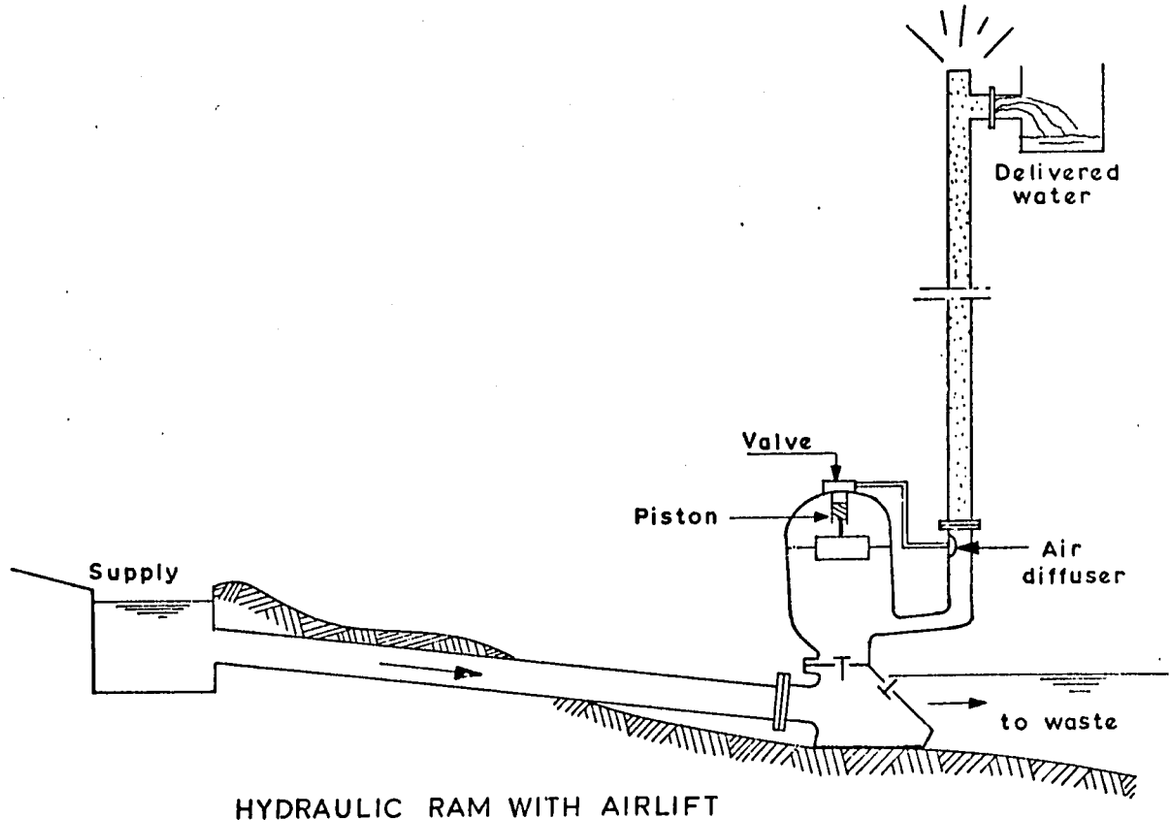
Title: Super hydro pump

Country: Nepal

Characteristics: Hydraulic ram with air lift

Principle/Description:

The capacity of a hydraulic ram is increased by automatically introducing air which is diffused in the water and giving it a lift.



HYDRAULIC RAM WITH AIRLIFT

Reference: Suphi, H.S., P.O. Box 108, Kathmandu, Nepal

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

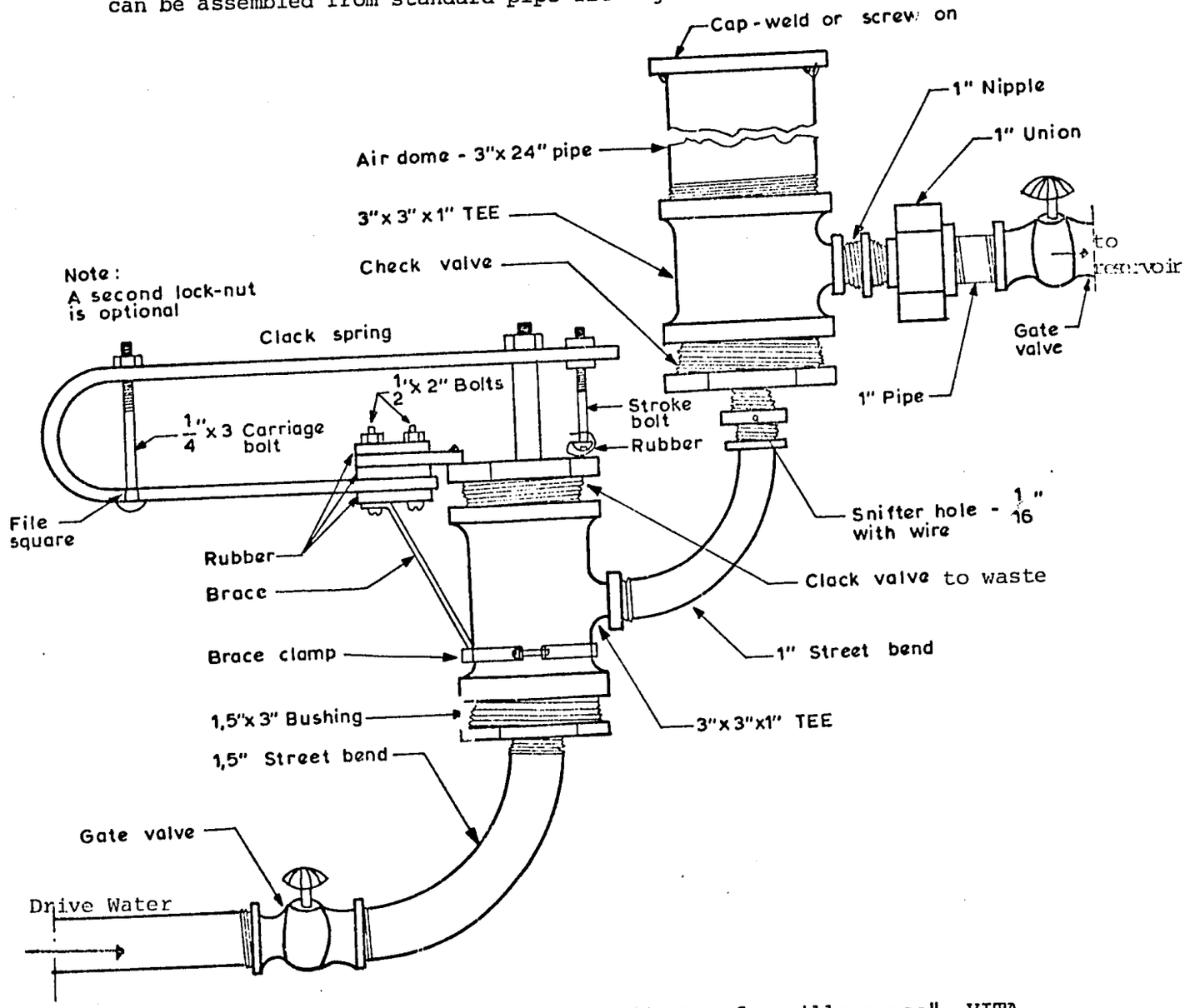
Title: Hydraulic Ram

Country: U.S.A.

Characteristics: Self help construction

Principle/Description:

In a hydraulic ram the potential energy of the drive water is used to lift a small portion of the water to greater heights. A ram is described which can be assembled from standard pipe fittings.



Reference: Kindel, E.W. c.s.,"A Hydraulic Ram for village use", VITA, Schenectady, N.Y.

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33604

Title: Balanced Float valve

Country: Uruguay

Characteristics:

Principle/Description:

A float is connected to a vertical rod to which two pistons are fastened which move up and down a cylinder. One is partially opening or closing inlet slits in the cylinderwall while the other balances the movement, so that a smooth operation is obtained. The valve is made of pipe and pipe fittings.

Reference: Obras Sanitarias del Estado, Uruguay

Remarks:

who international reference centre for community water supply

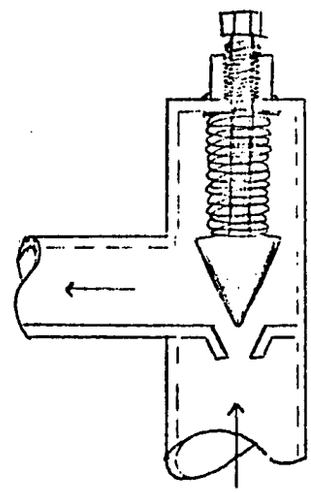
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 09 42 51, telegr.: worldwater the hague, telex: 33604

Title: Rate controller

Country: Japan

Characteristics: simple screw type

Principle/Description:



Reference: Toshiharu Yamamoto, Pacific Bldg. Jingumae 2-8-2
Shibuya-ku, Tokyo, Japan

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33804

Title: Water Flow Regulator

Country: Argentina

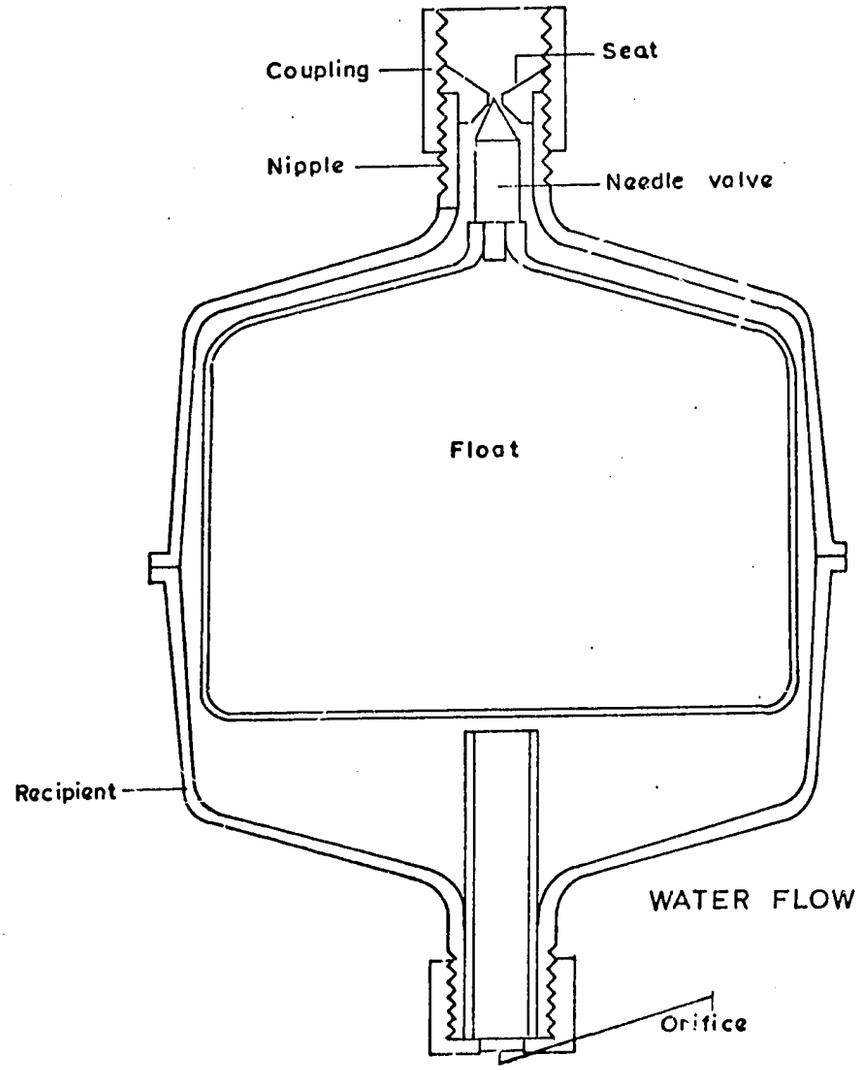
Characteristics: Material polypropylene

Principle/Description:

A constant level necessary for a constant discharge through a limiting orifice is obtained with a float and needle valve. Installed in domestic water tanks the device serves also as a float valve.

Cost: US$2.50 (1975). 60.000 units installed in rural communities in Argentina.

Practically no spare parts required.



WATER FLOW REGULATOR

Reference: Schkolnik, P., Civil Engineer, Avda. Brasil 3141 Dep. 1001, Montevideo, Uruguay

Remarks:

who international reference centre for community water supply

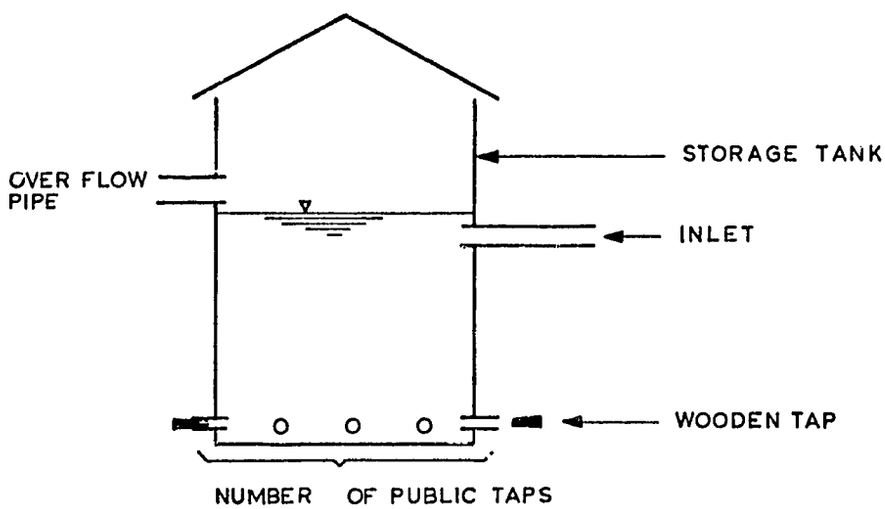
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 09 42 51, telegr.: worldwater the hague, telex: 33604

Title: Public Taps

Country: Japan.

Characteristics: Wooden taps

Principle/Description:



Reference: Yoichi . asaki, Suido-kiko K.K., 3-7, Yaesu, Chuo-ku, Tokyo, Japan

Remarks:

who international reference centre for community water supply

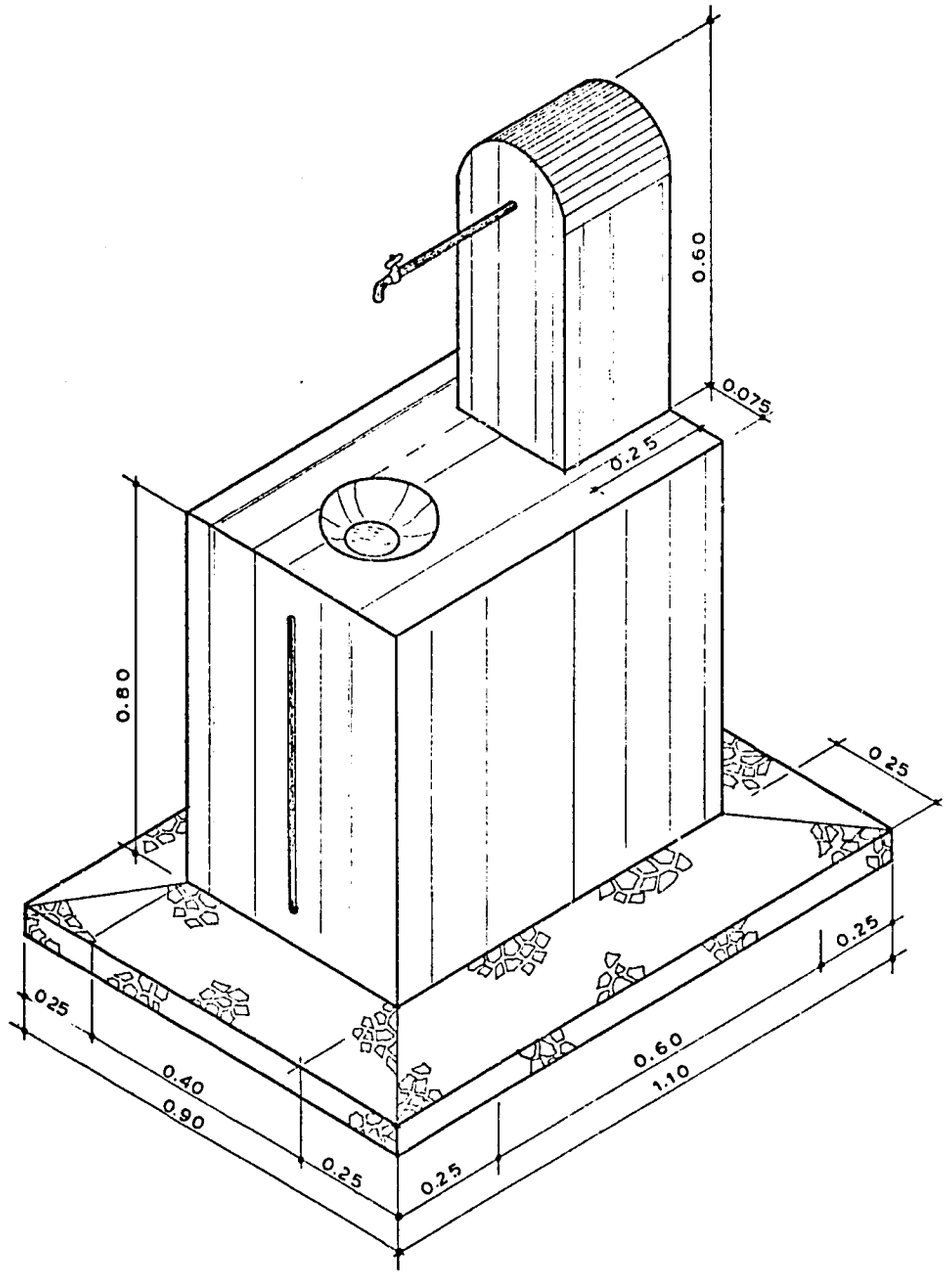
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw hoevenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33604

Title: Public Standposts

Country: Guatemala

Characteristics:

Principle/Description:



Reference: Celis E.E., Department of Sanitary Engineering, 2a, Av. 0-61, zona 10, Guatemala

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 09 42 51, telegr.: worldwater the hague, telex: 33004

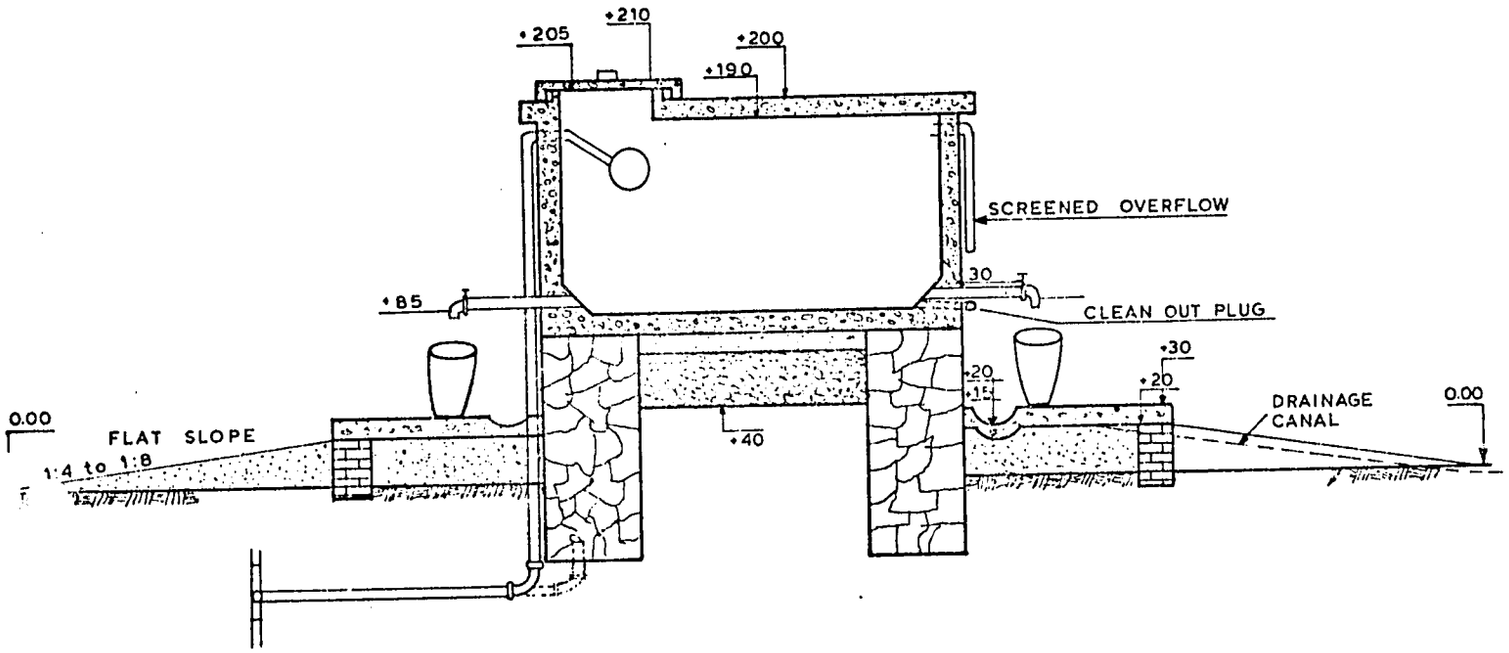
Title: Public tank standpost

Country: Afghanistan

Characteristics: less wastage of water

Principle/Description:

The tank has a capacity 3-4 m^3 and is provided with several taps.



Reference: Carrié, R. WHO Sanitary Engineer, c/o UNDP, P.O. Box 1011, Sierra Leone, (Freetown City)

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33004

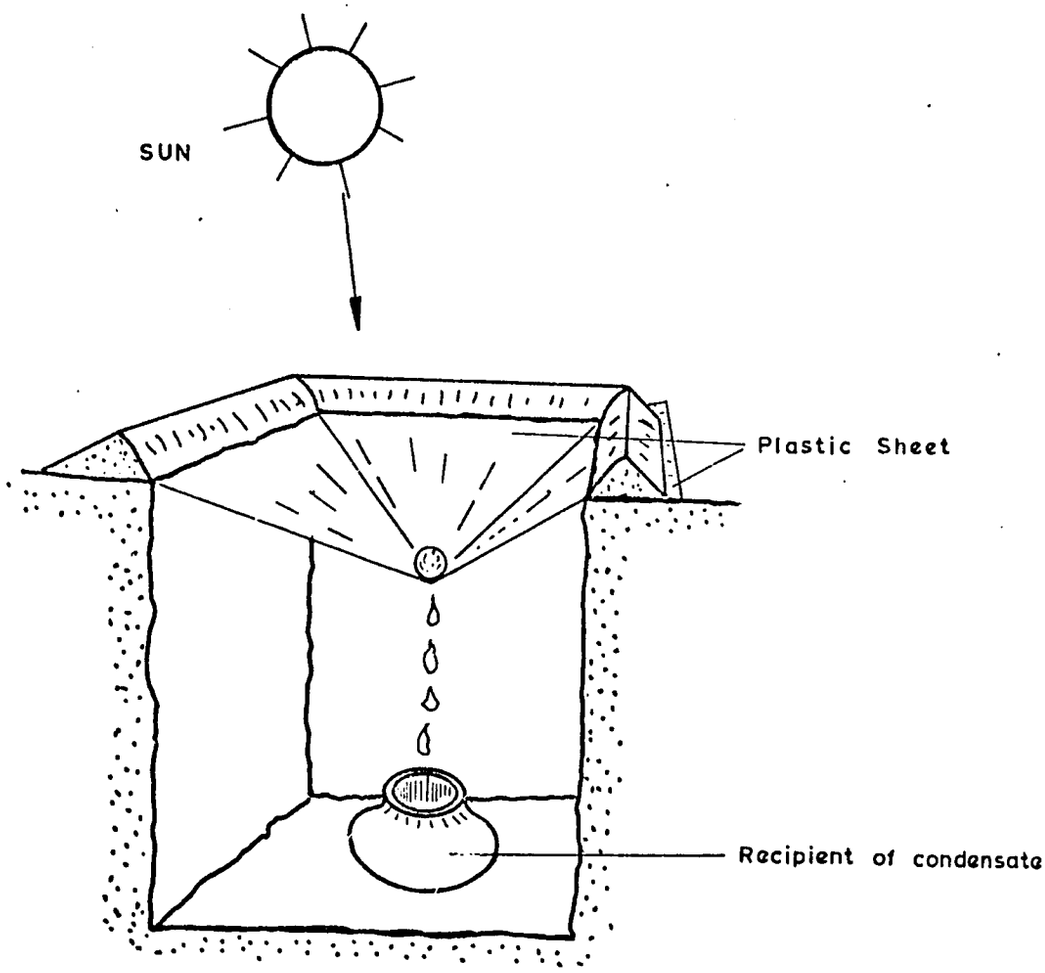
Title: Distillation of subterranean moisture

Country: Algeria

Characteristics:

Principle/Description:

When nothing is available, subterranean moisture can be collected by simple distillation



Reference: Jolly, P.W., P.K. 235, Yenisehir, Ankara, Turkey.

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33604

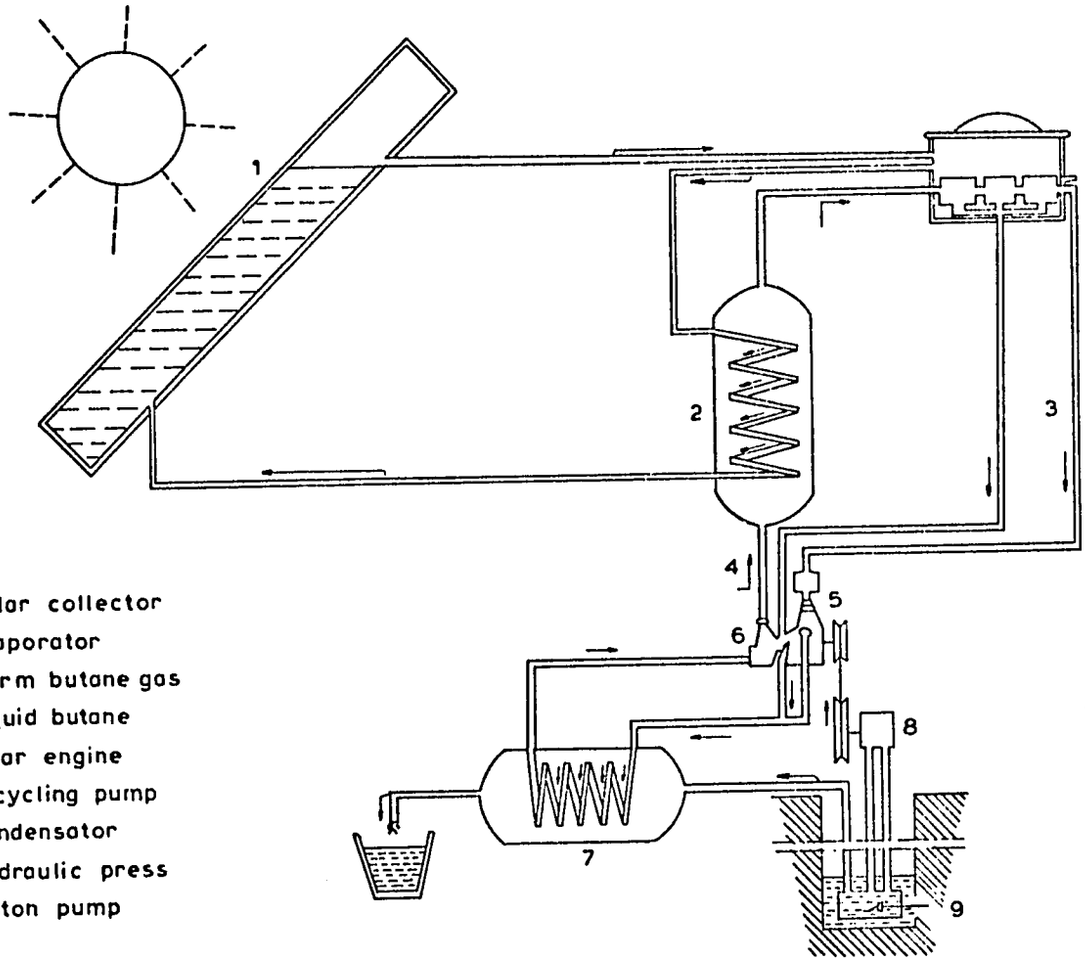
Title: Solar Pumps

Country: Mexico

Characteristics:

Principle/Description:

Extraction of water from deep wells by a piston pump driven by an expansion motor which operates on recycled butane. The butane gasified by solar heated water, expands, drives the expansion motor, is liquefied and recycled.



1 Solar collector
2 Evaporator
3 Warm butane gas
4 Liquid butane
5 Solar engine
6 Recycling pump
7 Condensator
8 Hydraulic press
9 Piston pump

SOLAR PUMP

Reference: "Bombas Solares", published by Secretaria de Salubridad y Assistencia, Mexico City.

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33604

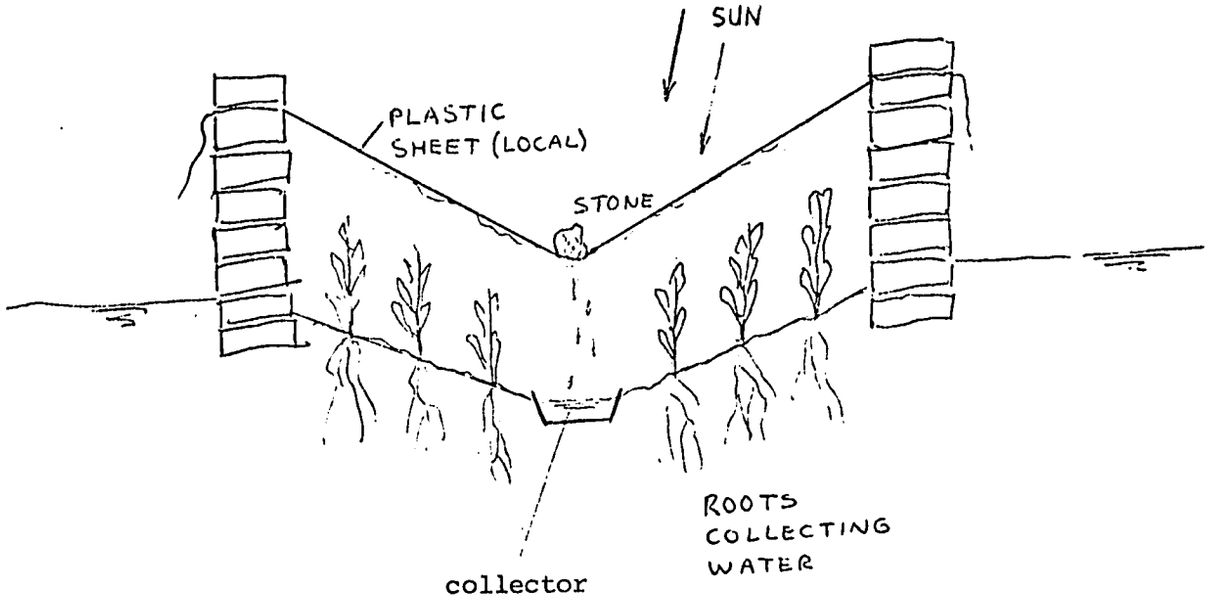
Title: Evapotranspirer

Country: Guatemala

Characteristics: Water distillation

Principle/Description:

Water evaporates, condenses against the sheet and collected in the centre.



Reference: Dr. M.G. McGarry, Program Officer, IDRC, P.O. Box 8500, Ottawa, Canada K1G 3M9

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

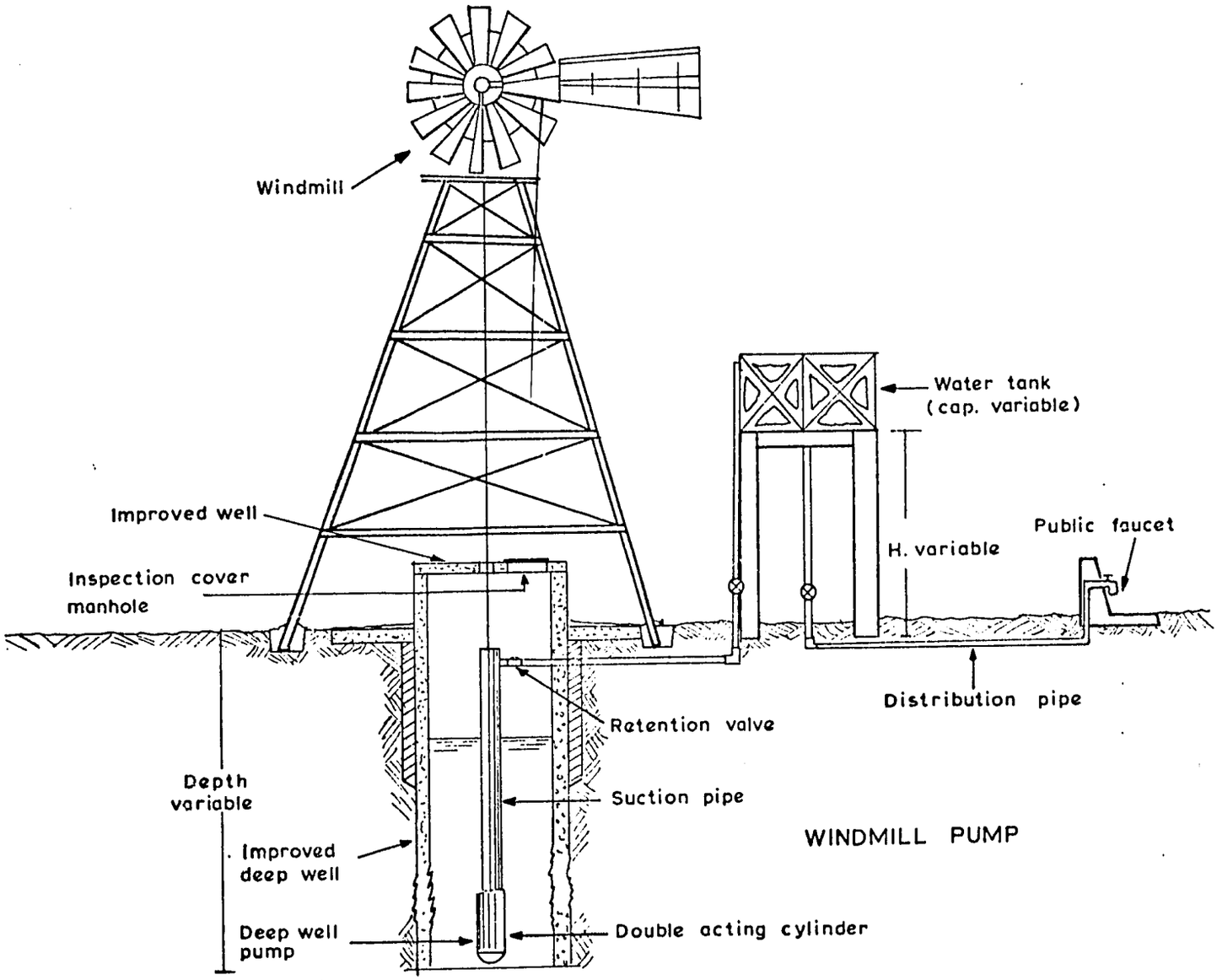
Title: Rehabilitation and improvement of existing wells

Country: India

Characteristics: Installation of windmill

Principle/Description:

Depth and lining of existing wells are improved, a concrete parapet, platform and cover provided with an opening for the windmill shaft. A windmill is installed. Water is pumped to a storage tank.



WINDMILL PUMP

Reference: (reported by Valdes-Pinilla, R). Public Health Engineering Department of State of Kerala, Trivandrum, India

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

Title: Low cost windmill

Country: U.S.A.

Characteristics:

Principle/Description:

Construction details of a windmill for pump drive, producing 1 HP in a wind of 6.4 m/sec. and 2 HP with a windspeed of 8.1 m/sec. Automatic feathering to prevent damage at high wind speeds.

Materials used are a rear axle and differential gear of a motor car, sheet metal, and ribbon, pipe, rod, angle iron/channel and wood. No precision work or machining required. Design can be adapted to different materials and skills.

Tested propotype.

Reference: Bossel, Dr. H., Low cost windmill for developing nations prepared for VITA. Schenectady, N.Y.

Remarks:

800 WASTE COLLECTION AND DISPOSAL

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33004

Title: Comfort station

Country: Nigeria (Ibadan)

Characteristics:

Principle/Description:

Combined unit providing toilet, bathing and washing facilities for groups of families (200-600 persons) in unsewered areas. Waste flows into an aqua privy tank and soakpit. The unit can be constructed on self-help basis.

Reference:- Finley, W.W., UNDP/WHO Sao Paulo, Brazil
- Obadina, Eng. Oluaotun, Ibadan Waste Disposal Board, P.M.B. 5443, Ibadan, Nigeria

Remarks:

postal address: p.o. box 140, rijswijk/holland, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

Title: Waste Water Absorption Pit

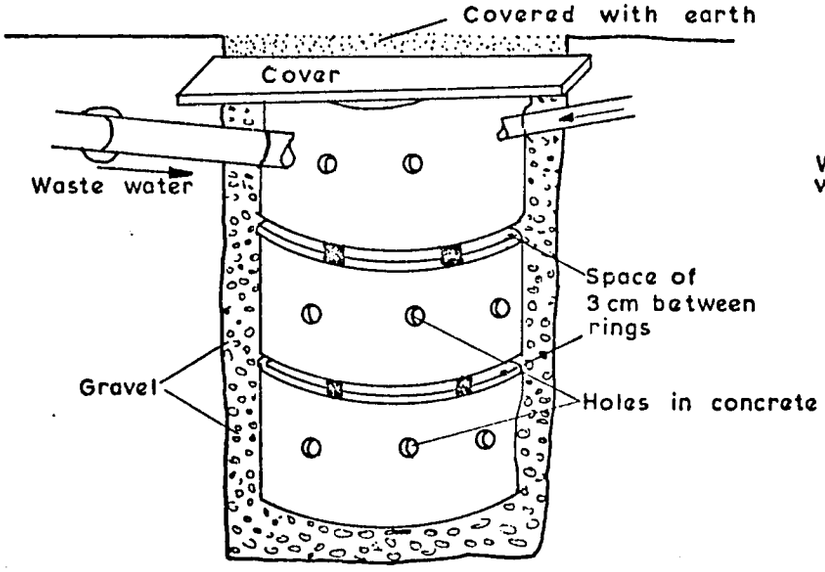
Country: Laos

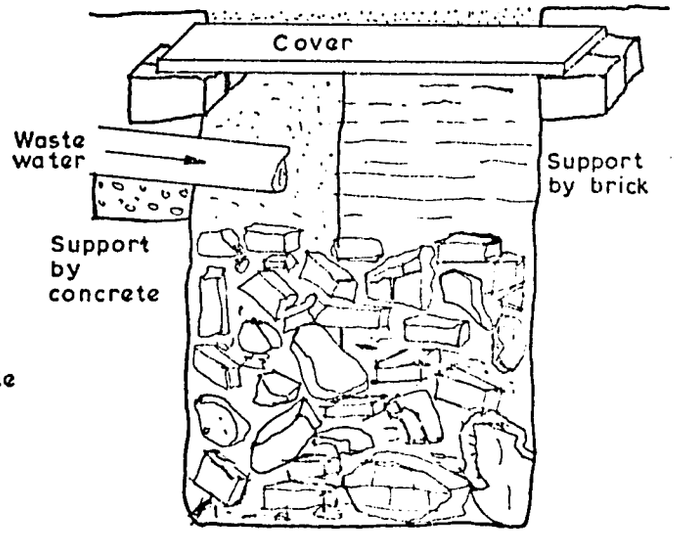
Characteristics: simple

Principle/Description:

A. System using three perforated concrete rings, piled up with spaces in between.

B Less expensive system filled up with stones and used bricks





Reference: Jolly, P.W., WHO, P.K. 235, Yenisehir, Ankara, Turkey

Remarks:

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33004

Title: Aqua privy slab casting

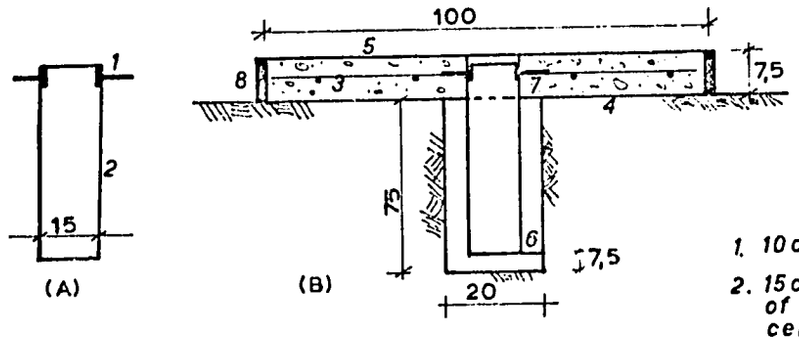
Country: Nigeria

Characteristics: simplified construction

Principle/Description:

The methods often reported in literature for incorporating the inlet drop pipe into the concrete slab floor of the aqua privy is too complicated for individuals in developing countries to cast his own floor as complicated moulds are required. The method reported simplifies the casting.

Simple method for casting Aqua privy floor slab



Dimensions in cm

KEY

1. 10 cm nails
2. 15 cm dia. drop pipe of wood or asbestos cement
3. 0.6 cm dia steel reinfor-cement
4. Ground level
5. Reinforced concrete slab
6. 20 cm dia. hole
7. Nail in concrete
8. Wooden mould

Reference: Oluwande, P.A., Ibadan, Nigeria

Remarks: cost: $3.00 per unit

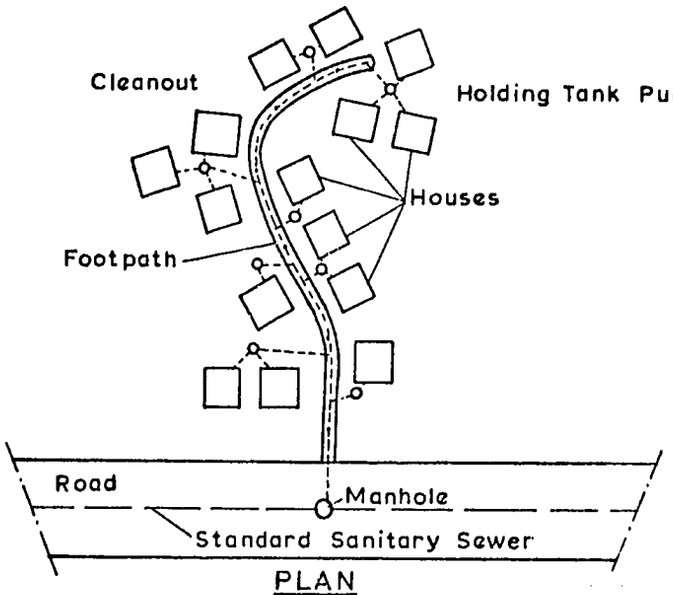
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33604

Title: Sewage disposal of temporary houses

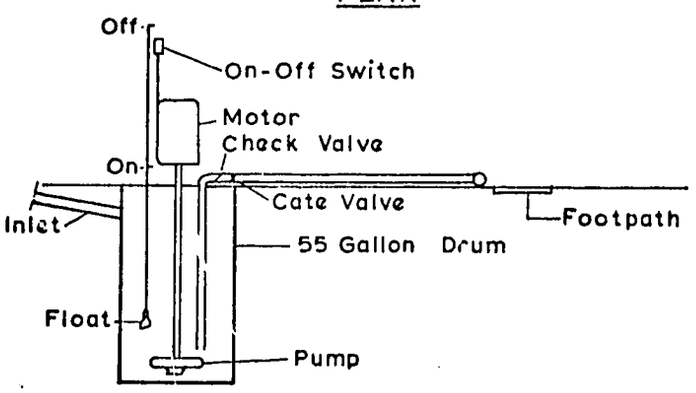
Country: Barbados

Characteristics: low cost temporary sewers

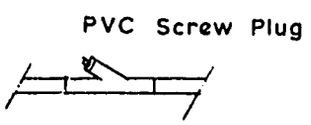
Principle/Description: each house provided with a holding tank, pump and PVC-pipe laid on the surface of the ground from the house to the collecting sewer. In many cases one pump could serve more than one house.



PLAN



DETAIL



Cleanout

Reference: Molin, A.E. - Sanitary Engineer, c/o PAHO/WHO, P.O. Box 508, Bridgetown, Barbados

Remarks: cost (July 1975) approx. $200.-

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33604

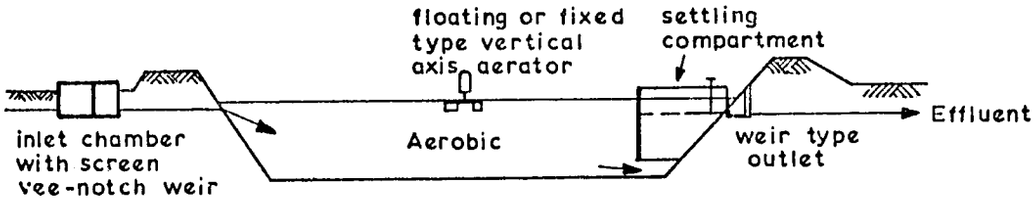
Title: Excess solids removal arrangement for aerated lagoon

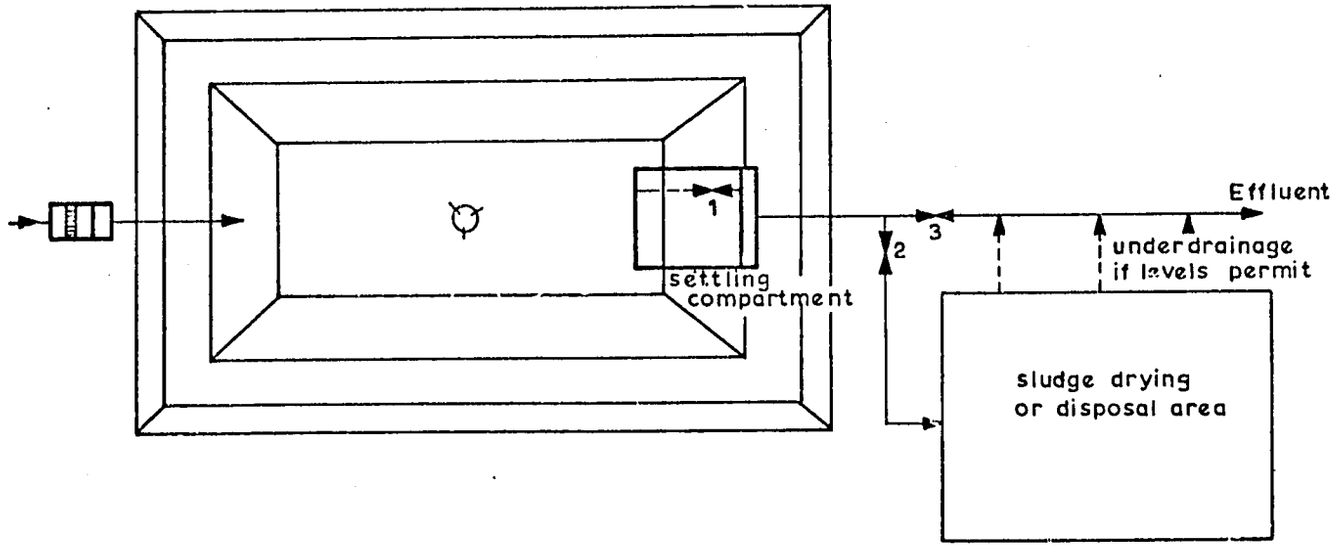
Country: Turkey

Characteristics: Settling compartment within the lagoon

Principle/Description:

When surplus sludge is to be removed from an aerated lagoon the settling compartment can be by-passed by opening a valve in a pipe connecting the aeration side to the outlet weir as shown in the figure. Simultaneously, the valve (3) in the effluent line is closed and a valve (2) in the line leading to a sludge disposal area is opened.





Reference: Arceivala, Prof. S.J., WHO, P.K. 235 Yenisehir, Ankara, Turkey

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 63 42 51, telegr.: worldwater the hague, telex: 33604

Title: Packaged installations for sewage purification of 12 to 200 m^3/24 hours capacity

Country: USSR

Characteristics:

Principle/Description:

The installations are intended for complete biological purification of town sewage and are advised for application in villages, workers's settlements, individual objects. The purification in installations of 12-200 m^3/24 hours capacity is based on the complete oxidation method, in which the sewage purification and activated sludge mineralization occur simultaneously in the aerated zone. The aeration method with separate stabilization of activated sludge is used in installations of 400-700 m^3/24 hours capacity. The installations are equipped with a mechanical or pneumatic aeration system. The installations are simple in exploitation and have a high efficiency.

Reference: Small installations for purification and disinfection of drinking water and sewage" Moscow, 1974. D.t.sci. S.A. Shubert, Director Research Institute for Community Water Supply and Water Treatment K.D. Pamfilov Academy of Municipal Economy, Moscow 123373, Volokolamskoye Shosse 87, USSR. (in Russian)

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office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33004

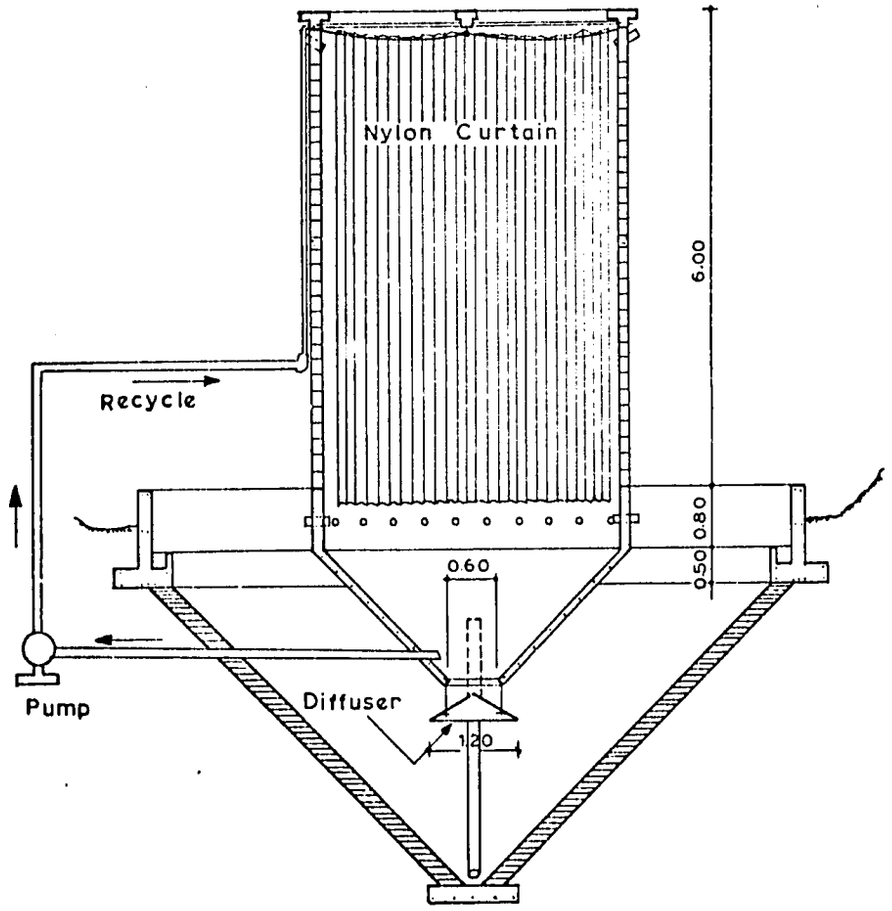
Title: Sewage treatment with nylon curtain percolator

Country: Uruguay

Characteristics:

Principle/Description:

Good contact with air is obtained by spraying the sewage along nylon sheets.



Reference: Obras Sanitarias del Estado, Uruguay

Remarks:

who international reference centre for community water supply

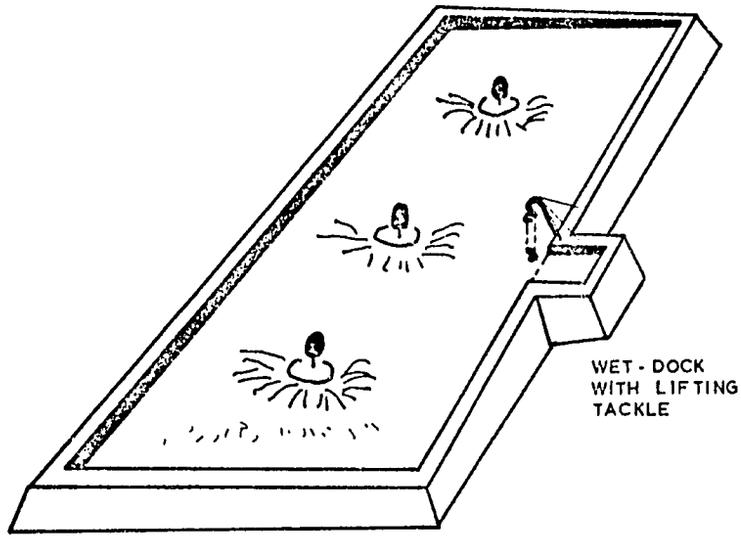
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw hoevenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 32604

Title: "Wet-dock" arrangement for maintenance work on floating aerators

Country: Turkey

Characteristics: Maintenance work facility without stopping the treatment proces.

Principle/Description: For repairs or maintenance a floating aerator can be dragged in water to a corner of the lagoon where a small loop or arm can be provided to "wet-dock" the aerator and enable lifting it up with a tackle for inspection.



Reference: "Simple Waste Treatment Methods" - Arceivala, Prof. S.J. Middle East Technical University, Ankara, Turkey, (1973)

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 32604

Title: Oxidation pond

Country: Brasil

Characteristics:

Principle/Description:

Settled sewage flows over a 1000 m long step channel (cascade) for good aeration. Pieces of asbestos-cement are used for the construction and the corrugated surface allows the formation of an active biological layer. Good BOD removal obtained.

Some data:

Characteristics	Raw Sewage	After Cascade	After Oxidation Pond
BOD mg/l	600	215	42
D.O. mg/l	0	2.3	18.2
Coliform/100 m.l.	2.4×10^8	1.6×10^8	1.6×10^3
Temp. C.	22.0	27.2	25.0
Settl. solids mg/l	7.2	4.0	0.1

Reference: Mattos de Lemos, Eng. H., FEEMA, Rua Fonseca Teles, No. 121-150, andar, Rio de Janeiro - R.J., Brazil.

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw hoevenstraat 6, voorburg (the hague)
telephone: 070 - 09 42 51, telegr.: worldwater the hague, telex: 33604

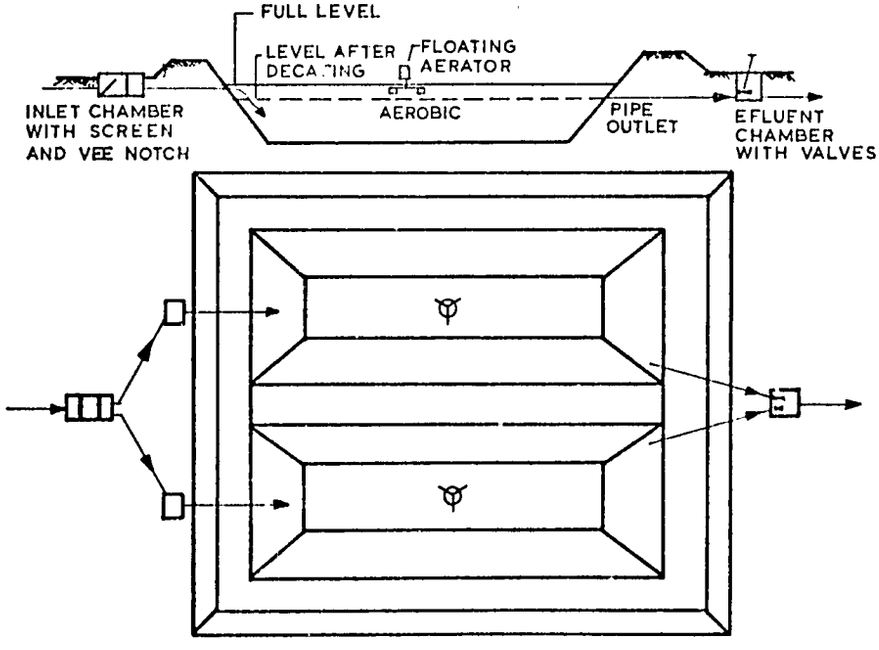
Title: Two-celled lagoon with intermittent operation for waste treatment

Country: Turkey

Characteristics:

Principle/Description:

Since solids are retained in the system, the lagoons quickly succeed in building up a concentration similar to extended aeration systems, thus requiring much smaller detention times (about 0.7 to 1.5 days) compared to facultative aerated lagoons of 3 to 10 days. Separate settling and recirculation of solids is not required. Excess solids are withdrawn separately for dewatering. Where discharge is to a water course, the system can be designed and operated to maximise BOD and nitrogen removal. When discharge is to land for irrigational use, the lagoons can be designed as facultative aerated lagoons, with minimum power consumption, but longer detention time and the quantity of treated wastewater withdrawn from each cell, and its timing, can be so kept as to match the daily irrigation routines.



Extended aeration type lagoon in two cells for intermittent operation and decantation

Reference: "Simple Waste Treatment Methods" - Arceivala, Prof. S.J. Middle East Technical University, Ankara, Turkey (1973)

Remarks:

who international reference centre for community water supply

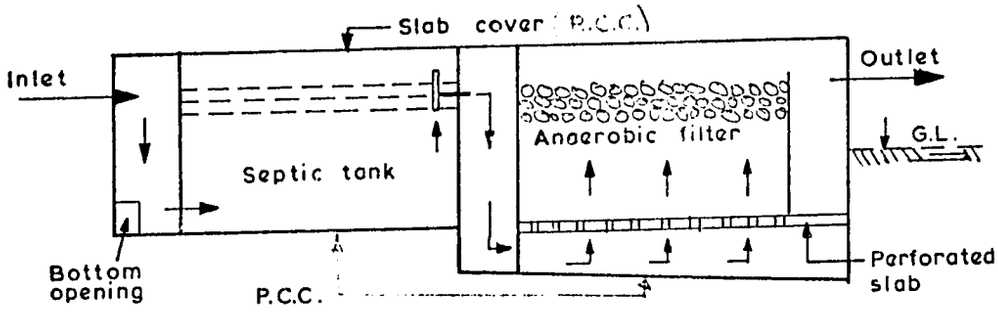
postal address: p.o. box 140, leidschendam, the netherlands
office address: nw haverstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33604

Title: Anaerobic filter for septic tank effluent

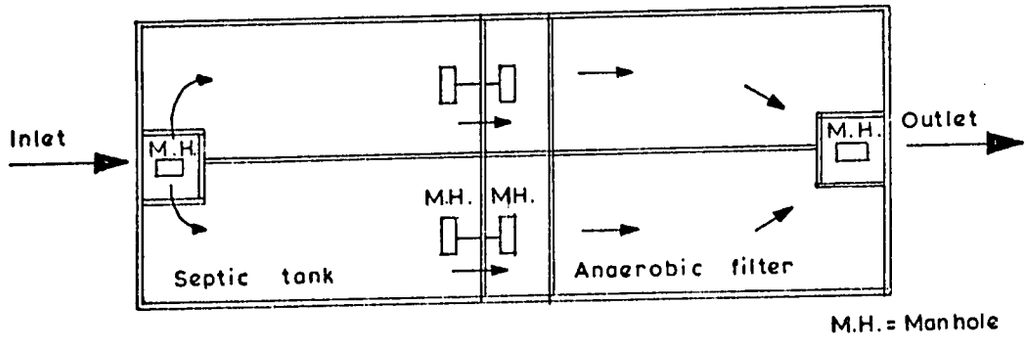
Country: India (Bombay)

Characteristics: for unsewered suburbs

Principle/Description: After treatment of septic tank effluent in an anaerobic flooded filter for housing colonies of 300 - 600 persons in unsewered areas. Good removal of COD, BOD and suspended solids reported.



LONGITUDINAL SECTION



PLAN

Reference: Mahabal, Prof. B.L. , Victoria Jubilee Technical Institute, Bombay, India

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw hovenstraat 6, voorburg (the hague)
telephone: 070 - 89 42 51, telegr.: wordwater the hague, telex: 33604

Title: Soak pit without fill

Country: India

Characteristics: Larger capacity of soak pit

Principle/Description:

Better and prolonged service particularly in places where the soil is tight. More head is available for seepage of effluent as ponding over stones is avoided and larger capacity of soak pit is available for storage of waste water. Pits without fill were found to have longer life and proved considerably cheaper to construct then filled pits.

Reference: Singh, Prof. R.C., Indian Institute of Technology, New Delhi - 110029, India

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: n.w. havenstraat 6, voorburg (the hague)
telephone: 070 - 09 42 51, telegr : worldwater the hague, telex: 33004

Title: Loosely lined septic tank

Country: India

Characteristics: Low cost

Principle/Description: Unlined or loosely lined septic tank serves both as a septic tank andas a soakage pit effectively. If overflow occurs, it can be passed into a soak pit of lesser capacity.

Advantages:-Considerably increase of detention time for organic matter, thus ensuring its more thorough decomposition. In some cases, organic matter may become almost as dry and inoffensive as earth.

-Absence of impervious lining reduces cost.

-The separate soak pit where needed, can be comparatively small and is less likely to be blocked even in tightsoils due to absence of coarse suspended solids.

-Cleaning of septic tank is generally not required for very long periods (up to 10 years)

-The land area required is minimal

Reference: Singh, Prof. R.C., Indian Institute of Technology, New Delhi-110029, India

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33604

Title: The Prai Latrine

Country: India

Characteristics: Local materials

Principle/Description: The PRAI latrine is a hand-water flushed, water-seal latrine with excreta disposal to a cess-pit or bored hole. The outhouse superstructure is similar to that of the pit privy, although the squat plate is set directly onto the ground into which the toilet pan is inserted. The pan leads to a water trap and effluent line. Defecation takes place into the pan which may be hand flushed by pouring water from a cannister into the excreta undergoing anaerobic digestion. The digested sludge after one year's residence in the pit can be used as a fertilizer. During the one year digestion period a second pit is dug and utilized. The major advantage which the PRAI latrine has over the pit privy is that it employs a water seal whereby all fly breeding in the pit and odours emanating from it are obviated.

Reference: Ministry of Health, New Delhi, India

Remarks:

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 09 42 51, telegr.: worldwater the hague, telex: 33604

Title: Field latrines

Country: Niger

Characteristics: Local material

Principle/Description:

Information leaflet for construction of pit latrines. Wooden stems are used to reinforce the walls. Used as a guide for practical work in rural schools so that the idea may catch on among the rural population.

Reference: Kane, A., WHO, B.P. 739, Niamey, Niger, "Fiche technique sur la latrine élaborée à l'intention de l'INDRAP pour les écoles de brousse".

Remarks:

WHO INTERNATIONAL REFERENCE CENTRE FOR COMMUNITY WATER SUPPLY

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33604

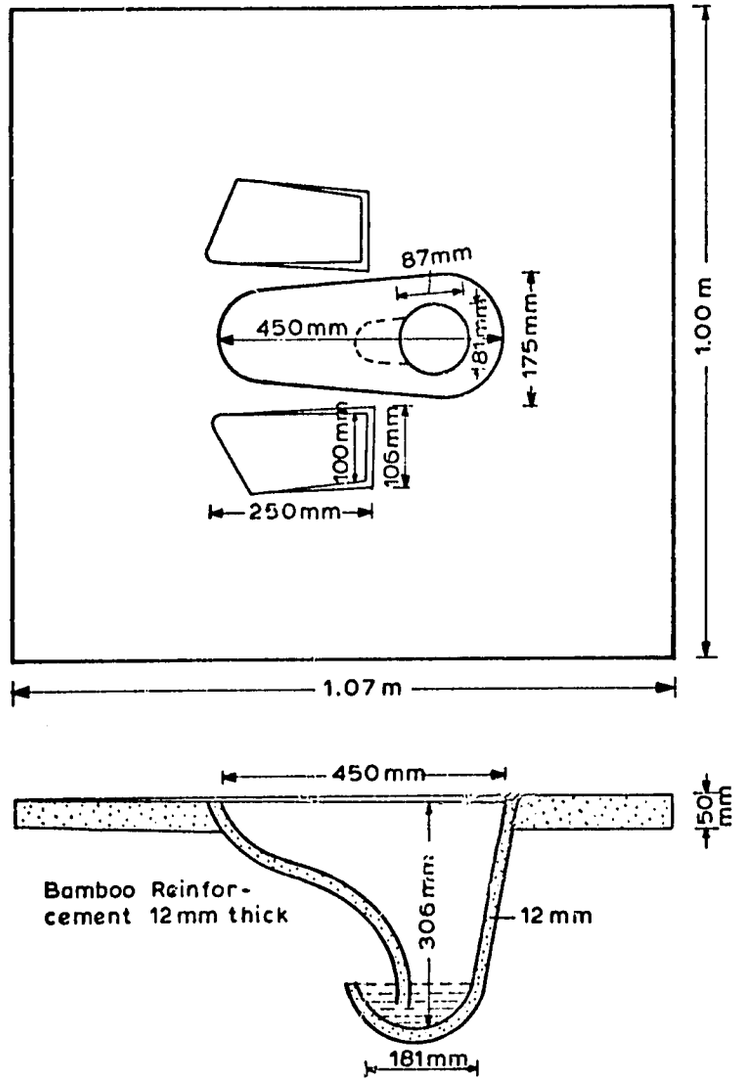
Title: Sanitary Latrine

Country: Bangladesh/India

Characteristics: Local construction

Principle/Description:

Provision of a simple water seal pan cast in situ on a slab kept over a pit suitable lined with rings of concrete or burnt clay. With the slab set at 18" above ground level and wells made of any indigeneous material it provides a safe and sanitary all weather latrine for a house of 6 to 8 to last 5 years. Can be easily flushed with one gallon water a time. Cost of slab July 1975: $8.-.



Reference:- Nayar, V.P.N., G.P.O. Box 250, Dacca, Bangladesh
- Chief Engineer PHED, Trivandrum, Kerala, India

Remarks:

WHO International Reference Centre for Community Water Supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33634

Title: Plates for latrines

Country: Ile Reunion

Characteristics: local material

Principle/Description:

Use of pulverized bagasse (cellulosic waste products of cane sugar factories), which is coated with a synthetic resin (glass fibre reinforced polyester) and pressed. Size of plates 116 x 115 x 3,5 cm. with a weight of 20-25 kg.
Local production in Reunion.

Reference: Maretto, Dr.Ing. D., WHO, B.P. 362, Tanarive, Madagascar.

Remarks:

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 60 42 51, telegr.: worldwater the hague, telex: 33604

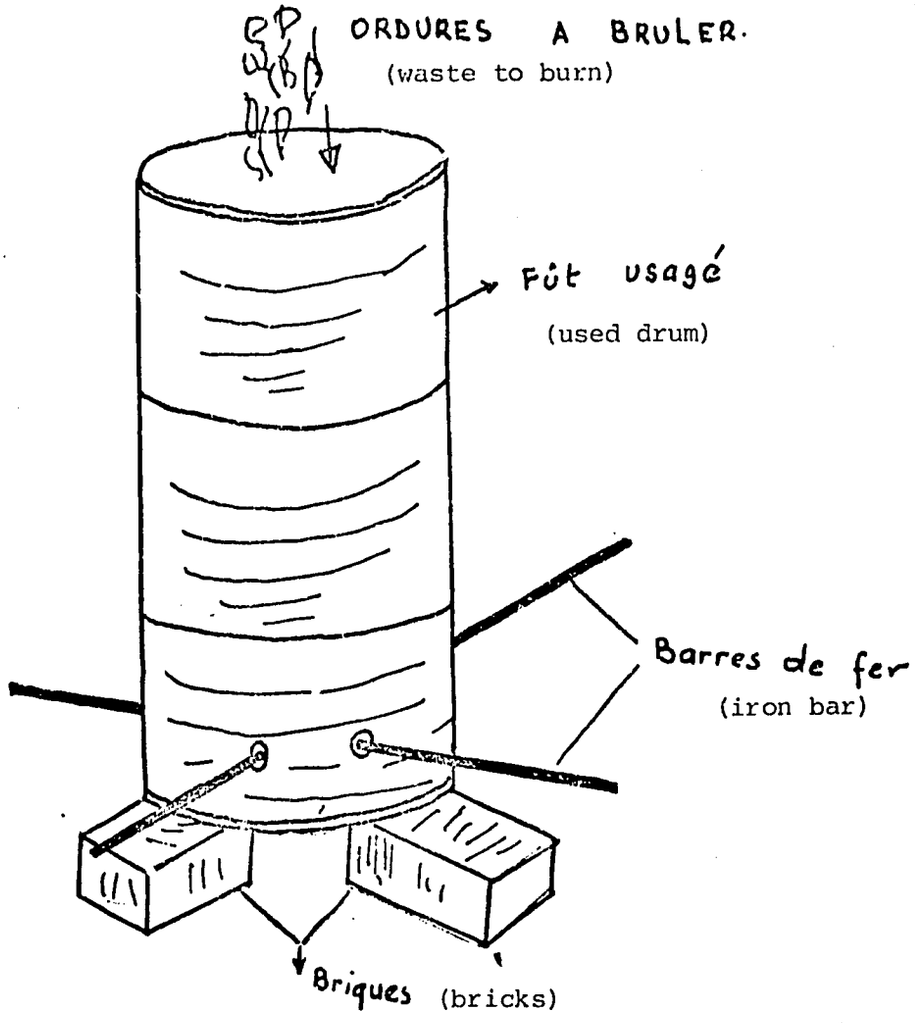
Title: Incinerator

Country: Guinea

Characteristics:

Principle/Description:

Only combrustible waste should be applied.



Four incinérateur fabriqué à partir d'un fût usagé

INCINERATOR

Reference: Dabo, M.T., Ministry of Public Health, Conakry, Guinea

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

Title: Incineration pit for domestic waste

Country: Senegal

Characteristics: for villages

Principle/Description:

Consisting of two open compartments for combustible and non-combustible waste (bottles, etc.). The incineration pit is provided with a grid and ash-pit.

Material: brick structure.

Reference: Kane, A., WHO, B.P. 739, Niamey, Niger, "Projet de lutte contre les ordures" (Khombole, Senegal)

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw hoevenstraat 6, voorburg (the hague)
telephone: 070 - 89 42 51, telegr.: worldwater the hague, telex: 33604

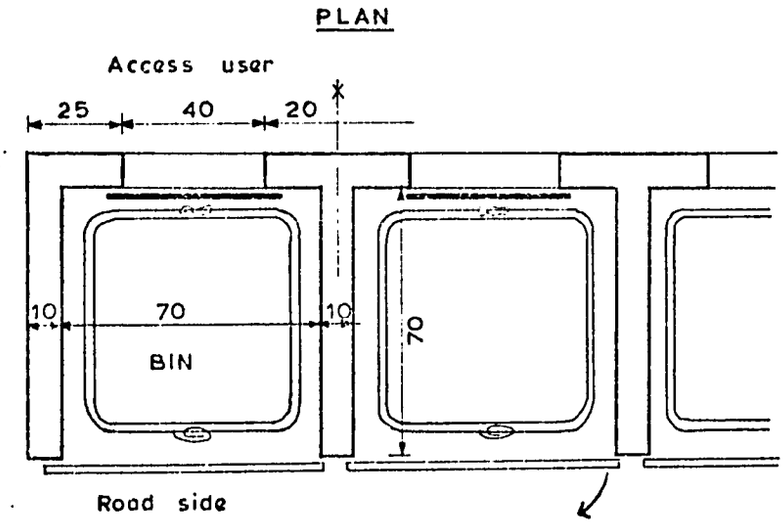
Title: Waste bin

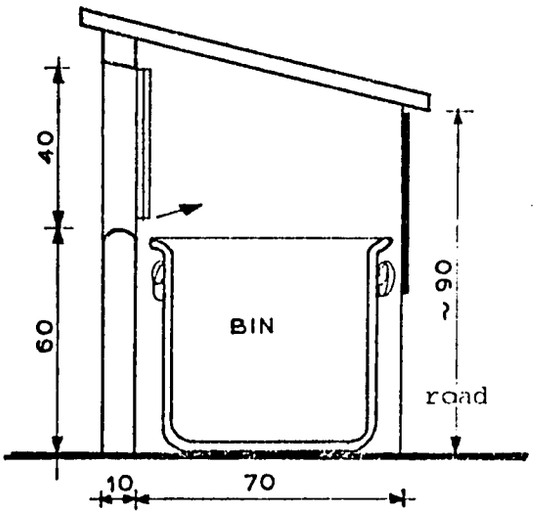
Country: Madagascar

Characteristics:

Principle/Description:

Plastic bins for waste disposal 150 l each in concrete housing.





Reference: Maretto, Dr.Ing.D. , WHO, B.P. 362, Tanarive, Madagascar.

Remarks:

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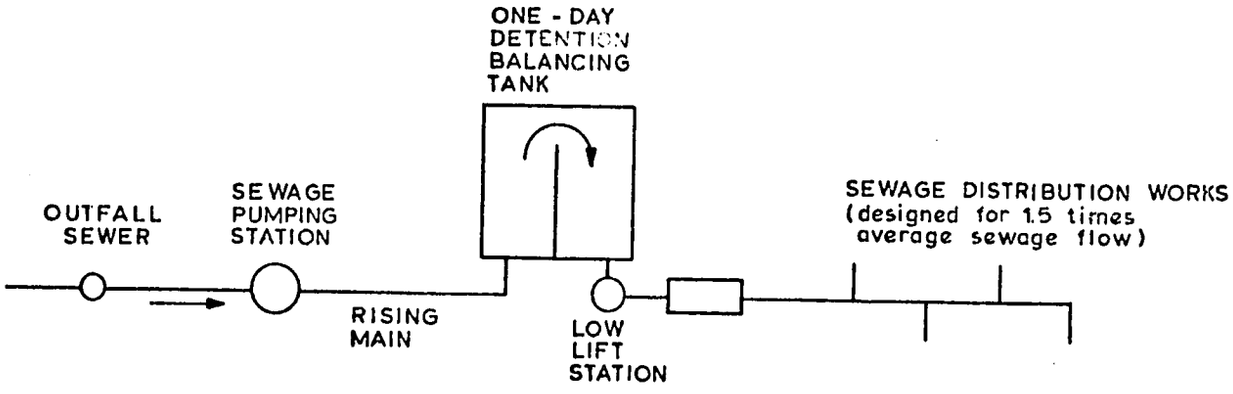
office address: nw hoevenstraat 6, voorburg (the hague)
telephone: 070 - 09 42 51, telegr.: worldwater the hague, telex: 33604

Title: Sewage farm design

Country: India

Characteristics: Use balancing tank before disposal on land

Principle/Description: Introduction of a pond with capacity equal to a day's discharge in order to have a constant flow of sewage to the farmers lands



Reference: Tyagi, P.C. - Civic Affairs, August 1974

Remarks:

who international reference centre for community water supply

postal address: p o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 03 42 51, telegr.: worldwater the hague, telex: 33604

Title: Gobar gas plant

Country: India

Characteristics:

Principle/Description:

Material: Sealed concrete or masonry, upturned mild steel or fibreglass cup or drum (the gasholder), polythene pipes.

Decription: Marsh gas or methane generated by anaerobic decompostion of domestic or farm wastes may be directly utilized as a fuel for nome lighting, cooking and power generation. Fermentation of wastes in anaerobic digesters not only recovers carbon as a readily useable form of energy it also provides for reclamation of wasted nutrients (N and P) in a digested sludge product which can be readily applied to the field as fertilizer. Human excreta, animal manure, weeds, household garbage and all other organic wastes from the farm can be used in the digester located on the farm operated by the householder. These wastes are dumped into the digester and allowed to ferment in a water medium to produce a carbon dioxide (45%), methane (55%) gas mixture which is collected in a gas holder comprising an inverted cupshaped dome resting on the liquid surface, rising and falling as gas is produced or withdrawn for use in the home.

Reference: S.R. Khanna, "Gobar Gas plant" , Science Reporter, 1975, 12(4)186-87, 189

Remarks:

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw hovenstraat 6, voorburg (the hague)
telephone: 070 - 09 42 51, telegr. worldwater the hague, telex: 33604

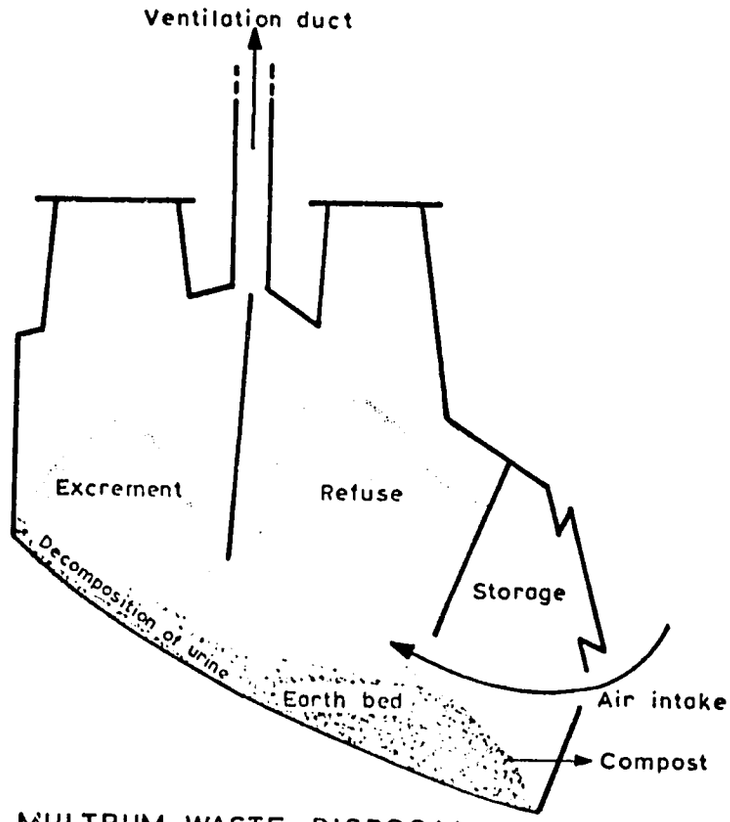
Title: Multrum composting vault

Country: Sweden

Characteristics: simpel operation

Principle/Description:

The multrum composting vault accepts both compostable household refuse and excreta and act as a container for their biological digestion, a process of both aerobic and anaerobic composting, The vault has separate ports for the introduction of household refuse and excreta. Air is introduced to the unit by inlets provided and vented by vertical riser. The excreta and refuse mix in piles on a layer of peat, soil, grass and/or leaves. After decomposition and an appropriate time for pathogenic organism die-off has elapsed the waste materials is removed from the unit and can be applied to the land as a composted humus/fertilizer.



MULTRUM WASTE DISPOSAL

Reference: McGarry, Dr. M.G., Programme Officer, IDRC, P.O. Box 8500, Ottawa, Canada K1G 3H9

Remarks: US$ 678-875 (1973)

P A R T II

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 09 42 51, telegr.: worldwater the hague, telex: 33604

100 WATER SUPPLY GENERAL

1. Title: Regional water supply programme
   Country: Sahel
   Subject: Indicates the problems i.e. more efficient well-digging, better lining, water intake structures. Maintenance of pumps is very important.
   Reference: Baehler J., UNDP, P.O. Box 575, Ouagadougou

2. Title: Tehran water supply
   Country: Iran
   Subject: Describing the water supply and treatment of river water for the city of Tehran.
   Reference: Alavi, A.A., Tehran Water Board, Iran; reported by Dr. Nejand, Institute of Hydrosciences, Tehran and Shahgholi, A.A., Tehran Regional Water Co.

3. Title: Water supply practice
   Country: Panama
   Subject: Informing current study of the University of Panama or design criteria (see 4)
   Reference: Pan American Health Organization, Washington D.C.

4. Title: Water consumption in rural areas,
   Country: Panama
   Subject: Study of water consumption in rural communities
   Reference: reported by H. Weitzenfeld, PAHO, El Salvador

5. Title: Criteria for selection of projects
   Country: El Salvador
   Subject: Development of criteria for selecting projects for execution. They are: per capita cost, water resource available, number of people who will profit from the scheme, degree of community participation.
   Reference: Weitzenfeld, H. PAHO, El Salvador
   El Salvador: Programa de Introducción de Agua Potable en Areas Rurales.

6. Title: Water supply system
   Country: Iran
   Subject: Tabriz water supply system: consisting of deep wells, sedimentation, pressure relief, disinfection, storage, distribution.
   Reference: Vadoud - Efteknar - Sadat, Tabriz Water Supply, Tabriz, Iran

7. Title: Drinking water quality
   Country: Latin America
   Subject: Programme document of conference on Drinking Water Quality, Sao Paulo, Brazil, October 1975, to identify problems and develop strategy, policy, organizational structure and procedures.
   Reference: Developing a plan of action to improve drinking water quality in the Americas. Pan American Sanitary Bureau, May 1975. reported by D. Donaldson

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200 WATER SOURCES AND RECOVERY

1. Title: Rain water tanks
   Country: Australia/Malaysia
   Subject: Low cost storage tanks for field assembly. Size: 100 to 100.000 gallon. Materials used: a. galvanized iron; a set of hand (or motor) powered rollers is used to curve flat G.I. sheets to desired radius.
   b. fibreglas sheets. Cold glue field fabrication, complete tank can be carried (on head) over jungle trails for field assembly.
   Reference: Stafford, R.E., P.O. Box 2550, Kuala Lumpur, Malaysia

2. Title: Sanitary Well
   Country: Guinea
   Subject: Open wells can be provided with a lid or concrete cover. In the latter case a handpump should be provided.
   Reference: Dabo, M.T., Ministry of Public Health, Conakry, Guinea

3. Title: Bamboo tube well
   Country: Japan
   Subject: Use of bamboo as well casing using hemp for the joints
   Reference: Isaburo Moriya, 11-13, 2-chome, Chuo Kakegawa City, Japan

4. Title: Rural water supply
   Country: Sri Lanka
   Subject: Providing a rural settlement close to a river with drinking water. Well screens were driven to about 5 meter depth and pitcher type pumps used for abstraction. The water needed no treatment.
   Reference: Kulasingham D.S., P.O. Box 1434, Colombo 7, Sri Lanka

5. Title: Dug well in river bed

Country: Sri Lanka

Subject: Construction of shallow well using 1.20 m. diameter precast reinforced concrete rings. Excavation till 3 meter depth. The bottom is covered with rubble and riversand. Capacity up to 400 cu m/day.

Reference: Kulasingham D.S., P.O. Box 1434, Colombo 7, Sri Lanka

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300 WATER TREATMENT

1. Title: Treatment of urban land run-off
   Country: Iran (Tehran)
   Subject: Utilization of urban land run-off by coagulation, sedimentation and adsorption; removal of 97, 85 and 100% of turbidity, COD and lead, respectively is reported. The possibility of re-using the treated water is under investigation.
   Reference: Samar, P., School of Public Health and Institute of Public Health Research, Tehran, Iran

2. Title: Ad hoc partial treatment
   Country: India (Madras)
   Subject: Several systems of simple treatment reported:
   river bed filtration + chlorination; infiltration gallery in river bed + chlorination; coarse stone filters in river bed + chlorination sedimentation, slow sand filtration + chlorination.
   Reference: Konchady, D., WHO, P.O. Box 235, Yenisehir, Ankara, Turkey

3. Title: Drinking water treatment practice
   Country: India
   Subject: Simplified treatment practice in India
   Mixing of chemicals in hydraulic pumps or with criss cross baffles; Gravity feeding of chemicals from a constant head tank and measured in a V notch; Flocculation/clarification in clariflocculators or hopper bottom tanks. First solids contact units for treating pre-settled water in Bombay recently installed; Filtration in rapid sand filter (rate 100 GPM and higher) with rate of flow controllers. Trend is to eliminate expensive controllers and introduce declining rate filters.
   Reference: Chhabria, Eng. N.D., 30, Sadhna, 4th floor, Nowroji Aamadra Rd., Bombay - 400026, India

4. Title: Laboratory solution feeder
Country: Argentina
Subject: Solution feeder, which adjusts itself by air sucking
Reference: Centro de Ingenieria Sanitaria, Avda. Pellegrino 250, Rosario (SFE), Argentina

5. Title: Water treatment practice
Country: India
Subject: Simplifications practiced in various treatment plants in Madhya Pradesh are as follows:
elimination of filter rate controllers; elimination of rapid sand gravity filters and mechanical equipment for desludging settling tanks (the water is flocculated, settled and chlorinated); use of hydraulic flocculators (tangential); rectangular settling tanks with round the end baffles, retention 2-6 hours handling 300-3000 ppm turbidity waters; elimination of roof over filters. Finally lab. experiments are being carried out to replace filter sand with crushed stone as filter media.
Reference: Jagannatha Rao, D.K., Chief Engineer, Madhya Pradesh, Public Health Engineering Department, Bhopal, India

6. Title: Modified sludge blanket clarifier
Country: India
Subject: It is proposed to stabilize the sludge blanket in an upward flow clarifier and prevent floc carry over with a 20 cm sand layer.
Referenc: Dhabudgaonkar, S.M. & Bhole, Dr. A.G. "Modified Sludge Blanket Clarifier", Journal of the I.W.W.A. Vol. VI, Nr. 3, July-Sept. 1974

7. Title: Laboratory solution feeder
Country: Argentina
Subject: Inverted bottle solution feeder, which adjusts itself by air sucking
Reference: Centro de Ingenieria Sanitaria, Avda. Pellegrino 250, Rosario (SFE), Argentina

8. Title: Native methods of water purification
Country: Sudan
Subject: Turbid Nile river water in the flood season is purified by coagulation with: rauwag (caly soil containing 90% bentonite); Crushed indigeneous plant material.
Reference: Samia al Azharia Jahn, Dr., Medical Research Council, P.O. Box 1304, Khartoum, Sudan

9. Title: Slow sand filters with intermittent operation
Country: Burundi, (Bujumbara)
Subject: In operating the city water supply of Bujumbara (capacity 15.000 cum./day The water level in the filters is periodically lowered by draining. This is beneficial for oxygenation the bed and giving a good purification effect. Filtration free from algae trouble is reported with rates up to 50 cm/hr. Extensive use of local material (sand from Tanganyka lake) Construction cost of the filter is less than US$ 0.01/cu m of water produced per year.
Reference: Drexler, IGIP, 61 Darmstadt, Martin-Buberstrasse 50, Federal Republic of Germany

10. Title: Slow sand filters
Country: U.S.A.
Subject: Data on Springfield, Mass. slow sand filtration plant, capacity 3 mgd.
Reference: Reid, Prof. G.W., University of Oklahoma, Norman Oklahoma, U.S.A., Journal of New England Water Works Associations 46 (1932), 345.

11. Title: Siphons in slow sand filter
Country: Federal Republic of Germany
Subject: A laboratory filter is described in which the filterbed can be periodically drained by means of a siphon. Air is then sucked into the sandbed. This is beneficial for water quality and it inhibits algae growth.
Reference: Schmidt, Dr. Kh., Dortmunder Stadwerke A.G., 5841, Geisecke/Ruhr, Federal Republic of Germany

12. Title: Earthenware household filter

Country: Mexico

Subject: Filter consisting of stacked earthenware pots, each containing a layer of sand supported by a piece of cloth.

Reference: Rodriquez, L.A., Rafael Rebollar 19, Mexico 18, D.F.

13. Title: Filter unit

Country: U.S.A./Bolivia

Subject: The unit consists of 2 stacked containers. The upper container has a perforated bottom covered with a layer of sand use filtered water. It is gradually filled with water and iodine solution added with a dropper. (15 drops 4% iodine solution per liter)

Reference: Reid, Prof. G., University of Oklahoma, Norman Oklahoma, U.S.A.

14. Title: Berry seed shell as filter media

Country: India

Subject: Berry seed shell is used as a medium in a dual media filter to replace anthracite, which is expensive and difficult to obtain in India. Berry seeds are soaked in water and thoroughly cleaned with water and alkali. The soft pulp is removed by rubbing. After that they were crushed to very small pieces. Then the seeds are separated from the shells. Specific gravity: 1,4; solubility: 24 hours soaked in 10% HCL: weight loss 2%; durability: loss 5%; hardness: 3-4 on Moh's scale; average Ψ : above 0,7. No data on filter experiments

Reference: Bhole, A.G., Visvesvaraya Regional College of Engineering, Nagpur (440-911), India, Journal of the Institution of Engineers (India), Vol. 54 PH No. 2 Febr., 1974

15. Title: Filter in reservoir corner

Country: Yemen, Arab Republic

Subject: A dam is built to store stormwater, which is filtered through a sand bed in a corner of the reservoir. The filtrate gives an additional supply to the yield of a nearby spring.

Reference: Zaghloul, Dr. H.F., WHO Sanitary Engineer, 1211-Geneva 27, Switzerland

16. Title: Rising head filter

Country: India

Subject: When clogging proceeds, the head-loss increases and water accumulates on the bed. This increases the head over filter, keeping the flow constant. No flow controller is required. When the water level in the filterbox reaches a certain level, the filter is put out of operation and washed.

Reference: Sen, Prof. R.N., Indian Institute of Technology, Kharagpur-2, (W.B.) India

17. Title: Arsenic Removal

Country: Taiwan

Subject: Treatment by conventional coagulation, sedimentation and filtration. With $FeCl_3$ the arsenic content (0.6 - 1.0 mg/l As) of the natural well water is removed. $FeCl_3$ not only acts as a coagulant but it also combines with the arsenic chemically.

Reference: Journal of the American Water Works Association, August 1973, pp. 543 - 548, reported by Lo, M.C., Taiwan

18. Title: Reverse osmosis

Country: Iran (Zahedan)

Subject: Well water with 2000 - 2500 mg/l total dissolved solids is treated by reverse osmosis with a capacity of 5500 m^3 drinking water for a city of 50.000 inhabitants a day.

Reference: South East Regional Water Board, Iran, reported by Dr. Nejand, Institute of Hydrosciences, Tehran, Iran

19. Title: Iron removal of tube well water

Country: Assan, India

Subject: Application in Dispur and other rural areas. No details available

Rererence: Reported Adviser Central Public Health and Environmental Engineering Organization, New Delhi, India

20. Title: Well disinfection with silver nitrate
Country: Czechoslovakia
Subject: Disinfection with a mixture of NaCl containing 1% of silver as silvernitrate dose: 10 ppm. For water with low organic matter content (permanganate value less than 3mg/l O_2)
Reference: Symon, Prof. K., 10042 Praha 10, Srobarova 48, Czechoslovakia

21. Title: In Situ production of chlorine
Country: Madagascar
Subject: Principle: based on 20 years experience of chlorine production for its waterworks (cap. 60.000 m^3/day) the following extension of the electrolysis plant for production of chlorine gas is planned: production: 800 kg gas per month; investment: $100,000.-; raw material: 4 ton salt per month; electric consumption: 7000 Kwh per month. Advantages: the gas is not compressed (no accidents). product cost: half of imported hypochlorite.
Reference: Maretto, M.D., WHO/UNDP, P.O. Box 362, Tananarive, Madagascar.

22. Title: Emergency chlorination of open wells
Country:
Subject: Plastic bag filled with hypochlorite and sand in an earthenware pot (both having 2 holes of 8mm each); H.T.H. gives a regular diffusion.
Reference: Konchady, D., WHO, P.K. 235, Yenisehir, Ankara, Turkey

23. Title: Hypochlorinator
Country: Yemen Arab Republic
Subject: Chlorine solution addition from a tank is manually adjusted to give an average dose 0.5 - 1 ppm. Cost apprx. (1975) US$ 12.00
Reference: Amara, H.A., Community Water Supply and Environmental Health Project Yemen 3201, P.O. Box 543, Sanaa, Yemen Arab Republic

24. Title: Direct chlorination in rural areas

Country: Senegal

Subject: Disinfection of wells by direct application of hypochlorite solution shows tat recontamination takes place after 1-7 days. A better method is needed. For protection at household level, health education is needed.

Reference: Kane, A., Médicine d'Afrique Noir, 1971, B.P. 739, Niamey, Niger

25. Title: Disinfection in the tropics

Country: Venezuela

Subject: Discussion of several physical-chemical and biological methods for micro-organisms/parasites

Reference: Rivas Mijares, G., La Desinfección del Agua en Areas Tropicales, Caracas. Italgrafica SRL/1970.

26. Title: Emergency water supply system

Country: Kenya

Subject: Complete emergency unit composed of a reservoir, portable pump, plastic hose, one reel of barbed wire, 310 kg bleaching powder, tins, a rubber syphon with tap, 12 gallons fuel, tent and field beds. River water is pumped into the 600 gallons plastic reservoir disinfected and distributed.

Reference: Diamant, B.Z., WHO Paper: "Portable unit for the supply of drinking water in emergencies", WHO/CWS/72.3

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400 WATER TRANSPORT AND USE

1. Title: Bamboo pipes for distribution
   Country: Japan
   Subject: Wooden joints (couplings, tees) can be used for a bamboo pipe distribution system.
   Reference: Nobuo Yamazaki, Chugokusuiko Co. 1464-5, Kiwanami, Ube City, Japan and Iwao Moritaka, Nishinomiya Water Supply Bureau, 10-15 Rokutamji-cho Nishinomiya City, Japan

2. Title: Household storage
   Country: Nigeria
   Subject: A rubber outlet tube of a household reservoir can be closed by weight of a lever to replace a standard tap.
   Reference: Oluwande, P.A., University of Ibadan, Ibadan, Nigeria

3. Title: Floating lift pump
   Country: Laos (Vientiane)
   Subject: A pump is attached between two oil drums, and floats on the river. The pump is driven by two waterwheels using the river flow as a motive force. Design for local construction. No data on flowrate, lift, capacities.
   Reference: Jolly, P.W., WHO, P.K. 235, Yenisehir, Ankara, Turkey

4. Title: Handpump
Country:
Subject: Describes studies to develop a durable handpump and evaluation in the field
Reference: Battelle Columbus Laboratories, 505 King Avenue, Columbus, Ohio 43201, U.S.A., Reported by A.D. Swisher.

5. Title: Hydraulic ram
Country: Lebanon
Subject: A hydraulic ram to supply pressure water (20 lbs/sq.in), needed for solution feed of chlorine gas is successfully operated by the Director of Health Department UNDWA Beirut (1967)
Reference: Konchady, D., WHO, P.K. 235, Yenisehir, Ankara, Turkey

6. Title: Hydraulic ram
Country: Malaysia
Subject: Installation of hydraulic ram for village drinking water supply
Reference: Stafford, R.E., P.O. Box 2550, Kuala Lumpur/Malaysia

7. Title: Manufacture of Venturi tubes
Country: Guatemala
Subject: Material: local fabrication is described of 2-6" Venturi tubes, epoxy resin and fibre glass which are applied to a core of sand and cement and dried.
Reference: Samayoa, Prof. J.O., Escuala Regional de Ingeniería Sanitaria Ciudad Universitaria, Zone 12, Guatemala

8. Title: Pressure reduction device
Country: Uruguay
Subject: In a couple of parallel pipes perforated plates are inserted with which the flow can be regulated
Reference: Von Cappeln, J.E., Aparatado reductor de presión XIVth AIDIS Congress, Mexico 1974

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500 SOLAR AND WIND ENERGY

1. Title: Solar water heater
   Country: Madagascar
   Subject: Water is heated in a solar plate collector (cap. 200 l/2.sq.m.), passes a heat exchanger, and the cooled water flows back closing the circuit. Household water is heated in the heat exchanger. Water for a swimming pool can be heated in the same way.
   Reference: Maretto, Dr.Ing. D., WHO, B.P. 362, Tananarive, Madagascar.

2. Title: Solar pump
   Country: Madagascar
   Subject: For the arid zones of Madagascar the feasability of pumping water rising solar engines which have been developed in Senegal is being studied. The solar motor will transform caloric energy into mechanical energy by a low temperature thermic cycle.
   Reference: Masson,c.s., Rapport sur l'utilisation de l'énergie solaire pour le pompage de l'eau en zones arides, University of Dakar, Senegal. Reported by Maretto, Dr.Ing.D., Tananarive, Madagascar.

3. Title: Windmill
   Country:
   Subject: Lifting water by a windmill pump in Geza: supply 30 m^3 for 400 people at wind speeds of 6-30 km/hr. is reported
   Reference: Konchady, D., WHO, P.K. 235, Yenisehir, Ankara, Turkey

4. Title: Water pumping windmill

Country: India

Subject: Design and construction of a 10 meter diameter water pumping windmill incorporating the traditional Greek cloth-sail configuration built recently in India. Stone, cement, teak, steel, bamboo and cloth are the materials used. The windmill pumps 1,636 liters per hour from a 9.1 meter deep well at minimum operating wind speed of 6-8 km per hour. No construction details avaiable.

Reference: Sherman, M.M., An intermim report: "Design and construction of an appropriate water pumping windmill for Indian agriculture". Madurai Windmill Committee, 69 P.T. Rajan Rd., Madurai, Tamilnadu 625002 India.
remark: cost (1975 approx. US$ 400.00)

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800 WASTE COLLECTION AND DISPOSAL

1. Title: Septic tank effluent
   Country: Sri Lanka
   Subject: Proposal for investigation to lower cost: chlorination of waste to communal septic tanks, which should be desludged every 2-3 years; discharge to river after dark; evaporate on shallow basins.
   Reference: Kulasingham D.S., P.O. Box 1434, Colombo 7, Sri Lanka

2. Title: Monthly record of chlorine residual
   Country: Kenya
   Subject: Design of a sheet for recording residual chlorine, time and date, p.p.m., place, bacteriological analysis, etc.
   Reference: Chatiketu, S., WHO Sanitarian, WHO, P.O. Box 2021, Kano, Nigeria

3. Title: Syphon for waste water
   Country: Madagascar
   Subject: Proposal for installing only one syphon in the waste line of household equipments instead of one syphon for each equipment.
   Reference: Maretto, Dr.Ing. D., WHO. B.P. 362, Tananarive, Madagascar.

4. Title: Heavy metals and nitrogen in ground water
   Country:
   Subject: A study has been made to find out whether the present practice of sewage disposal in discharge wells affect the quality of Tehran ground water. Analyses of heavy metals, NO_3 and NH_3 indicate chemical contamination by industrial and domestic wastes.
   Reference: Razeghi, N., c.s., Heavy metals and nitrogen in Tehran Ground Water, reported by Dr. S. Nejand, Institute of Hydrosciences, Tehran, Iran.

5. Title: Septic tank effluent
   Country: Sri Lanka
   Subject: Proposal for study to lower disposal cost: chlorination of effluent of communal septic tanks. These tanks can be desludged every 2-3 years; discharge to river during the night; evaporate in shallow basins.
   Reference: Kulasingham, D.S., P.O. Box 1434, Colombo 7, Sri Lanka

6. Title: Stabilization ponds
   Country:
   Subject: Proposal for research in pilot plants or actual small city installations for experimentation and study in order to determine the maximum loading that can be used in a local area. Promotion of the use of this non mechanical method of waste treatment.
   Reference: Spangler, C.D., 10212 Brookmoor Drive, Silver Spring, Maryland 20901, U.S.A.

7. Title: Waste water treatment in a packed tower
   Country: Guatemala
   Subject: In the treatment scheme: primary sedimentation, percolating tower, Imhoff tank, the tower is packed with volcanic stones allowing intimate air-water contact and growth of micro-organisms on the surface.
   Reference: Arturo Pazos, S. Investigacion de tratamiento de aguas negras por medio de "Filtro Percolador Torre", Escuela Regional de Ingenieria Sanitaria, Guatemala, reported by F. Couradin, PAHO, Guatemala.

8. Title: Treatment of textile water
   Country: Iran (Isfahan)
   Subject: Study on the use of oxidation ponds in treating textile waste water
   Reference: Samar P. Reported by Dr. S. Nejand, Institute of Hydrosciences, Tehran, Iran

9. Title: Water and sewage treatment

Country: Iran (Isfahan)

Subject: Existing water supply (from wells and planned treatment plants) and waste treatment (trickling filters and planned activated sludge process) are reported.

Reference: Esfahan, Regional Water and Sewage Board, reported by Dr. Nejand, Institute of Hydrosciences, Tehran, Iran

10. Title: Emergency sanitation unit

Country: Bangladesh

Subject: 20 glass fibre squatting plates are connected in series to two 21.000 litre flexible reinforced butyl rubber sedimentation tanks (8-10 day retention time under anaerobic conditions) These may be connected to an optional precolating filter made of locally available stone. Unit is assembled from contents of wooden crate measuring 2m x 2m x 1m and weighing $\pm$ 500 kg. and can be installed in a day to provide sanitation for 500 persons. Reduction of cholera vibrio counts by 1000 fold reported during an epidemy.

Reference: Howard, J., c.s., The design and testing of a new concept in sanitation and sewage treatment for disasters and long term use. Jan. 1975, OXFAM, Oxford, United Kingdom.

11. Title: Low cost aqua privy

Country: Lebanon

Subject: Low cost water-sealed family and communal privies developed by the U.N. Relief and Works Agency, Beirut

Reference: Konchady, D. WHO, P.K. 235, Yenisehir, Ankara, Turkey

12. Title: Sewerless toilet

Country: U.S.A.

Subject: Excreta and recycled waste are spread on a screen belt and dried with infrared (200 W). The filtered liquid is mixed with activated carbon filtered and recycled.

Reference: Reid, Prof. G.W., University of Oklahoma, Norman Oklahoma, U.S.A.

13. Title: Disposal of septic tanks effluent by wooden flumes

Country:

Subject: Flumes made of hard dense wood which is resistant to rotting, are laid in drainage ditches to transport septic tank effluent to a central treatment plant.

Reference: Molin, A.E., Sanitary Engineer, PAHO/WHO, P.O. Box 508, Bridgetown, Barbados

14. Title: Dual-flushing cistern for toilets

Country: Israel

Subject: Standard cistern flush down 9.5 liters each time they are operated. This modification enables to flush only 5 or even 4.5 liters after urination. The invention consists mainly of an additional liquid (water) quantity distributor in the form of a single and small box (for example 142 + 132 + 111 mm) which has a special construction with technical additions. This distributor can be added to and placed inside any type of cistern with a syphon, float valve or other type of mechanism. The dual flushing cistern can be operated by one handle with two positions or two separate handles of different size and/or color

Reference: Israel Centre of Waterworks Appliances (ICWA), c/o The Standards Institution of Israel, Tel Aviv 69977, Israel.

15. Title: Flap-trap toilet

Country:

Subject: A simple toilet, of either squatting or sitting variety, the flap-trap toilet employs a simple flap to ensure door closure as a seal which attempts mechanically to stop odours from the excreta storage chamber or pit reaching the WC and limit the ingress of insects and vermin. Good cleaning is required.

Reference: McGarry, Dr. M.G., Programme Officer, IDRC, P.O. Box 8500, Ottawa, Canada K1G 3H9

16. Title: Aerobic composting

Country: India

Subject: Composting pit with an arrangement for shredding and turning over for more uniform and rapid decomposition and utilizing bull power.

Reference: Bhole, A.G., Visvesvaraya Regional College of Engineering, Nagpur (440-911), India, New Suggestion for a cheap method of Aerobic composting Environmental Health, Vol 10, 113-119 (1968)

17. Title: Aquacultural re-use of wastes

Country:

Subject: In waste stabilization ponds sewage organics are converted to algae which contain 50% protein. As algae separation is complicated, protein can be recovered in an indirect way by growing fish such as carp and tilapia in secondary and tertiary aerobic ponds. The protein chain is waste - algae - fish - man

Reference: Mara, D.D., University of Dundee, Dunda, DD1 4HN, Scotland

18. Title: Reduce of pollution potential of distillery wastes

Country: India

Subject: Distillery wastes mainly contain sugar (2 to 2.8%) and are acidic in nature (pH 4-5). Yeast (candida Utilis) is cultivated in the waste, and can be utilized as cattle and chicken feed. BOD reduction was found to be 80%. This eflluent can be treated by any biological treatment process.

Reference: Bhatt, N.M., Indian Water Works Association, Baroda Centre, "Ranga", 4811 Arunoday Society, Alkapuri, Baroda Baroda 5, India

19. Title: Sewage effluent for crop growing

Country: Zambia

Subject: Disposal of sewage stabilization pond eflluent with residual 20mg/l BOD to water bumper crops during dry seasons. Washing edible crops in dilute solutions of $KMnO_4$ is suggested. Fodder crops can be grown alternately.

Reference: Uplap, P.L., P.O. Box 867, Lusaka, Zambia

20. Title: Sewage farming

Country: India (Madras)

Subject: Sewage farming has been practiced successfully in Madras to reduce health hazard; pretreatment in oxidation ponds is proposed.

Reference: Konchady, D., WHO, P.K. 235, Yenisehir, Ankara, Turkey.

To: WHO International Reference Centre
for Community Water Supply
P.O. Box 140
Leidschendam
Netherlands

1. I received the first compilation of an International Reference Centre mail survey on Practical Solutions in Drinking Water Supply and Wastes Disposal for Developing Countries.

2. I would appreciate receiving the next addendum. yes/no

3. I wish to - give the following comment
- make the following contribution
- give additional data/references

Name : _____

Address: _____

_____

_____

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ANNEX

to:

date
ur reference 7570/Tji
ur reference --
nclosure several
subject Practical Solutions in Drinking Water Supply and Wastes Disposal for Developing Countries.

Dear

As you know, engineers who are designing systems for drinking water supply and wastes treatment and disposal, are often making use of existing techniques and information from published literature. In other cases they rely on personal experience.

Of course, textbooks have been written on drinking water supply and waste disposal. However, they usually deal with the latest technology which may not be applicable or appropriate in the area where one is working. Limited resources, with respect to finance. material and spare parts on the one hand and problems as to lack of trained personnel and even sociological problems on the other hand, often prevail in developing countries.

Inventive men all over the world and in the lapse of time have improvised, invented and adapted devices in providing society with the drinking water and sanitary services it so requires. They have to do so, when funds are limited, specific material not available or simplified solutions are needed. Practising sanitary engineers may in their career have developed or met with some innovative device or process as mentioned. There should be a wealth of information on these techniques or practical solutions, since every engineer in seeking a more optimal performance is making adjustments or adaptations. In many cases they even do so for the simple reason in order to keep the supply or services running.

- Scattered -

Scattered as this information may be, if it is compiled to a reference of "Applications of processes using indigenous resources, self help techniques, etc.," and regularly updated and widely made available, it can become of great value. It will then be available to engineers, who each in their own locality and with limited resources are struggling, trying very hard to provide their fellowmen with the necessary sanitary services.
An so we have directed this letter to a selected number of practising Sanitary Engineers who are involved in the provision of drinking water supply and the disposal of waste.
By means of this questionnaire we intend to make a start with such a survey and information collection; it results from a cooperation between the International Reference Centre for Community Water Supply and the University of Oklahoma. Application of certain techniques may very well be widespread and generally accepted but never published. We feel that a collection of such data is very much needed. Therefore the University has started a thorough survey of the literature on innovative and adoptive technologies for water and sewage treatment as elaborated above.
The International Reference Centre for Community Water Supply is now requesting your collaboration in this effort. We should like to request you to make such information available to us so that we can make it widely known. This, we feel, may help the increased provision of drinking water and better sanitary services especially in developing countries. It goes without saying that your cooperation will be duly acknowledged in the book.
If every one who is working in this field would search his files or his territory and report at least one successful device, process or even untested idea to our Centre, a process of extremely valuable information exchange will be started. From this ultimately both information supplier and receiver will benefit.

Objectives.

This action is intended to collate data, designs and processes from the field, which are innovative with respect to more simple operation, easier control, use of readily available material, low cost and adaptation to local situations, conditions which apply to circumstances prevailing in developing countries.

What kind of information are we looking for ?

Some examples of information which we think are of great interest are:
- Bank filtration: Abstracting ground water near a river (Water resource)
- Lifting device for water such as Persian wheel, locally developed handpump etc. (Pumping)
- Simple constant dosing of alum (Chemical dosing)
- "Mixing" channel: Flocculation by means of hydraulic force (Flocculation)
- High rate settler: use of multiple plates or tubes (Sedimentation)
- Slow sand filters: use of local materials (Treatment)
- Local filtermedia: coconut husks, etc. (Filtration)
- Elimination of rate control in filtration (Process Control)

- Applying of hypochlorite in a perforated pot hung in the water (Disinfection)
- Bamboo pipes for watertransport: success, limitations (Distribution)
- Public standposts:sturdy construction, effective management (Distribution)
- Waste water collection, simple waste treatment.

Available data on construction, cost, operation and maintenance will be very useful also.

Why should you contribute?

- because you can draw other people's attention to some untried idea of yours;
- because you may find from the intended guide that for some problems you have been struggling with, a solution might have been found in another part of the world (you will surely get a copy of that guide);
- because you might like to contribute to this guide and help people to obtain their sanitary services in a more efficient and cheaper way at an accelerated pace by providing them with selfhelp techniques.

Please indicate your intention to contribute or give reference to prospective contributors by sending back form 1 by return mail. Contributions are anticipated not later than 15 August, 1975.

We sincerely hope that this project can have your attention and support.

Thanking you for your interest and response.

Sincerely yours,

Drs. J.M.G. van Damme
Manager.

FORM 1

Intent of Contribution

To: WHO International Reference Centre for Community Water Supply
Voorburg, The Netherlands.

I am/am not* preparing a note/idea for your data collection on Practical Solutions in Drinking Water Supply and Waste Treatment for Developing Countries.
It concerns the following topic: . . . . . .
It will be sent to you before: . . . . . .
(ultimate date 15 August, 1975)

I suggest you send your questionnaire also to:

Mr.:
Address:

Mr.:
Address:

Signed: . . . . . .
Address . . . . . .

Date . . . . . .

*) Circle appropriate answer

Please send this sheet to IRC by return of mail.

who international reference centre for community water supply

postal address: p.o. box 140, leidschendam, the netherlands
office address: nw havenstraat 6, voorburg (the hague)
telephone: 070 - 69 42 51, telegr.: worldwater the hague, telex: 33604

FORM 2

Re: Practical Solutions in Drinking Water Supply and Waste Disposal for Developing Countries

Name of Innovation/Practical Solution:

the device/process/method is tested ☐ untested ☐

Subject area: water supply ☐ water treatment ☐ distribution ☐
waste collection ☐ waste treatment ☐ other ☐

Location: Country: _____ City/Village _____

Characteristics of device/process/method:

System is an adaptation ☐ a simplification ☐ unique ☐
Significant use of local material: yes ☐ no ☐
Cost saving ☐ foreign currency saving ☐
Gives: quality improvement ☐ capacity increase ☐ better efficiency ☐
Operation: simple ☐ needs special skill ☐
Spare parts: local ☐ import ☐
Acceptance by community: good ☐ requires promotion ☐

Background information of the community in which the innovation is found

Community: urban ☐ rural ☐ number of people [_____]
Major means of living: agriculture ☐ trade ☐ industry ☐ other ☐
Drinking water: consumption_____l/cap/day; Price US$ 0, /cu.m.
Community water supply:
connection: house ☐ public standposts ☐ other ☐
source : surface water ☐ well ☐ other ☐
supply : gravity ☐ handpump ☐ electric pump ☐ other ☐
process : filtration ☐ chemical treatment ☐ disinfection ☐ other ☐
operation/maintenance: good ☐ adequate ☐ inadequate ☐
Major sewage disposal:
individual ☐ municipal ☐
treatment: yes ☐ no ☐

DESCRIPTION OF THE INNOVATION

Please indicate the principle of the device/process or method reported.
A sketch, diagram or picture will be helpful.
Please include operation and cost data (if available).

Reference: publication manufacturer,if any

Reported by:: Name :
Title :
Address:

EXAMPLE

Practical Solutions in Drinking Water Supply and Waste Disposal

Name of Innovation: Simple hypochlorinator for water disinfection

Country : Sudan

Material : Used plastic jerrycan

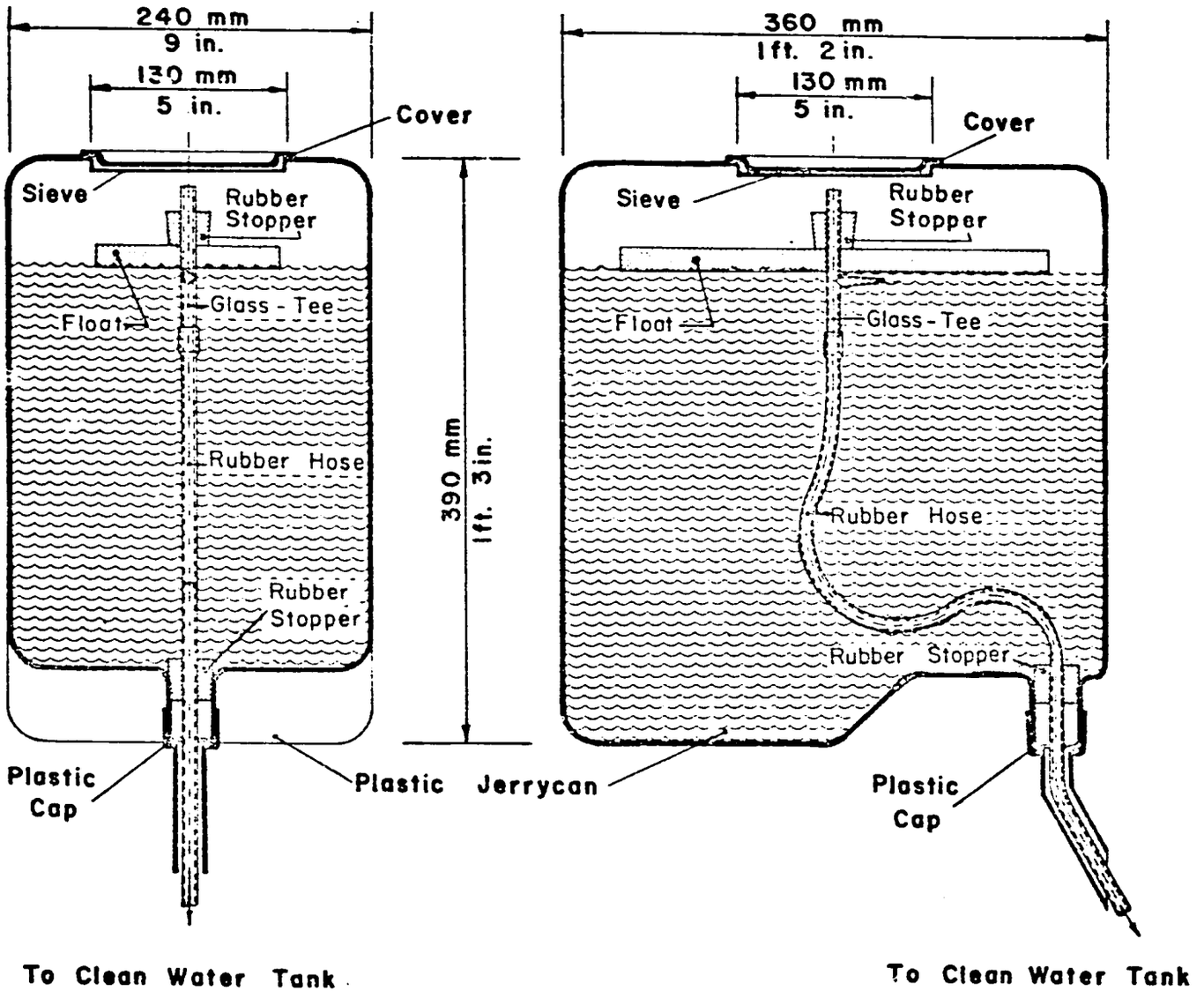
Characteristics : Self help, local construction

Principle : Constant dosing of a hypochlorite solution by arranging a constant head of liquid above the opening of the glass-tee (see sketch).
The dose can be changed by:
1. using another opening size of the tee
2. changing the concentration of the solution.

Operational difficulties:
1. the orifice should regularly be cleaned (clogging)
2. the liquid should "freely" fall through the orifice into the rubber hose (otherwise the constant head principle will not apply).

Cost : Total cost US$ 9.00

Reported by : H.E. Grombach, WHO Project Sudan 42, referred in IPSED Series, University of North Carolina.



PLASTIC JERRYCAN CHLORINATOR