PN-AAW-087
ISN= 47556

JAVAN BIOGAS PLANT

Mr. Daddy Dampha (Gambia)
Miss Maha Ali Elfaki (Sudan)
Miss Bulgis Suliman AlGadir (Sudan)
Mr. Dongrin Mangok (Sudan)

Seventh Session

Training in Alternative Energy Technologies

University of Florida, Gainesville, U.S.A.

May 1983

ACKNOWLEDGEMENT

We are very much pleased to come to the conclusion that we have learned a lot in the T.A.E.T. program concerning our field of work in our particular countries.

Special thanks are therefore extended to the T.A.E.T. staff who were always by our sides to help us with any difficulty we had during our project work.

Special thanks is also extended to the USAID for allowing us to participate in this useful training. We therefore here promise the T.A.E.T. staff that we have gained a lot from what ever they told us and we also promise that we will surely make use of this incrediole training. Special thanks to Dr. Bush, our supervisor, for his appreciable help.

INTRODUCTION

The term biogas system is somewhat of a misnomer though biogas systems are considered as an energy supply technology, there are many reasons why biogas systems are constructed. (1) Some people regard their systems primarily to provide them gas for cooking, lighting, and fuel to operate their generators; (2) others consider it primarily to provide fertilizer.

In case number one is one's objectives to construct a biogas plant, then, careful attention is needed to operate the plant without any problem; the likely problems that can lead to failures are leaking, the temperature drop, and the material to be used. The sludge in this case is the by-product which is used in the farms or gardens to improve their yield. Number 2 needs less care because the objective of the system is purposely for fertilizer or sanitary disposal, the gas in this case is the by-product. but to meet your objectives, the plant should have enough temperature for fermentation, this will provide well disgested manure and it will also solve the sanitary problem.

Any technology has a complete series of impacts on the environment in which that technology operates. That is, the system purposely constructed for biogas production requires extra work, collection of manure, proper cnecking for leakage. On the other hand, instead of fertilizer and sanitary this could cause pollution, especially when using human waste.

The concern over technology's appropriateness is based on the need to determine clearly who will be affected by the technology and in what ways decision making in this case is necessary before you start constructing this plant. Instead of providing you gas, fertilizer, it can cause pollution to others. Wherever the pit type biogas plant is to be constructed, first

find out the water level in that particular area and also make sure it does not leak, and the sludge also should be considered, too. Biogas is a simple village technology. Most of the materials are available in the village and the technology is less a problem of hardware than appropriate data collection, financing, installation, and use with all the problems of sending out competing demands and value judgments in each of the tasks mentioned.

BIOGAS

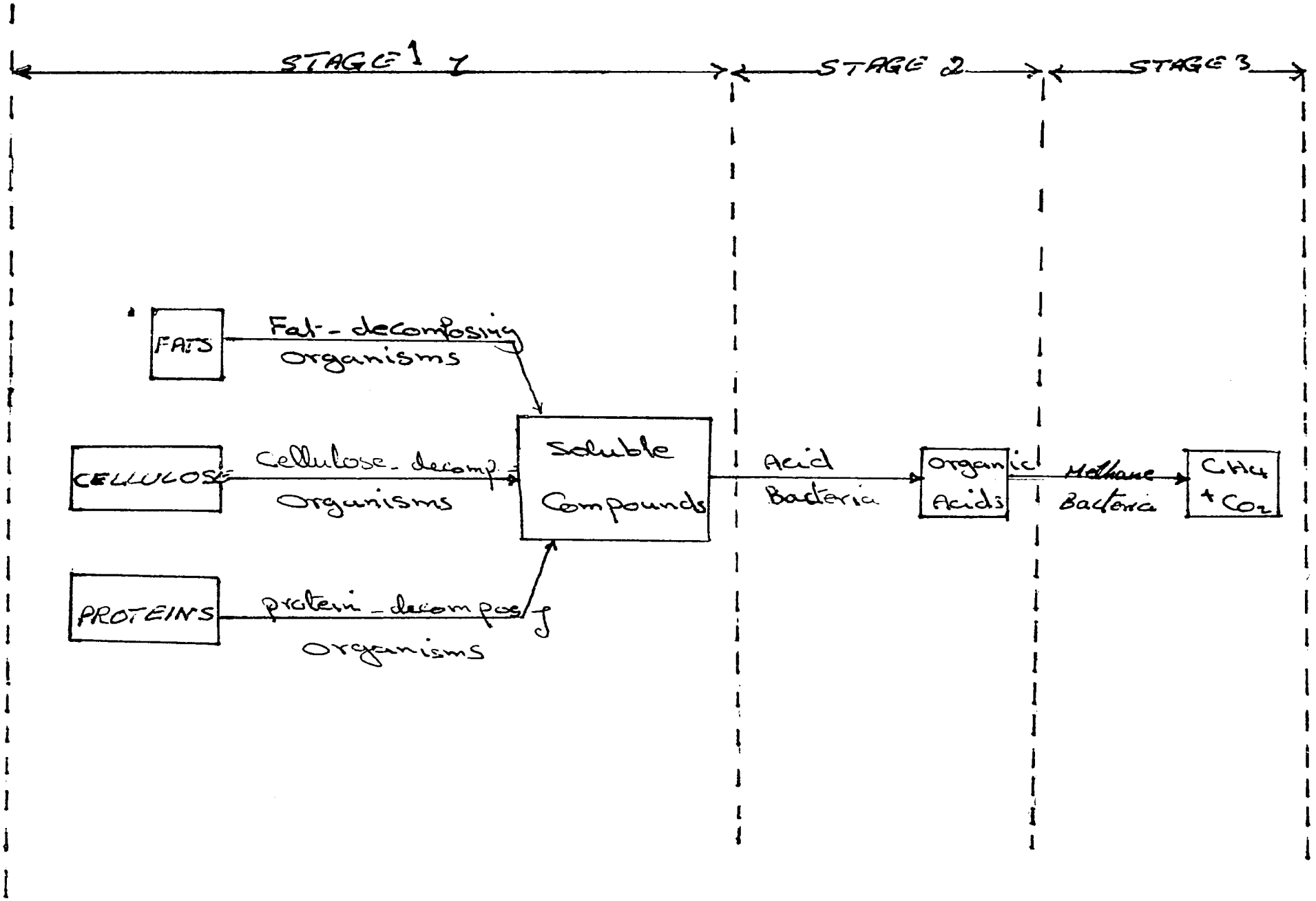
Biogas is the gas which is produced by the anaerobic (airless) biological process, and it is composed of CH_4, CO_2 (carbon dioxide), H_2O (water as a vapor), and sometimes N_2 (nitrogen gs), H_2S (hydrogen sulfide), H_2 (hydrogen gas) and other gases.

In literal terms, biogas means "gas produced by life." It is sometimes called methane as well.

BIOGAS PRODUCTION

The process of the anaerobic breakdown of organic material is called DIGESTION. Where does it happen? In gas production we are talking of the plant designed to produce gas either in a pit type or tank type. By feeding the digester, the oxygen inevitably enters with the raw materials and so anaerobic bacteria use this oxygen up. The material are broken down, CO_2 is released, and some heat is generated. In this stage, anaerobic bacteria release enzymes that attack larger molecules which are still outside their own bodies (extra cellular). The molecules in this case will be broken into "bits sizes" but finally are absorbed by the bacteria and digested. The main by-products of this third process are

ANAEROBIC FERMENTATION OF ORGANIC SOLIDS



simple molecules. These actions are more effective, which the biogas production depends on, when the digester is 35°C to body temperature. If the generator is below or about 10°C the gas production will either stop or very little gas will be produced during that time. In that case the generator needs to be heated but not with open fire because the gas is flammable. It should either be heated with solar collectors or an electric element or any heating system available, except open fire.

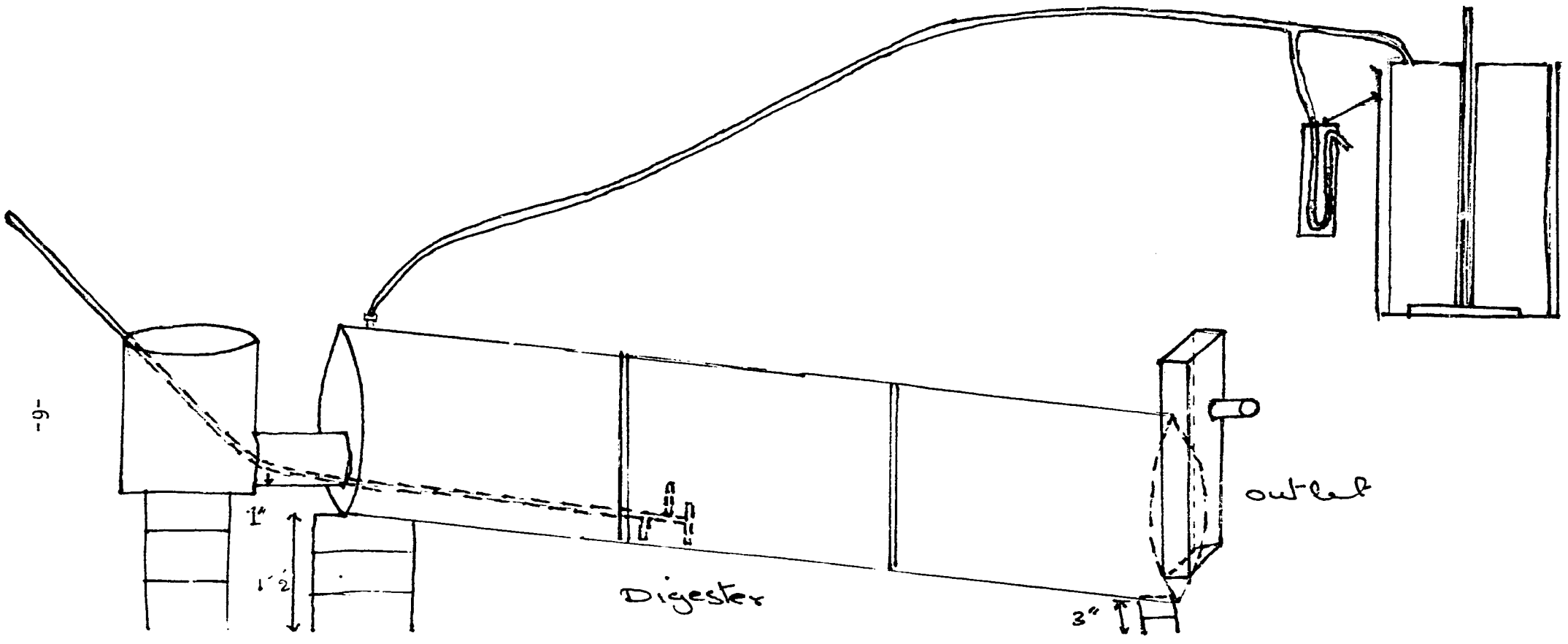
The most important part of biogas production is that the digester should be completely leak proof.

The type of biogas plant shown overleaf is JAVAN biogas plant. It is one of the simplest types of biogas plants which could be used in a village. the materials are 44-gallon drums and pipes. In construction of the plant, 44-gallon drums are welded together to provide a reasonable size. There are 2 openings, inlet and outlet (feed-in and flow-out). The diagram below shows the separable parts with measurements. Below that, the second diagram shows how the parts are put together.

If you want to build a digester like this, before opening the inlet and the outlet, make sure the joints are properly sealed. The tube on top of the digester, measuring 2" in height and 3/4" in diameter, should first be welded. This will help you to blow in air to see whether it is leaking by pouring water over the welding seams.

For safety, the pressure of air should be very low; high pressure could cause an explosion. The inlet is a small drum measuring 1' 9.5" in height and 1' 3.5" in diameter, the pipe connection measured 10.5" in length and 0.55" in diameter. This could be a pipe of these measurements or any sheet metal could be rolled to this shape. From the bottom of the digester to the pipe connection should measure 2.5" and the opening on the digester (this is the three drums) should be equal to the diameter of the pipe to be welded. The cutting of that hole should start 1" (one inch) from the bottom with the same diameter of the pipe.

Biogas Plant

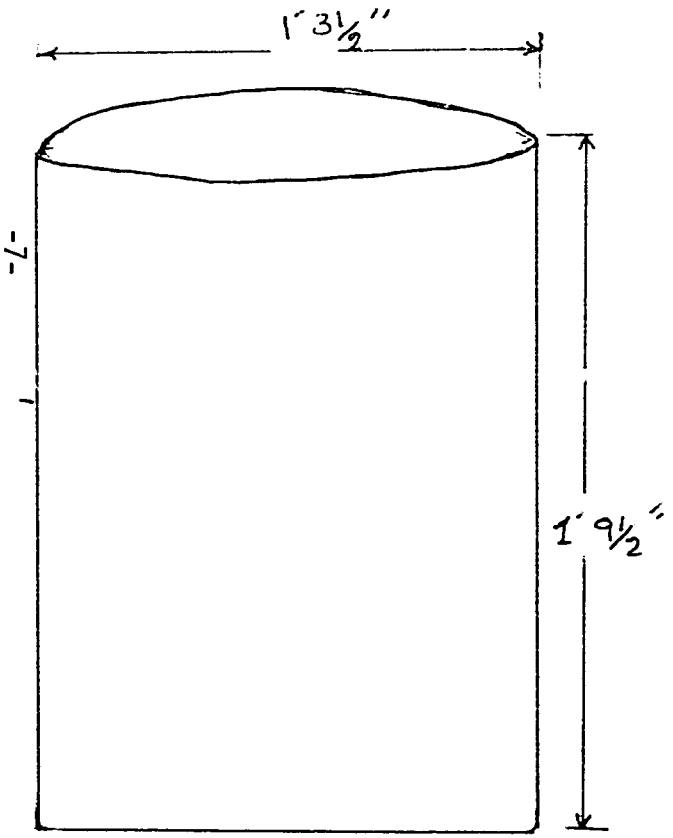


length of connecting pipe = 10½"
Dia = 0.55"

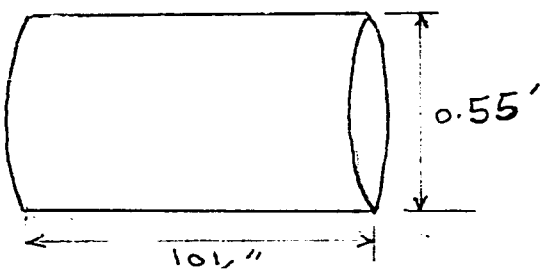
length of Agitator = 12 ft

Total length of Digester 8' 9.5"
(3 drums)

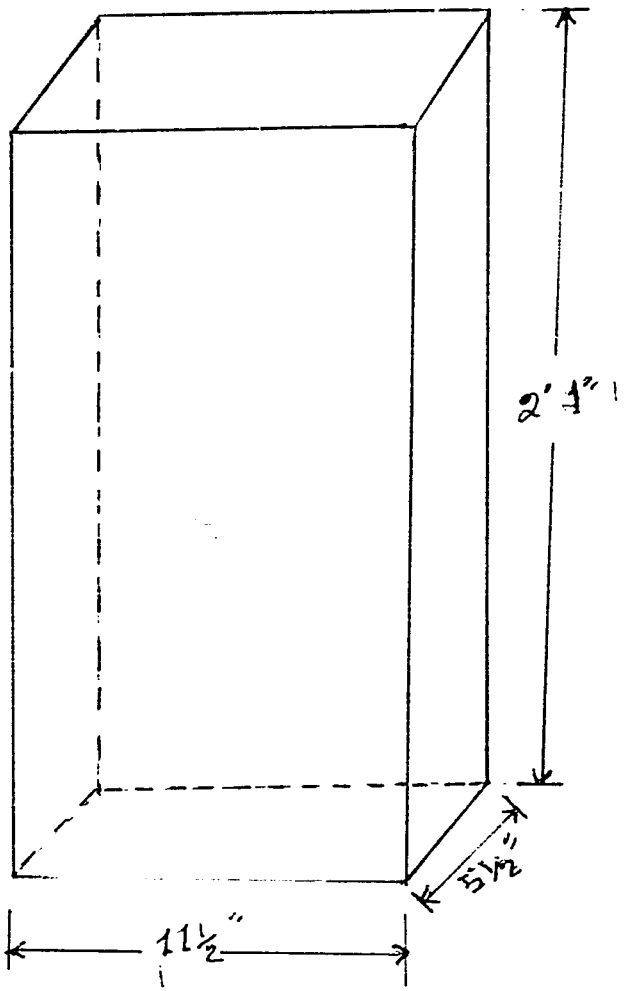
MIXING TANK



CONNECTING PIPE



OUTLET TANK



SCALE: 2in ≡ 1ft

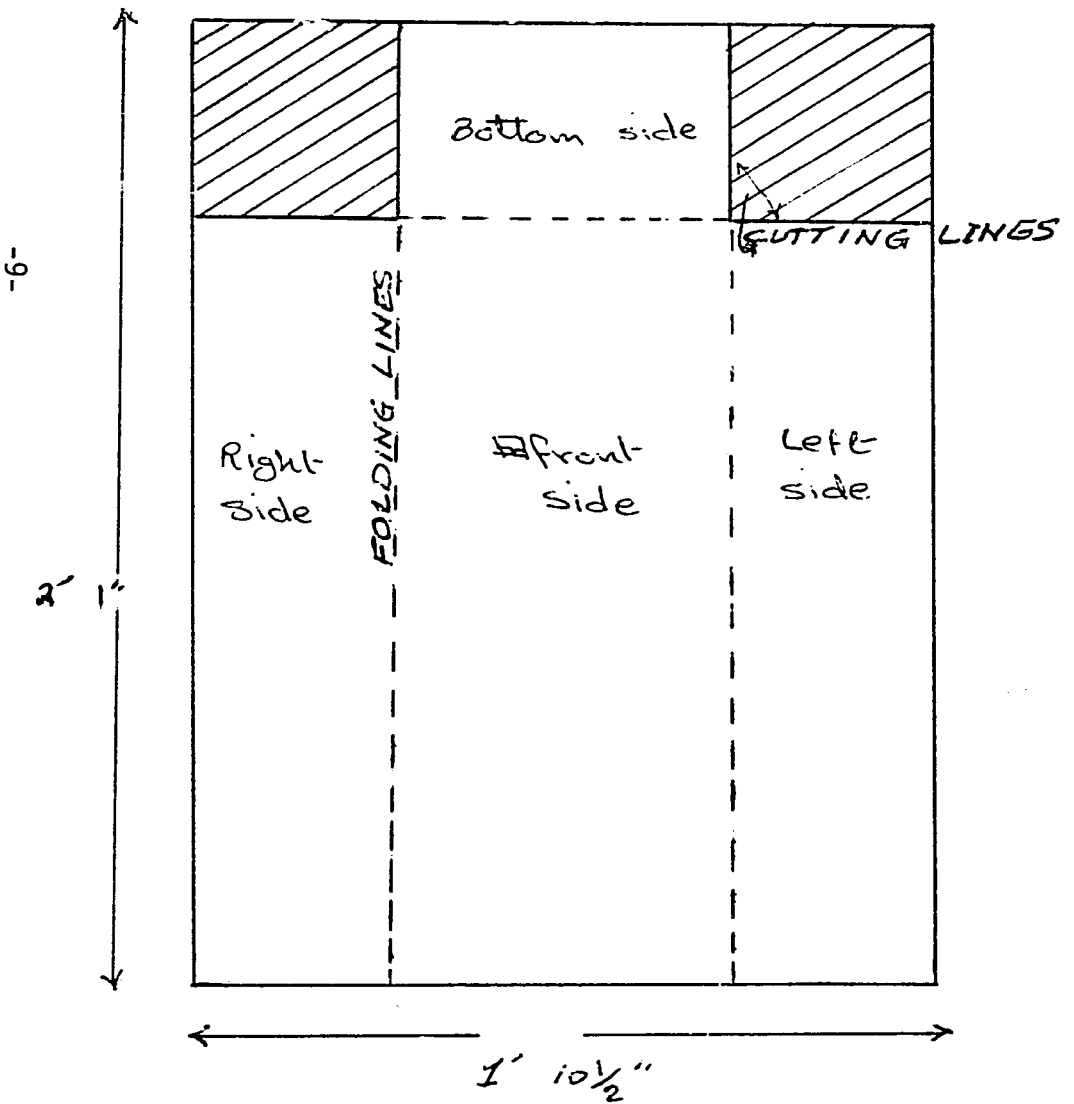
The outlet construction will be shown on the next page. The agitator could be made out of any flexible rod with baffles at the end. The use of the agitator is to mix the dung properly. This allows the equal distribution of temperature in the digester.

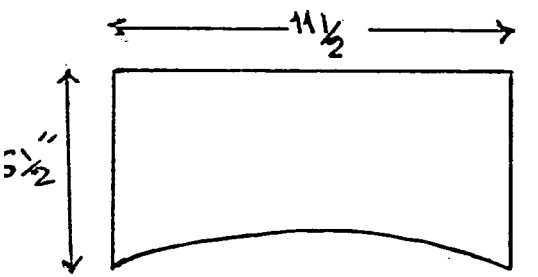
The digester should be laid horizontally so that the last drum is completely full of the sludge to prevent the gas generated from flowing through the outlet. The inlet should also contain sludge because the gas generated is collected from the first drum which is not completely full because of the slope. Instead of filling up that space, the sludge will flow through the outlet. That flow of sludge is like a by-product; it is very rich fertilizer and it could be used directly or it could be dried and stored.

For collecting the gas from the digester, you need 2 drums. One should be bigger than the other. The larger drum is filled with water upright and the other drum is open, which is placed upside down in the drum with water with the pipe connections on top for connecting the plastic tube from the pipe on the digester to the pipe on the holder. The smaller drum should sink completely in that water to remove air. The holder will rise up when there is gas produced. It will stay down for two reasons: no gas production or gas leaking, or very low temperature.

Therefore, our recommendation is, when constructing a biogas plant, make sure the system is leak proof before feeding. We have been handicapped to produce data because the system was fed without testing for leakage. To overcome this problem caused us more work than constructing two of the same type. The material used in this type is cow dung in the ratio of 1:1.

CONSTRUCTING THE OUTLET TANK





DIMENSIONS

Item	Length		Diameter
Digester (3 drums)	8' 9.5" total		1' 11 3/4"
Mixing tank	1' 9.5'		1' 3.5"
Connecting pipe	10.5"		0.55'
Gas holder	28" inside height		
Outlet tank	11.5" length	5.5" width	2' 1" height
Gas outlet from drum	2" height		3/4"
Level of drums	1' 2" inlet		3" outlet
Agitator	12'		