FREE FUEL

By Peter Thompson, Lecturer, and Post Certificate Diploma Students 1977, at Vudal Agricultural College

The construction and installation of a Hydraulic Ram water pump to provide an easily maintained and reliable water supply to a group of settlers near Vudal Agricultural College is described.

The 1977 group of Post Certificate Diploma students started practical extension work with a group of Tolai people who had settled on land between Vudal College and Keravat.

One of the needs of these people was for a more reliable and easily accessible water supply. The people are living on the tops of ridges and although there is permanent water in the valleys in between, it is often a long distance from the house. In the dry season it can become contaminated by people and animals washing in shallow pools. Their other source of supply is old 200 l (44 gallon) drums which catch water from the roof of a house on a sheet of corrugated iron. These are not enough to supply the needs of a large family or in many cases a number of families, particularly in the dry season.

The P.C.D. students together with a group of Tolai people, started looking at different ways of improving the water supply. From this investigation the students found some sites which were suitable for putting in a Hydraulic Ram water pump. This is a pump which if placed in the valley works by the force of water alone and can pump water a long way up hill to where the people have built their houses.

We shall not go into the details about how the pump works except to say that it only has two moving parts and once it is set up in the correct way it will pump water as long as there is water flowing into it.

One small group of settlers was very keen to try one of these pumps, so the students decided to help them. There were 20 people (including children) living in 4 houses close together and they had a small spring 130 metres downhill from the hamlet. The water flow from the spring was 10 litres per minute (2.2 gallons per minute) and there was a suitable site for the pump about 30 metres downhill. This is the dry season flow of the spring.

We decided to try and make a hydraulic ram pump according to a design in a book called "A Manual on the Hydraulic Ram for Pumping Water" by S.B. Watt, published by Intermediate Technology Publications Ltd. This was because Hydraulic Ram pumps on the market varied from K150 to K250 but we could purchase the fittings

for the pump shown in the manual for about K60.

We suspected that the water flow from the spring would not be enough to keep the pump working so it was decided to construct a small dam by building a concrete wall about 1 metre high just down from the spring outlet. Diagram 1 shows a diagramatic representation of the water supply as it was eventually set up. After the pump was installed we found the dam would hold enough water to keep it working for 1½ hours and in this time it pumped about 360 litres (80 gallons) of water up to the header tank at the hamlet. In the dry season the dam filled up overnight but in the wet season there is usually enough flow from the spring to keep the dam full even when the hydraulic ram is working.

The P.C.D. students made the pump using the design in the Manual from parts as shown in the list at the end of this article. To do this they used an electric welder and drill but these items are available in most workshops. The design of the pump and the parts are shown in Diagram No. 2.

Tande and his family at the dam which supplies water to the pump through the pipe which goes through the base of the wall

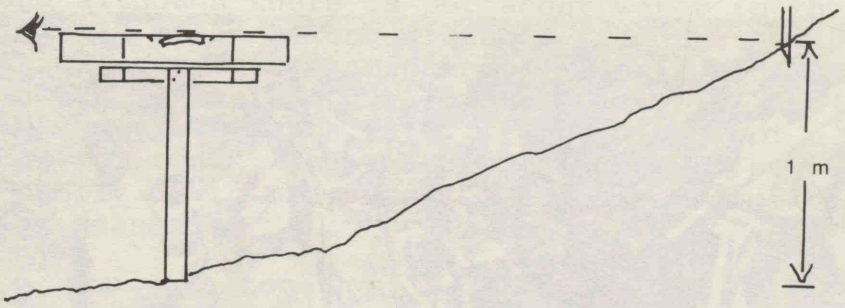
After the pump was installed and operating, we found the original design for the impulse valve as shown in the Manual was not strong enough to last for a long time. John Cooper (Deputy Principal, Vudal Agricultural College) produced two improved designs of impulse valves which were tested and found to be easier to construct and more reliable. These are shown in Diagram No. 3. Type No.1 has been working on the pump since October 1977 and so far has shown very little wear.

The design of the delivery valve is satisfactory and has worked well for 8 months before the rubber washer needed to be replaced. The construction of this valve is shown in Diagram No. 4.

If you think there may be a suitable site for a hydraulic ram pump in your area you should:-

1. Test the flow of water by catching it in a bucket of a known size and measuring the time it takes to fill the bucket. If a 2 or 3 gallon (9 or 13.5 l) bucket fills up in at least one minute there will be enough water for part time pumping each day. If a 3 gallon (13.5 l) bucket fills up 3 times in a minute, there should be enough water to keep the pump going continuously if necessary.

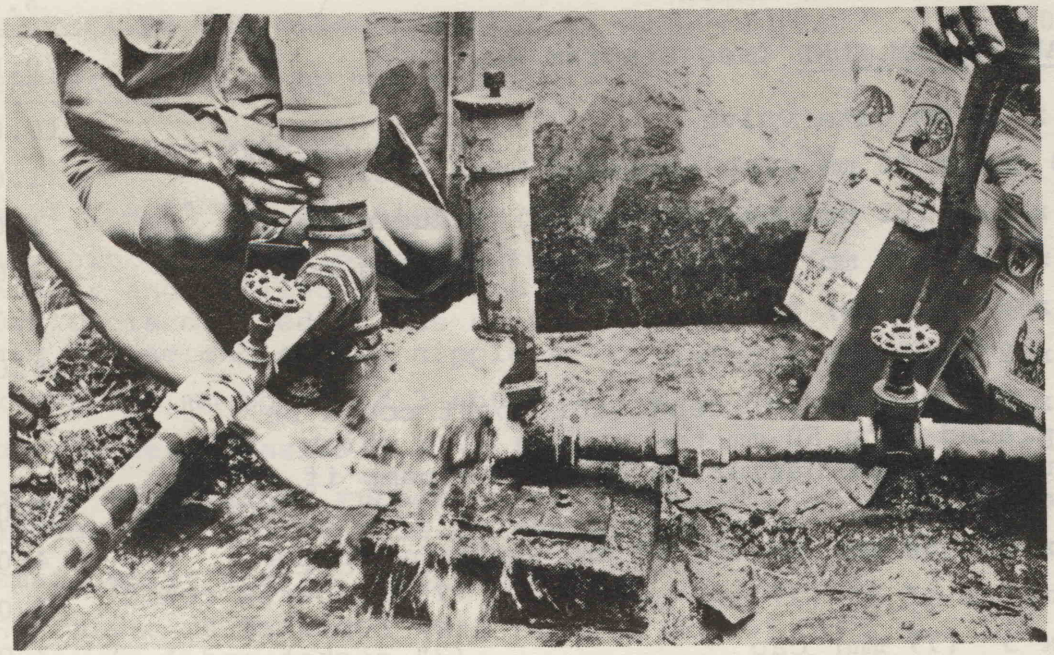
2. Measure the vertical height from a good site for a small dam down to another site which could be levelled for the pump. This should be at least 5 metres (about 17ft). The best way to check this is to tie a carpenter's level to a one metre long stick. Mark your starting point then move down hill keeping the top level until you can sight along the level to that point. Mark that point with a stick and repeat the procedure.



3. The hydraulic ram will pump water a long way but will work best if the outlet is not more than 200 metres from the pump.

Turning on the pump. Note the drive pipe on the right which comes from the dam and the delivery pipe on the left which goes up to the village

In a suitable site the home-made hydraulic ram pump provides water to a village for a cost of about K260. Once installed, like any machine it will need some maintenance. The rubber in the delivery valve will have to be replaced about once every 6-9 months and the impulse valve may have to be serviced once a year. The dam will have to be cleaned out regularly, particularly if it is in a flowing creek which floods in the wet season. However the running costs are almost nil because the fuel to keep the pump going is the water itself.



A close-up of the pump working

Acknowledgements

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EDITOR'S NOTE:

A pump has been constructed similar to the type described here; the major difference is in valve design and the use of only hand tools and drill press. The construction details are available in a booklet entitled "The Construction of a Hydraulic Ram Pump" by A.R. Inversin from the South Pacific Appropriate Technology Foundation, P.O. Box 6937, Boroko, Papua New Guinea.

MATERIALS USED TO MAKE AND INSTALL THE HYDRAULIC RAM WATER SUPPLY SYSTEM

	APPROX. COST
DRIVE PIPE	
* 5 x 1¼" (32 mm) steel water pipe	K 60.00
* piece of fly wire to wrap around the inlet as a strainer	2.00
* 1 x 1¼" (32 mm) Union	8.00
	70.00
HYDRAULIC RAM PUMP (See Diagram No. 2)	
* 1 x 32 mm gate valve	10.00
* 30 cm of 32 mm pipe threaded both ends	1.00
* 1 x 1¼" (32 mm) to 1½" (40 mm) reducing bush	1.00
* 2 x 1½" (40 mm) to 2" (50 mm) reducing bush	3.00
* 2 x 2" (50 mm) tee	5.00
* 3 x 2" (50 mm) nipples	5.00
* 1 x 2" (50 mm) 90° bend (this part could be replaced by a 50 mm tee with a plug which would make it easier to clean the pump if necessary)	4.00
* 1 x 2" (50 mm) to 3" (77 mm) reducing socket	4.00
* 1 metre of 3" (77 mm) steel pipe (These parts could be replaced by a 2" socket and 1 metre of 2" pipe with a 2" cap)	2.00
* 1 x 3" (77 mm) cap	3.00
* 1 x 1½" (40 mm) to 3/4" (20 mm) reducing bush	1.00
* 1 x 3/4" (20 mm) globe valve	4.00
* 1 short length (about 30 mm) 3/4" steel pipe threaded both ends	1.00
* 1 x 1 metre length 3/4" steel pipe threaded both ends (or a 20 mm polythene pipe connector that screws into the 3/4" globe valve	
* 2 short steel straps or angle iron to weld pump to a steel base plate	
* 1 steel base plate about 5 mm thick, 25 cm x 25 cm with 4 holes in the corners for the bolts set in the concrete base	
* 4 x 30 cm bolts to set into a concrete block	2.00
	K 46.00

DAM AND PUMP BASE

* 3 bags of cement		6.00
* 6 bags of sand and gravel	)	
* timber for form work	) collected or second hand	
* Arc mesh for reinforcing	)	

DELIVERY PIPE

* 130 metres of 25 mm polythene pipe	60.00
* 5 hose clips for attaching pipe to pump	1.00

DELIVERY VALVE (PART OF THE PUMP)

(See Diagram No. 4)

* one of the 2" (50 mm) nipples from pump parts
* 3 mm thick steel or brass plate, 50 mm in diameter and drilled with 5 mm holes, one of which is drilled in the centre. Weld plate to one end of the nipple.
* 1 x short 5 mm bolt and 2 nuts
* 1 curved metal washer
* A piece of flexible rubber sheet 45 mm in diameter with a 5 mm hole in the middle
* 1 small split pin for air valve

IMPULSE VALVE - TYPE No. 1 (See Diagram No. 3)

* 2 x 2" (50 mm) nipples	3.00
* 1 x 2" tee	2.00
* 1 x 2" connector	1.00
* 1 x 2" cap welded or screwed to connector, with a 1 cm hole in the middle	1.00

* 1 50 mm insert made from 5 mm plate with a 32 mm hole in the centre and welded into one end of the bottom 50 mm nipple
* A small strip of metal with a 1 cm hole drilled in the centre and welded to the other end of the bottom 50 mm nipple to support the centre bolt
* 1 x 30 cm long, 1 cm sized bolt with 3 nuts
* 1 x 45 mm diameter piece of 6 mm plate with a 1 cm hole in the centre
* 1 rubber stopper with a 1 cm hole in the centre
* 2 steel washers

(Note: All the impulse and delivery valve parts have not been costed as most can be made from scrap parts).

TANK STAND

* Various lengths of ½" water pipe	20.00

TANK

* Second hand 100 gallons	30.00
* Outlet pipes, tap and shower rose	20.00
APPROXIMATE TOTAL COST OF MATERIALS	K 260.00

Tande's wife gives her baby a wash in the shower which is connected to the header tank

Tande gets a bucket of water from the header tank

Water flowing into the header tank

Diagram No 1

Cross-section of water supply system using hydraulic ram pump

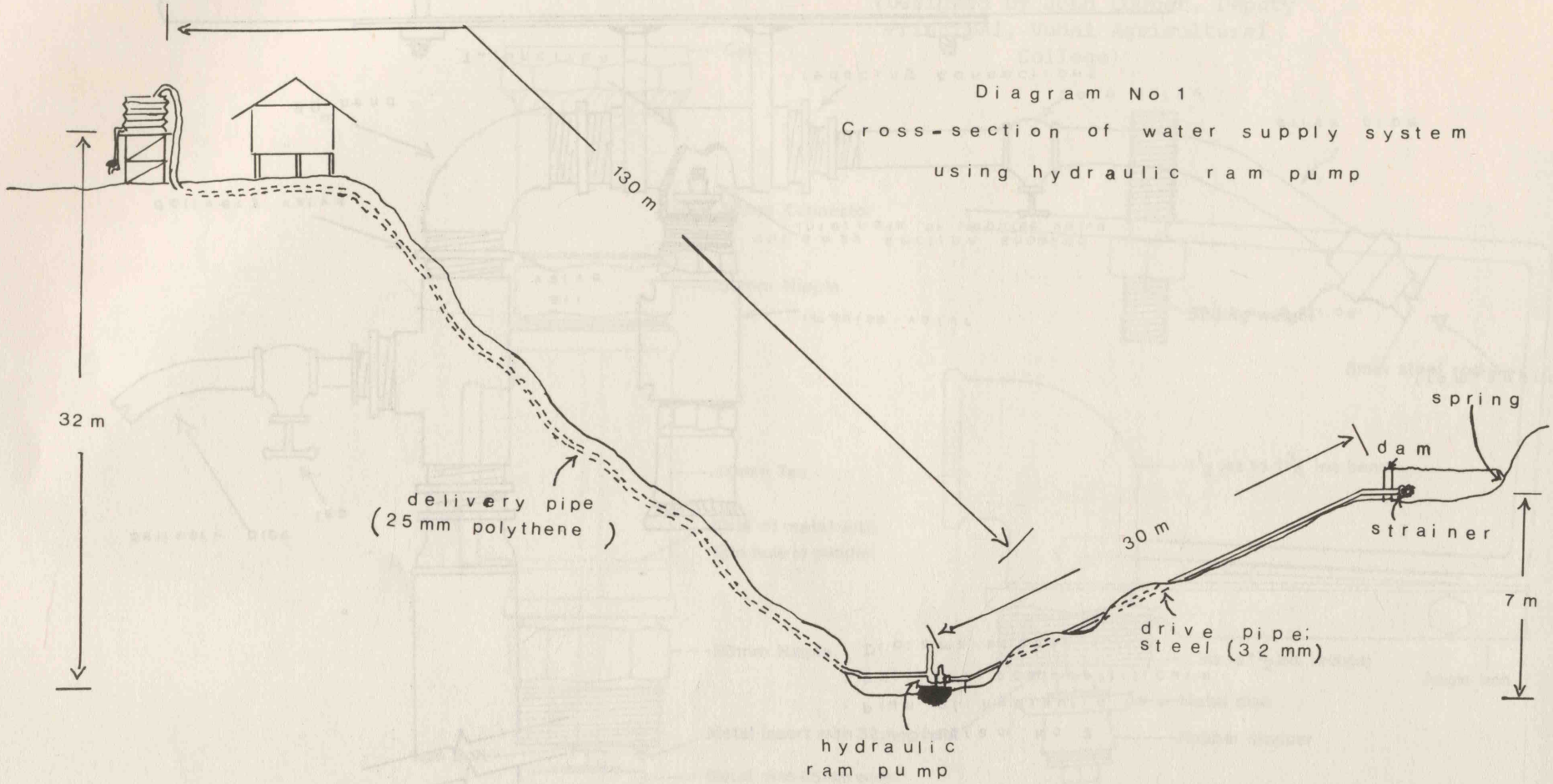


Diagram No 2
Plan of hydraulic ram
built by post-certificate
Diploma students

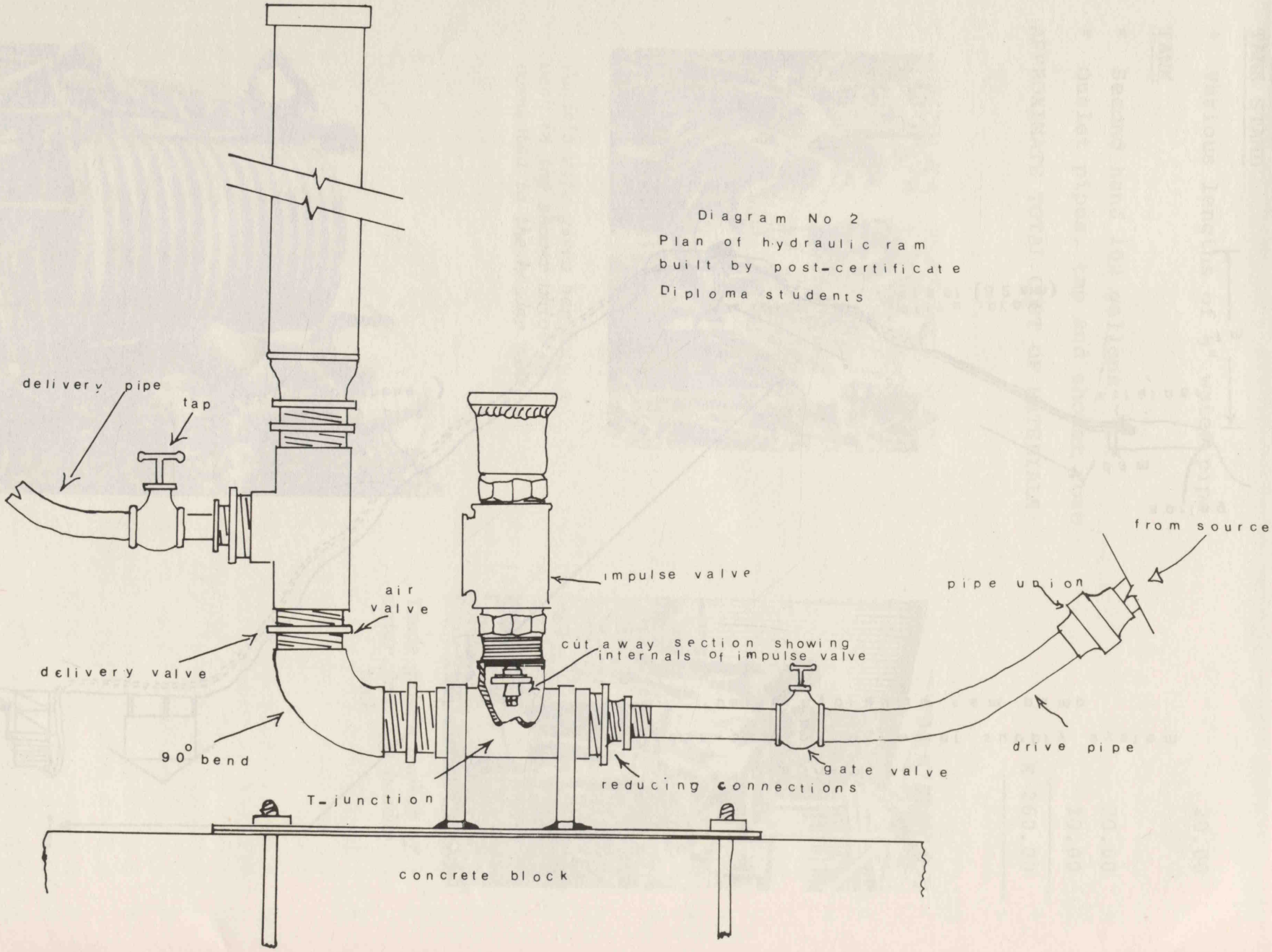
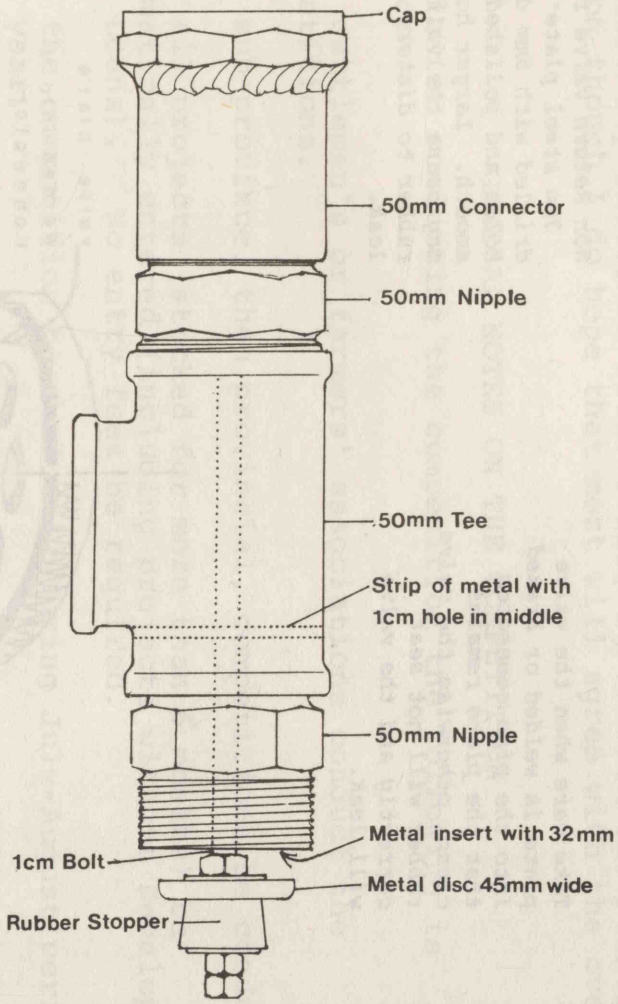
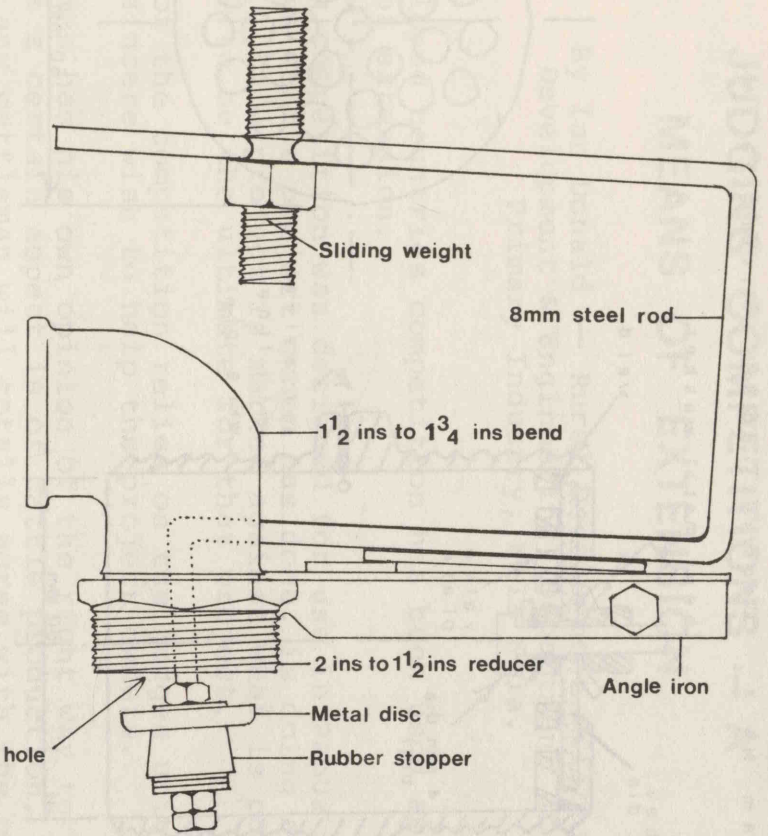


Diagram No. 3

Two types of Impulse Valve.
(Designed by John Cooper, Deputy Principal, Vudal Agricultural College)

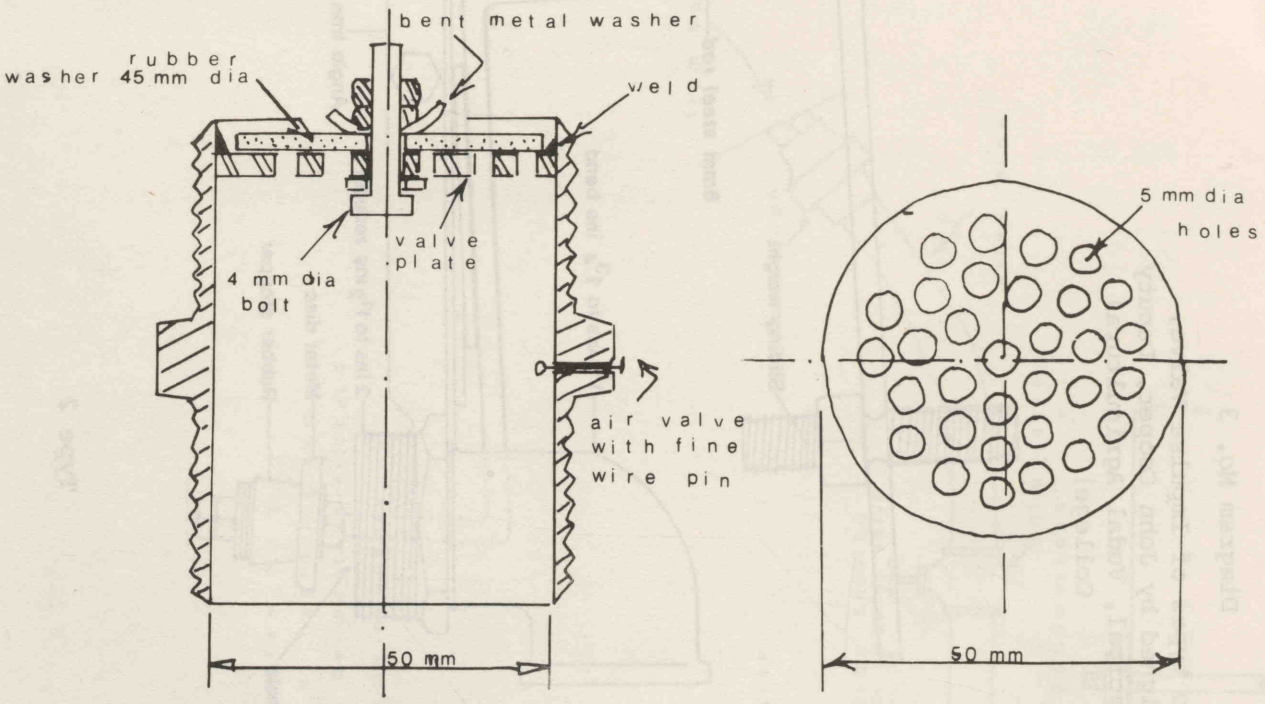


Type 1



Type 2

Diagram No 4 Construction of delivery valve



Take care when the valve plate is welded or brazed into the pipe connector that the plate remains clean, otherwise the valve rubber will not seat correctly and the valve will leak.

Non Return valve from 3mm steel plate - drilled with 5mm dia holes and polished smooth. Larger holes may cause the valve rubber to distort and leak.

The delivery valve