JAERI 1153

JAERI 1153

JRR-2 Irradiated Fuel Storage Facility

January 1968

日本原子力研究所

Japan Atomic Energy Research Institute

日本原子力研究所は，研究成果，調査結果の報告のため，つぎの3種の研究報告書を，それぞれの通しナンバーを付して，不定期に公刊しております．

1. **研究報告**	まとまった研究の成果あるいはその一部における重要な結果の報告	JAERI 1001-3999
2. **調査報告**	総説，展望，紹介などを含め，研究の成果，調査の結果をまとめたもの	JAERI 4001-5999
3. **資　　料**	研究成果の普及，開発状況の紹介，施設共同利用の手引など	JAERI 6001-6999

このうち既刊分については「JAERI レポート一覧」にタイトル・要旨をまとめて掲載し，また新刊レポートは「原研びぶりお」でその都度紹介しています．これらの研究報告書に関する頒布，版権，複写のお問合せは，日本原子力研究所技術情報部（茨城県那珂郡東海村）あてお申し越しください．

Japan Atomic Energy Research Jnstitute publishes the nonperiodical reports with the following classification numbers:

1. **JAERI** 1001-3999 Research reports,
2. **JAERI** 4001-5999 Survey reports and reviews,
3. **JAERI** 6001-6999 Information and Guiding Booklets.

Any inquiries concerning distribution copyright and reprint of the above reports should be derected to the Division of Technical Information, Japan Atomic Energy Research Institute, Tokai-mura, Naka-gun, Ibaraki-ken, Japan.

編集兼発行　日本原子力研究所
印　　刷　三美印刷株式会社

JRR-2 Irradiated Fuel Storage Facility

Abstract

The JRR-2 (Japan Research Reactor-2, CP-5 type) irradiated fuel storage facility has been used for over 7 years, and many problems and troubles have arisen until now. We have made efforts to overcome them and at the present time many of them were solved.

This irradiated fuel storage facility and the experiences are described in this report. The troubles and problems encountered, such as the pool lining, irradiated fuel storage rack, handling tools and so on, as well as the operation data on the water quality of the pool are also reported.

September, 1967

SADAMU SAWAI
Division of Power Reactor Development
MITSUYASU UENO
Division of Research Reactor

Tokai Research Establishment, Japan Atomic Energy Research Institute

JRR-2 照射済燃料貯蔵施設

要　旨

JRR-2 使用済燃料貯蔵施設はその使用を開始してから7年以上経過したが，その間いろいろな問題点やトラブルを経験してきた．我々はそれらの解決に努力を払い，現在ではこれらの多くが解決されている．

ここでは我々の使用済燃料貯蔵施設の概況と経験を報告し，特に，プールライニング，使用済燃料貯蔵架台，ハンドラーなどで起った問題点やトラブル，そして水処理の実績などを合わせ記してある．

1967 年 9 月

日本原子力研究所　東海研究所
動力炉開発部　沢　井　　定
研究炉管理部　上　野　三　安

Contents

1. Introduction 1
2. Outlime of JRR-2 irradiated fuel storage Facility 1
   2.1 Irradiated fuel storage pool 1
   2.2 Pool water circulation and purification System 4
   2.3 Handling Tools and Equipments 6
3. Problems in JRR-2 irradiated fuel storage Facility 6
   3.1 Design of JRR-2 irradiated fuel storage Facility 6
   3.2 Circulation and purification System 9
   3.3 Irradiated fuel storage rack 12
   3.4 Handling tools 14
   3.5 Gamma irradiation 16
   3.6 Ruptured fuel can 17
   3.7 Irradiated fuel cutting machine 17

Acknowledgement 18

目　次

1. 序　　文 1
2. JRR-2 使用済燃料貯蔵の概要 1
   2.1 使用済燃料貯蔵プール 1
   2.2 プール水の循環系と精製系 4
   2.3 使用済燃料のハンドリング装置等 6
3. JRR-2 使用済燃料貯蔵設備の問題点 6
   3.1 JRR-2 使用済燃料貯蔵設備の設計 6
   3.2 循環系と精製系 9
   3.3 使用済燃料の貯蔵架台 12
   3.4 使用済燃料の操作具 14
   3.5 γ 線照射設備 16
   3.6 破損燃料収容缶 17
   3.7 使用済燃料の水中切断機 17

謝　　辞 18

1. Introduction

The JRR-2 irradiated fuel storage facility has been used for more than 7 years, and many problems or troubles have arisen until now. We, therefore, have made efforts to overcome them and at the present time many of them were solved.

Recently, some problems, two ruptured irradiated fuels and increase in the radioactivity of the ion exchangers were found in this facility. Details of these problems will be reported in the future, after being carefully studied.

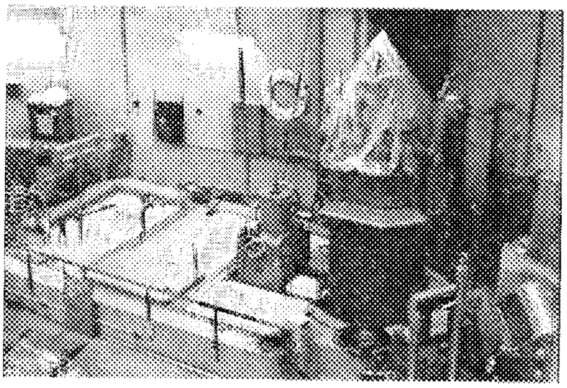
There are only a few reports published on the irradiated fuel storage facility in the world, such as on the operation and trouble experiences, equipment for handling the irradiated fuel and so on. In the present paper, a description is made of the JRR-2 irradiated fuel storage facility and its experiences. The troubles or problems encountered on the JRR-2 irradiated fuel storage facility as well as the procedures taken to solve them are also reported, which might be useful for designing and maintaining similar irradiated fuel storage facility.

2. Outline of JRR-2 Irradiated Fuel Storage Facility

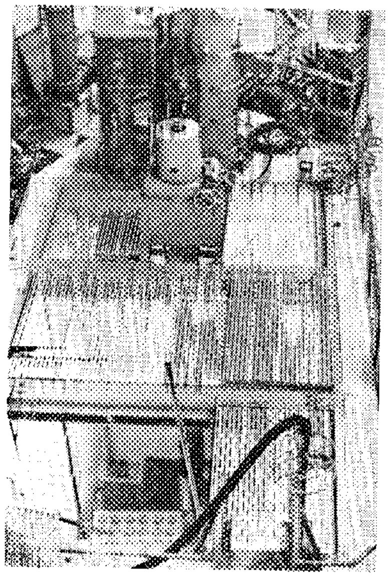
(Fig. 1 (a) and (b), Fig. 2 (a) and (b))

The JRR-2 irradiated fuel storage facility consists of the following:

(a) the irradiated fuel storage pool,
(b) the pool water circulation and purification system,
(c) the tools and equipment for handling the irradiated fuels and others.



(a)



(b)

Fig. 1 JRR-2 Irradiated fuel storage facility

2.1 Irradiated Fuel Storage Pool

The JRR-2 irradiated fuel storage pool has the dimensions of about $4.4 \times 2.6 \times 6$ (depth) m^3, and is lined with an ordinary steel painted by epoxi resin paint (Fig. 3) so that no water may leak out through the pool walls without being monitered and also the pool wall surface would not be rusted and easily decontaminated if necessary. The pool was so built as shown in Fig. 4 and Fig. 5 that the irradiated fuels might be easily inserted into the pool from the refueling cask

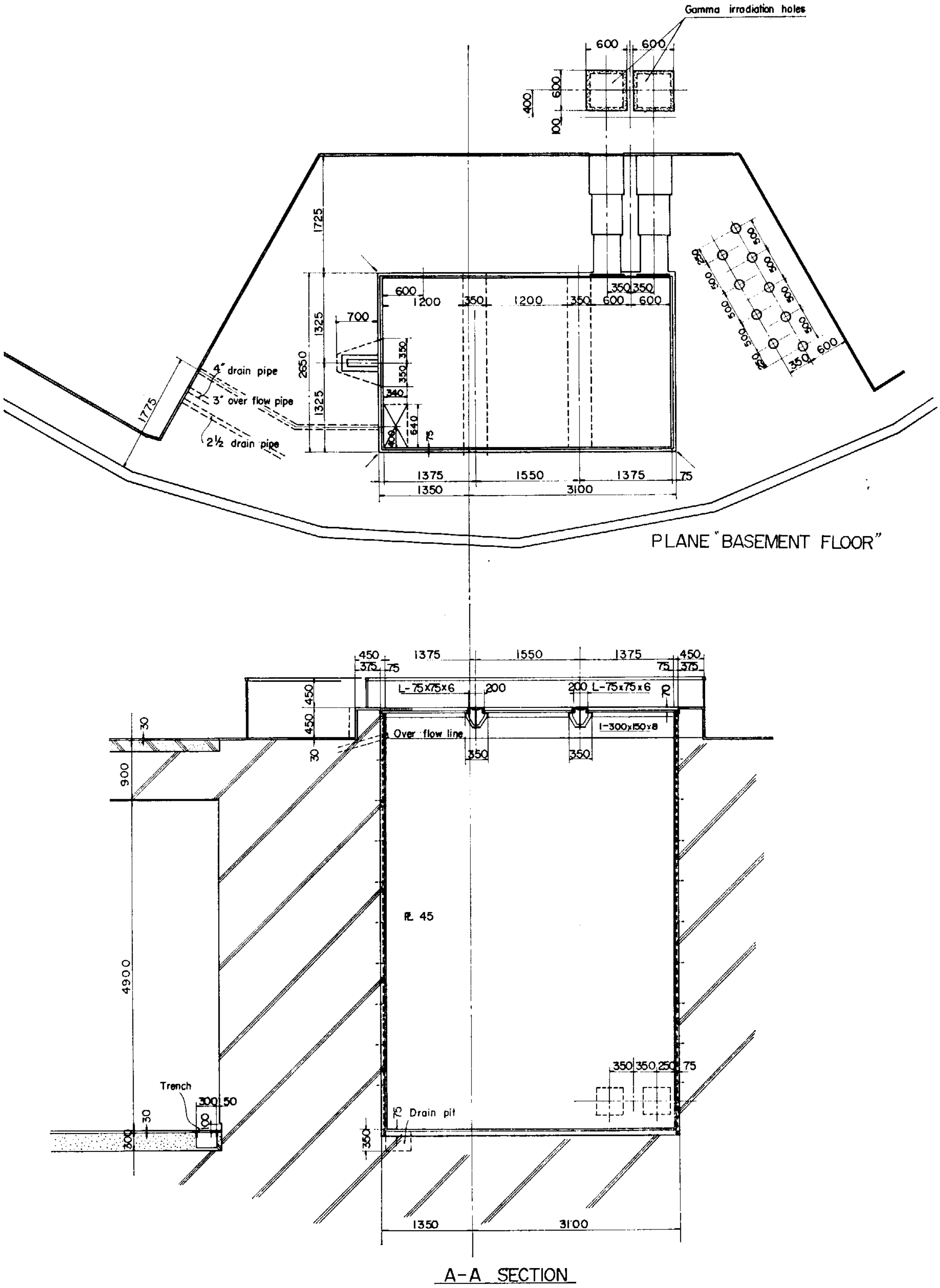
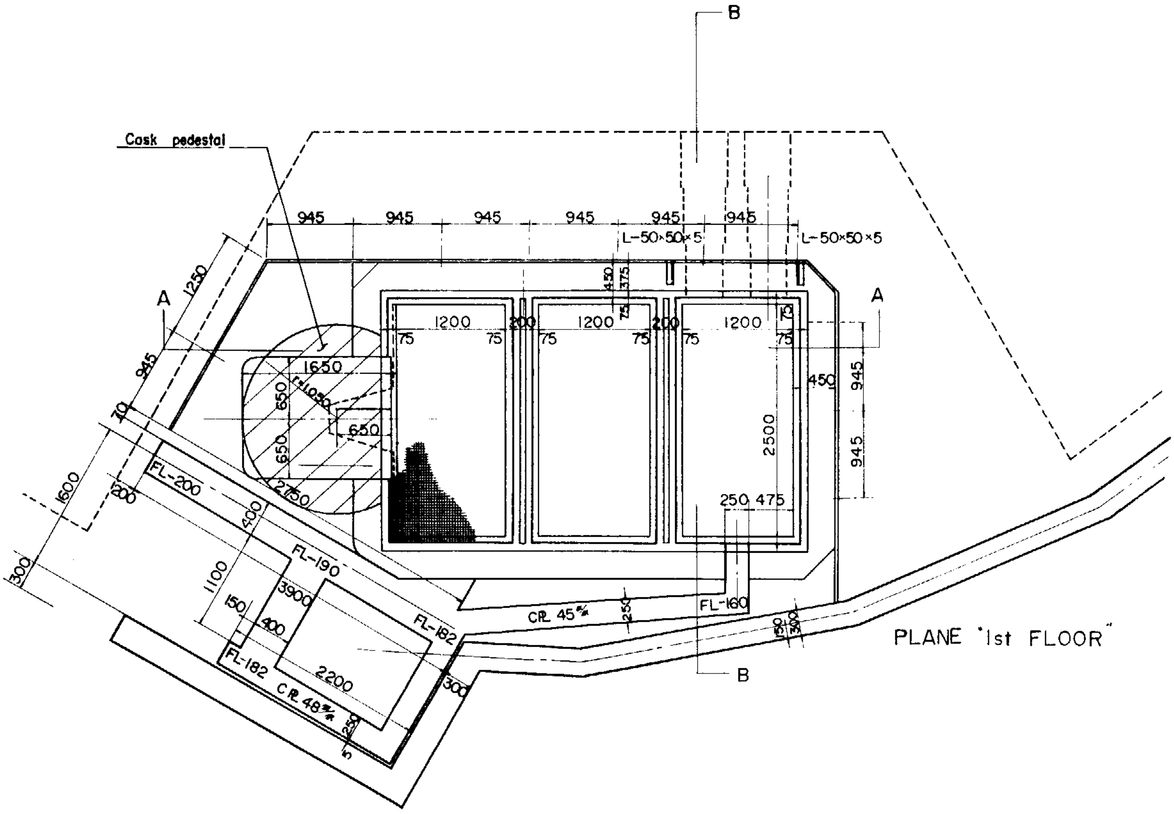
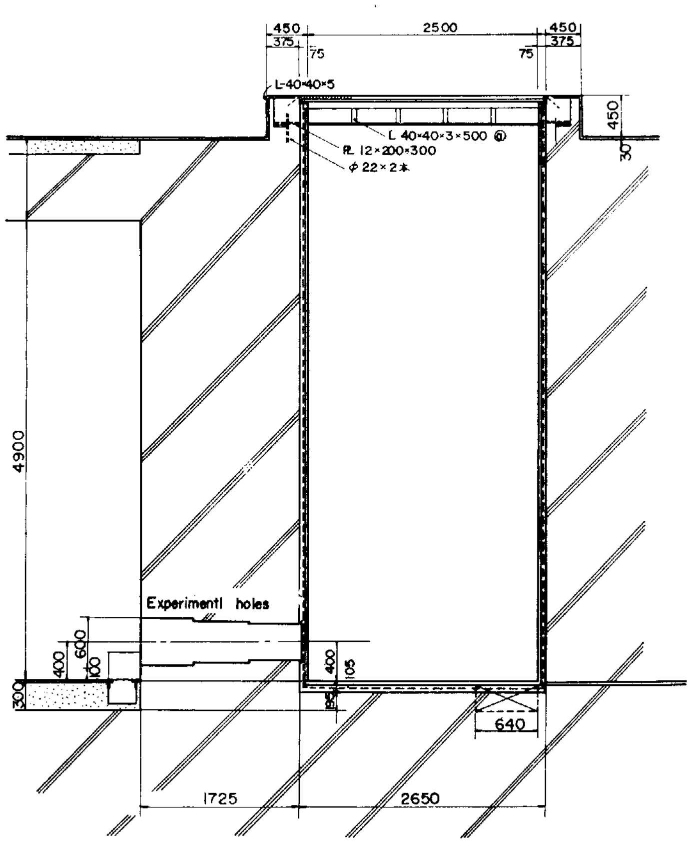


Fig. 2 (a) JRR-2 Irradiated fuel storage pool





B-B SECTION

Fig. 2 (b) JRR-2 Irradiated fuel storage pool

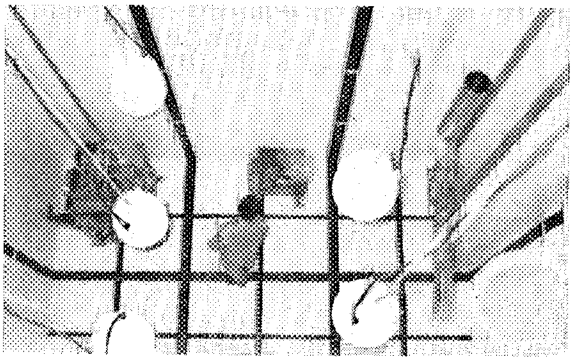


Fig. 3 Inside of JRR-2 irradiated fuel storage pool (Before setting stainless steel plate on the bottom of pool)

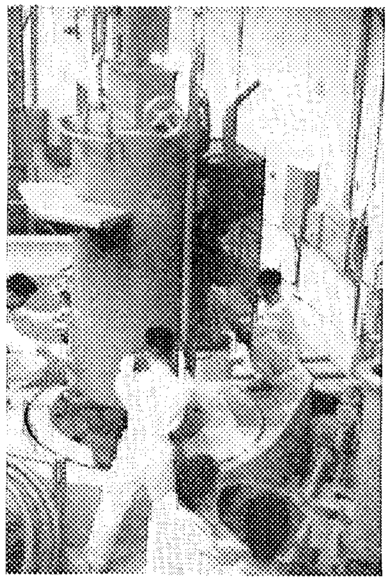


Fig. 5 Setting refueling cask at cask pedestal

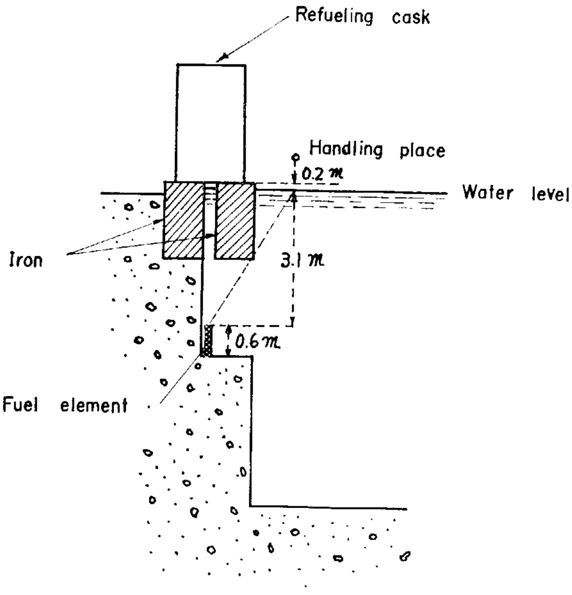


Fig. 4 Inserting irradiated fuel into pool

which can insert or withdraw the fuel for the distance of about 3.5 m. The cask pedestal of the pool is made of iron for protecting the presonnels and operaters from the gamma rays dose of the irradiated fuels (**Fig. 4**).

2.2 Pool Water Circulation and Purification System

The quality of the pool water is maintained in the range of about 6.5 of pH and over 500,000 ohm-cm of the specific resistance by this system, so that the corrosion of the aluminum (cladding material) may be minimized.

When the pool water is contaminated by the ruptured fuel or other materials, the system purifies the water.

The flow sheet of the system is shown in **Fig. 6** and the water level of the pool is controlled by the overflow pipe. The demineralized water is supplied to the system once every two weeks, to keep the water level at the specified one and also to remove the dusts on the water surface (details will be written in **3. 2. 5**). Alarms are given for a low water level, high water temperature and high radioactivity of the pool water.

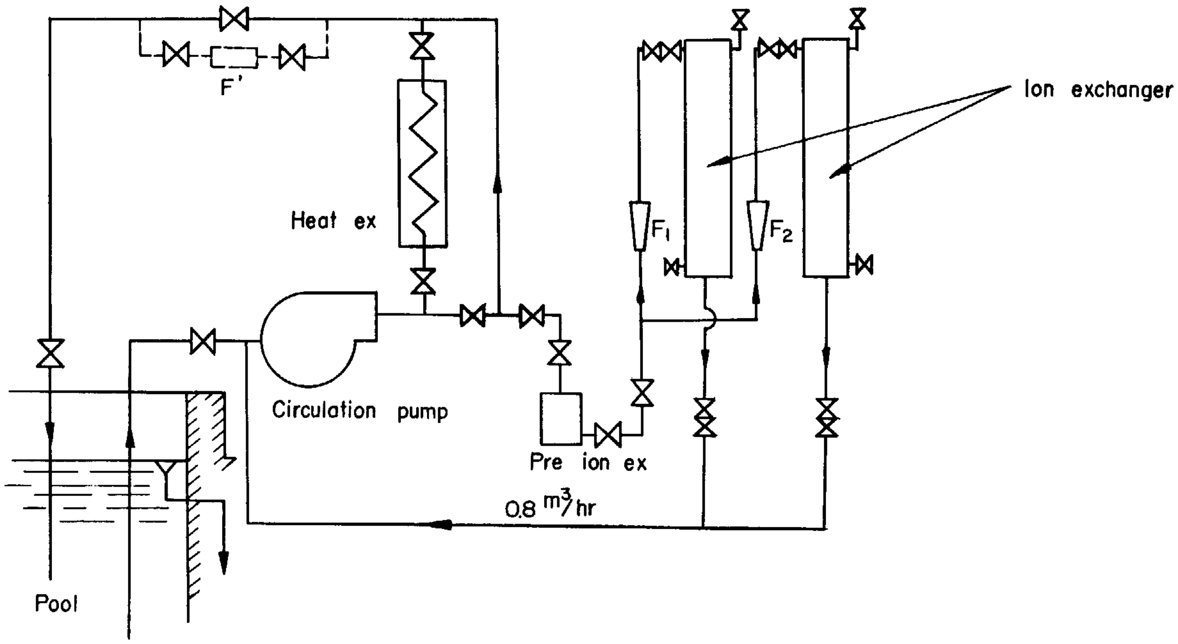


Fig. 6 Pool water circulation & purification system

The specifications of the equipments in the system are as follows:

(A) Circulation pump

Flow rate	25 m^3/hr
TDH	14 m
Motor horsepower	3 HP
Type	centrifugal, self-priming
Material	stainless steel (parts contacted with water)

(B) Heat exchanger

Type	shell and tube type, U tube
Material	aluminum, 3 S
Heat transfer area	13 m^2
Capacity	30 kW
Tube side	
Flow rate	25 m^3/hr
Inlet temperature	30°C
Outlet temperature	29°C
Shell side	
Flow rate	9 m^3/hr
Inlet temperature	25°C
Outlet temperature	28°C

(C) Ion exchanger

Purification flow rate	0. 8 m^3/hr
Ion exchanger	
Type	mixed bed
Total resin volume	36 liters
Cation resin	IR-120, 12 liters

Anion resin IRA-400, 24 liters
Number of ion exchangers 2

2.3 Handling Tools and Equipments

Irradiated fuel storage racks
Irradiated fuel handling tools
Irradiated fuel cutting machine
Cans for accomodating the ruptured fuels etc.

3. Problems in JRR-2 Irradiated Fuel Storage Facility

3.1 Design of JRR-2 Irradiated Fuel Storage Pool

3.1.1 Pool Capacity

The following items must be considered before determining the capacity of the irradiated fuel storege pool:

(a) storing rate of the irradiated fuels which depends on the reactor operation program (including its power),

(b) cooling time of the irradiated fuels, which depends on the reprocessing schedule,

(c) materials and equipments stored or set in the pool,

(d) handling method for the ruptured fuel,

(e) dimensions of the irradiated fuel shipping cask.

These items, however, were not so clearly fiixed when the facility was planned as in today, and therefore some assumptions were made to determine the pool dimensions.

The primary factor limiting the pool dimensions was its location, which was first decided in the reactor room (diameter of 25 m). The burn-up of the JRR-2 fuel is 20%, which was estimated to be attained after 60 days continuous operation at full power, and full core refueling would then be three times in a year considering the annual overhaul of the reactor prescribed by the law. The cooling time of the irradiated fuel is usually taken to be about 90 to 120 days from the standpoint of its reprocessing and decay of fission products. From the above considerations, the pool section or area of $4.4 \times 2.6\ m^2$ were chosen to accomodate 48 irradiated fuels (two cores) and equipments for handling them. The depth of the pool water was decided to be 5.6 m on the basis of the other examples of the irradiated fuel storage pools and this could be raised by about 0.3 m or more if necessary. From the operating experiences, it is felt, however, that the pool area of $4.4 \times 2.6 m^2$ is somewhat small for storing 48 fuels and equipments for handling them plus some experimental materials.

3.1.2 Pool Lining

The principal ideas for design of the pool were as follows:

(a) the steel lining was made on the pool wall, so that no water of the pool might leak out of the pool without being monitered,

(b) no drain line was installed at the bottom of the pool, and the pool water be pumped out, when draining.

Tile lining (just on the steel lining) was first considered following the ANL gamma facility and MTR irradiated fuel storage canal. However, for fear that tile falling off in the future, this plan was changed and mortar was used on the steel lining and then painted.

After the above works, it was noticed that "Blistering" occurred on the paint surface a few days after the pool was filled with water. Then motar was removed and the steel lining was painted with only epoxi resin paint.

It was found that the epoxi resin coating was very weak against any shocks and blows, and so the bottom surface of the storage pool was covered with the stainless steel plate as shown in **Fig. 7** and **Fig. 21** (**a**), (**b**), considering heavy equipments (shipping casks, irradiated fuel cutting machine, etc.) to be placed or set on the bottom of the pool.

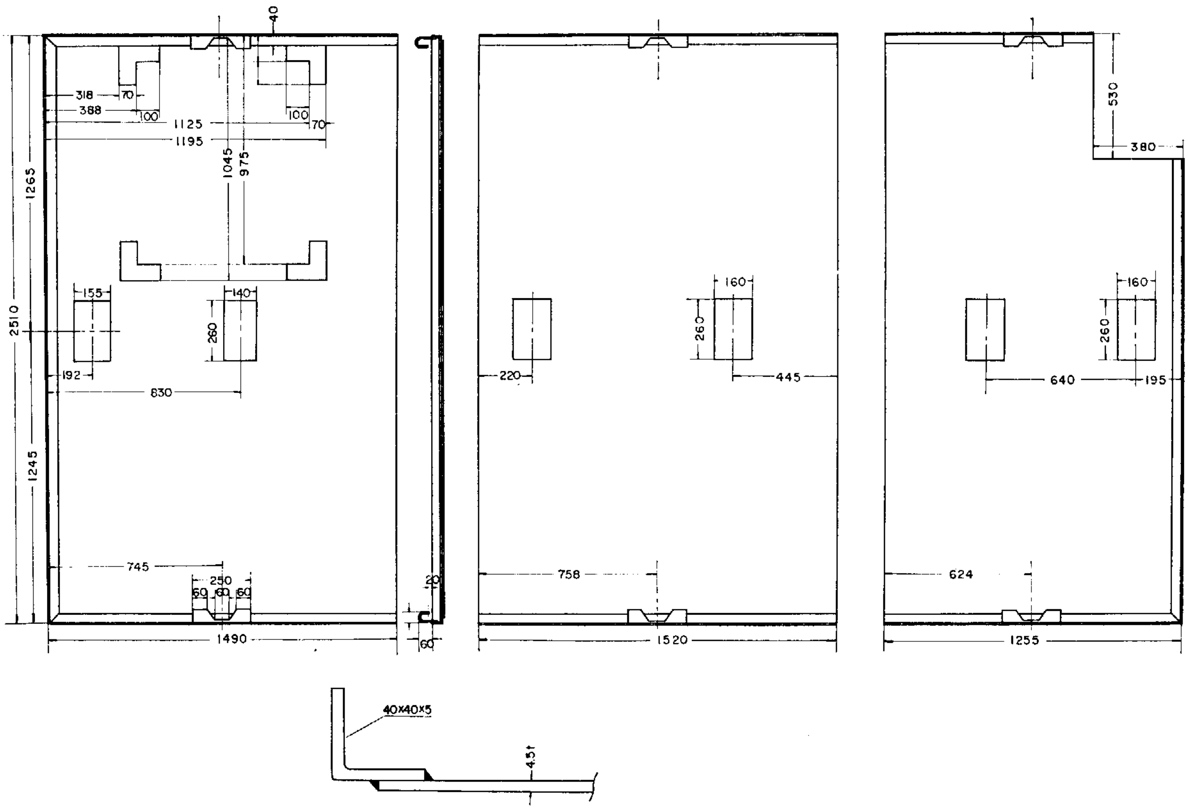


Fig. 7 Cover stainless steel plate (for pool bottom.)

Painting the steel lining and the integrity of the painting on the lining much depend on the surface condition, and the steel surface was carefully polished before painting. As the pool was large and deep, the pool was filled with paint-solvent vapour while the pool was painted. An effort was made to remove the paint solvent vapour out of the pool by means of the large fan, but the painting work was still laborious.

The stainless steel is rather expensive, but this material may be considered the best for the lining of the irradiated fuel storage pool, because of easy maintenance and decontamination. In the MTR irradiated fuel storage canal, the tiles were replaced by the stainless steel lining due to the trouble of leaking the canal water and so on; and the ATR (Advanced Test Reactor) canal was also lined with the stainless steel. In Canada, tendency is also to use the stainless steel lining, as in the pools of the NPD and Douglass Point nuclear power stations. The same suggestion or proposal was derived through our experiences on this pool.

3. 1. 3 Drainage of Pool Water

No drain line was installed at the bottom of the pool, fearing the water leaks out due to the pipe rupture in the drain line. The pool water was so designed to drain that a drain pit was installed in one corner of the pool bottom and the pool water drained by a circulation pump through the suction pipe (circulation system) extending to the pit. One problem was found in draining the pool water; when the level of the pool water approached the bottom of the pool, a vortex was formed around the suction pipe, which made the drain flow rate to reduce. This trouble could probably be eliminated to much extent if the pit was much deeper and the mouth of the suction head was larger.

The pipe rupture accident might hardly be considered to happen through the conventional piping experiences, if properly designed. Should this trouble happen (which may be informed by the alarm of low water level, etc.), there may be sufficient time to stop this water leakage by the use of a plug or tap just like ordinary baths for example, since 3 hours would be taken to drain all the pool water by the 3 HP circulation pump. At the same time rather narrow diameter of the drain pipe may be used for taking a longer time to drain all the water out. The above consideration may enable us to set the drain line at the bottom of the pool.

3. 1. 4 Ladder for Descending to Pool Bottom

Frequently we had to enter the pool to check the painting, to set many equipments and so on, which could not be expected at the earlier stage of the planning of the pool. This fact requests a ladder set in the pool, however, once the irradiated fuels are placed in the pool, one could seldom enter the pool. The removable ladder was thus made as shown in **Fig. 8**, which may be used for other irradiated fuel storage pools in our institute, if necessary.

3. 1. 5 Grating of Pool Top

The pool surface or top was covered with the gratings, as shown in **Fig. 1**, so that one might not fall into the pool and the operater could handle the irradiated fuel, etc. easily.

This grating consisted of nine sections and was first made of iron, which was too heavy to handle without the crane. Opening and shutting of the gratings were required many times for

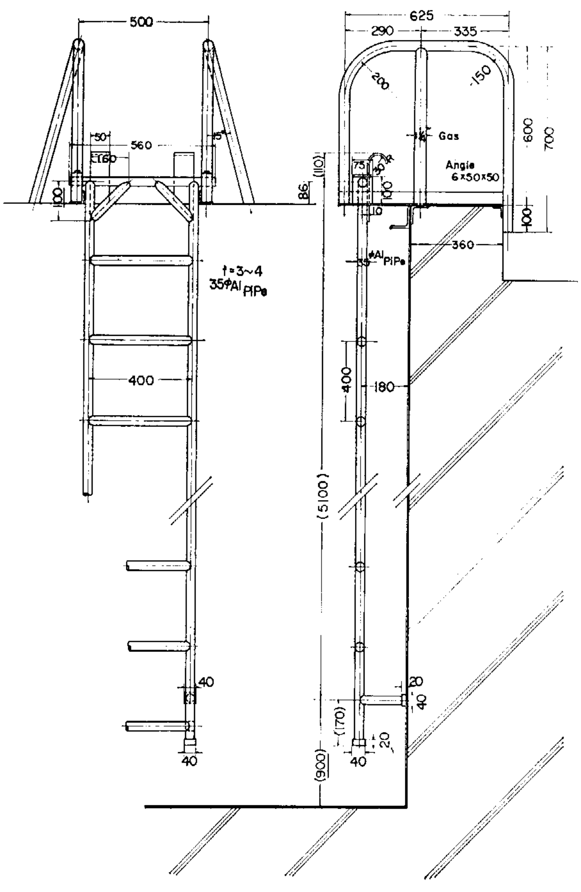


Fig. 8 Radder

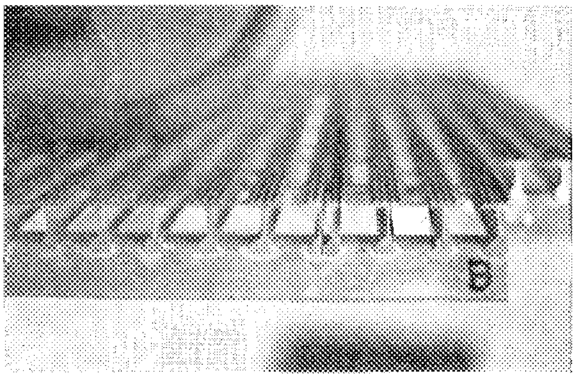


Fig. 9 Side view of aluminum grating

handling the irradiated fuels and so on, and this iron grating was replaced by the aluminium one which is light and could be handled by even one hand (Fig. 9 and Fig. 17 (a)).

3.2 Circulation and Purification System

3.2.1 Pump Priming

The suction of the circulation pump was designed as simply as possible, taking into account the maintenance and repair of the system; that is, the foot valve was not used and the self-priming type (pump) was adopted for the circulation pump. After having tested the circulation pump, it was found that the pump was able to prime only in very small head difference and moreover, much time was required to prime. Priming device (removable) with the vacuum pump and silica gel was then used for this purpose (Fig. 10). Silica gel was set before the vacuum pump, and 5 liter glass bottle was used for the surge tank. Air tightness of the suction side of the pump was good and no priming is requested after about one week shut down of the circulation pump.

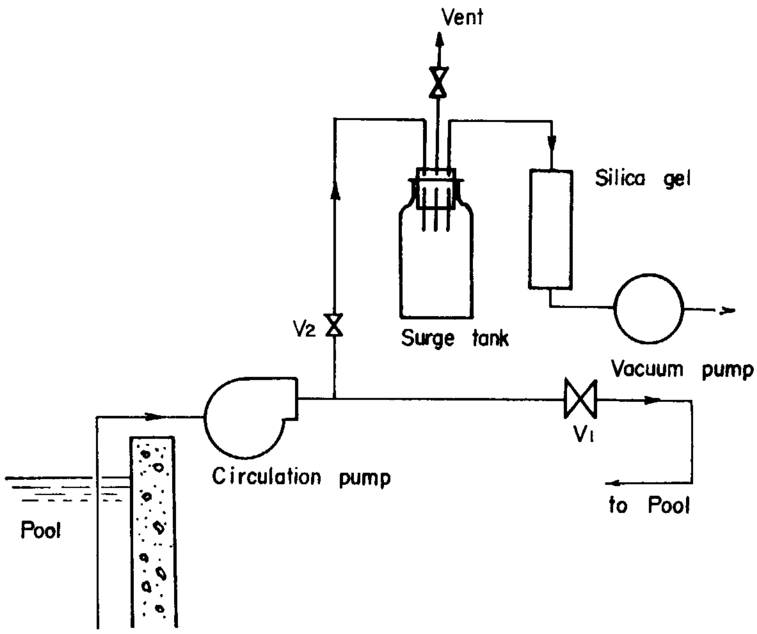


Fig. 10 Flow sheet of priming system

3.2.2 Piping

The piping of vinyl chloride was used because of considering its less corrosive effect on the irradiated fuel-cladding, aluminum. No particular trouble has been encountered and no large vinyl chloride valve (more than 1 inch) was changed for these 6 years. As the vinyl chloride pipe is very weak against load or blow, we have had a few experiences of breaking the small valve for shutting off too tight; and one has to design this piping carefully at this point. Piping should be made so as its repair and change to be easy, if necessary, with the consideration that the pipe and valve might be contaminated, or ruptured.

3.2.3 Flowmeter and Thermometer in System

The flowmeter of the integrating type was firstly set in the circulation system for taking data quantitatively. However, the flow rate could be estimated by the pressure at the circulation pump delivery, using the pump characteristics curve. Moreover, the operaters appreciate simple operation method or procedure. Then the integrating flowmeter was taken off and the pressure at the circulation pump delivery is now specified for its operation.

The rotar-meter type flowmeters were set before the ion exchangers for the purpose of checking the blockade of the ion exchangers and also the proper flow rate through them. This flowmeter requires simplicity and visibility with small pressure drop. Until now we have had no trouble at all and the meters operate satisfactorily.

Two types of simple thermometers were used in the system; one is the alcohol thermometer in a stainless steel sheath (**Fig. 11**) and the other bimetal which issues alarm at high temperature of the pool water (**Fig. 12**).

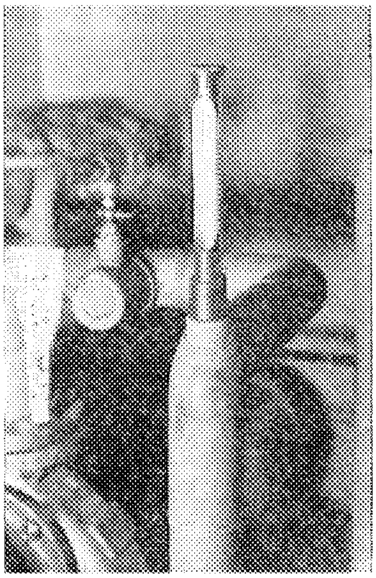


Fig. 11 Thermometer (Alcohol)

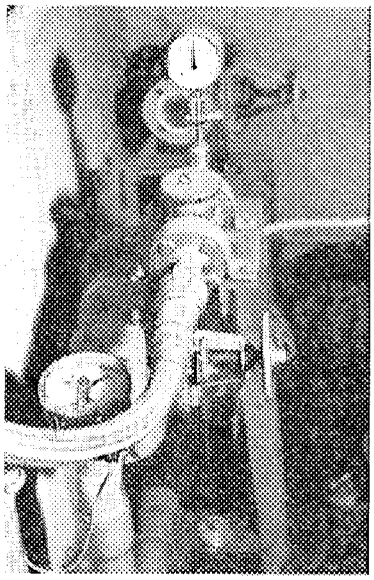


Fig. 12 Thermometer (Bi-metal) and pressure gage of pump delivery

3.2.4 Purification System

(A) Ion exchanger

The capacity and the water flow rate of the ion exchanger were so determined that the quality of the pool water might be maintained in the range written in section **2.2**, and at the same time the ion exchange resins may be changed about two or three times a year. These values are listed in section **2.2** (C) and it may be considered that the above aim and design criteria is achieved as shown in **Fig. 13**.

The used ion exchange resins are now thrown away instead of regenerating them. The ratio of the anion resin to cation resin in the ion exchanger was taken as 2 which is the same as the one specified for the ion exchanger of the JRR-2. Recently the radioactivity of the ion exchanger is becoming higher, and the pre ion exchanger shielded by the lead was set just before the ion exchanger for absorbing the radioactivated ions (**Fig. 6**).

As the density of the ion exchange resins is nearly 1, the changing the ion exchange resins is easily done by the water flow (hydraulically). The filters are usually set before and after the ion exchangers, the former is for catching the dusts and preventing the blockade of the ion exchanger and the latter for preventing the ion exchange resins (broken) to leak out. The water in the pool was considered very clean and the filters were eliminated in this system.

It may be reasonable that the ion exchanger is designed in a very simple form taking into account the shielding and changing the ion exchange resins hydraulically, etc. At the same time, it may be preferable that the ion exchanger is placed in the shielded room or designed to be shielded easily if the radioactivity of the resins becomes high.

(B) Water treatment

The pool water circulation and purification system is now operated in the following procedures.

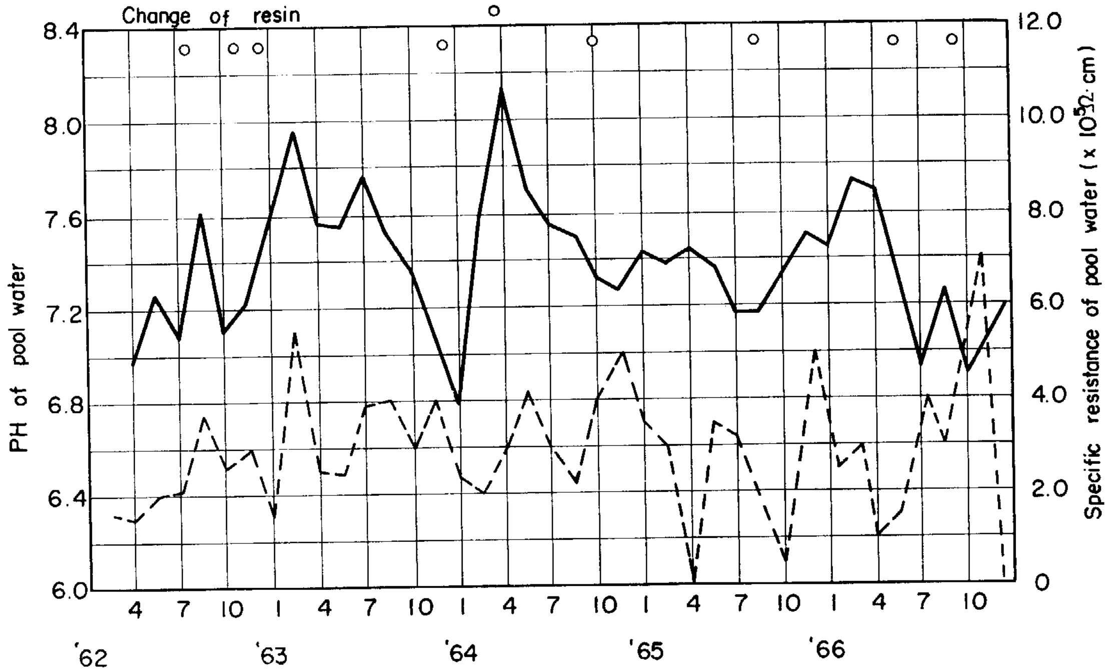


Fig. 13 Quality of pool water

(a) 8 hours operation in a day at the flow rate specified in the section **2. 2**,

(b) The demineralized water is supplied one or two tons every two weeks,

(c) pH and specific resistance of the pool water are checked every day, and continuous measurement of them will be made before long,

(d) The radioactivity of the pool water is always monitored by the scintilation counter set

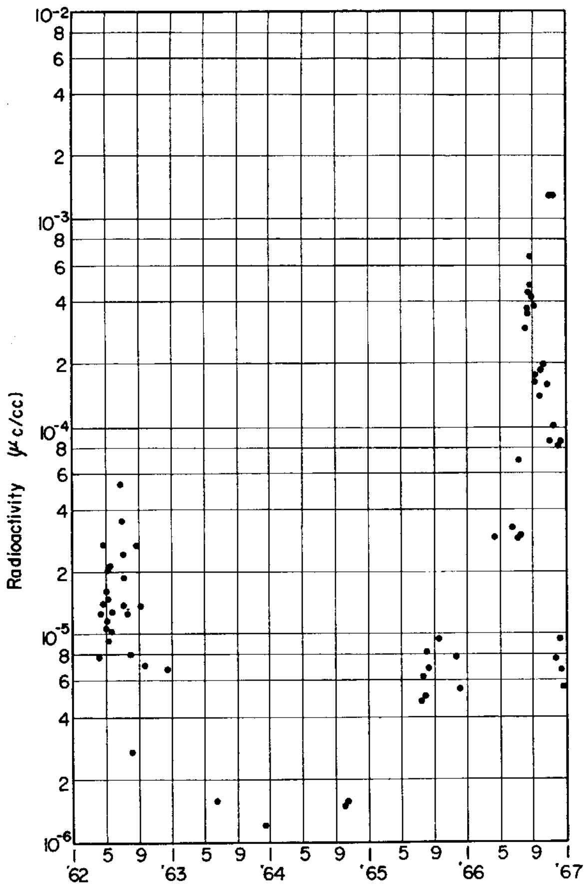


Fig. 14 Radioactivity of pool water

in the ion exchanger; and also water sampling is made once in a while, especially when the irradiated fuel is put into the pool.

Operation data of this system, pH, specific resistance and radioactivity of the pool water, changing period of the ion exchange resins, are shown in **Fig. 13** and **Fig. 14**.

It may be said that no algea is found to grow in the pool water by using the demineralized water and eliminating the stagnant place in the pool: and at the same time it is necessary to remove organic matters at the raw water treatment facility.

3. 2. 5 Removing Dusts in Pool

The dusts floating on the water surface could be removed easily by the following procedures:

(a) The overflow line is shut off and the demineralized water is supplied into the pool, until the water level be raised one or two centimeters above the line,

(b) Then the valve of the overflow line is opened and the dusts are entrained by the water flow to the overflow line.

The overflow pipe head is something like dish as shown in **Fig. 15**. It was found that dusts on the pool water could not be removed by the water supply at the rate of about 1 ton/hr or so, in our case.

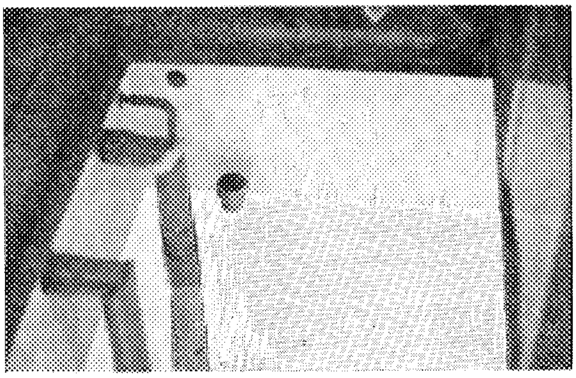


Fig. 15 Overflow pipe head

The dusts on the bottom of the pool may be cleaned or gathered by the method of something like the vacuum cleaner, using the circulation pump and filter in the system. The pipe size of this apparatus was first taken as two inches, however, this was heavy to handle easily. It may be said that about $1^1/_4$ inch of aluminum pipe is handy to operate.

3. 3 Irradiated Fuel Storage Rack

The first irradiated fuel storage rack was made as shown in **Fig. 16**, and each irradiated fuel is surrounded with the 1 mm thick Cd plate. The openings of the rack for the irradiated fuels were square, considering the shape of the fuels, MTR type. However, some difficulty was found in inserting the irradiated fuels into the square openings; direction of the fuels should be considered when inserting and at the same time some deformations or errors of squareness of the fuels as well as openings were estimated. This consideration made us to manufacture new racks with circular openings; each irradiated fuel is accomodated by the double aluminum cylinders between which is inserted Cd plate (**Fig. 17** (a) and (b)).

After three years service of the initial irradiated fuel storage rack, the 1 mm thick Cd plates were deformed as shown in **Fig. 18**; and one Cd plate stuck to the irradiated fuel, and the corrosion was observed on the contact of the irradiated fuel surface.

Then these initial irradiated fuel storage racks were immediately removed and the new racks

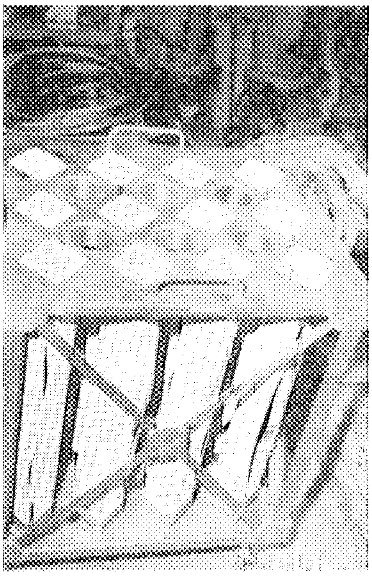


Fig. 16 First irradiated fuel storage rack

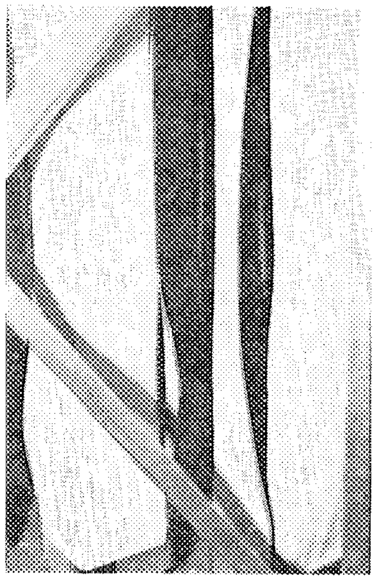


Fig. 18 Deformation of Cd plates

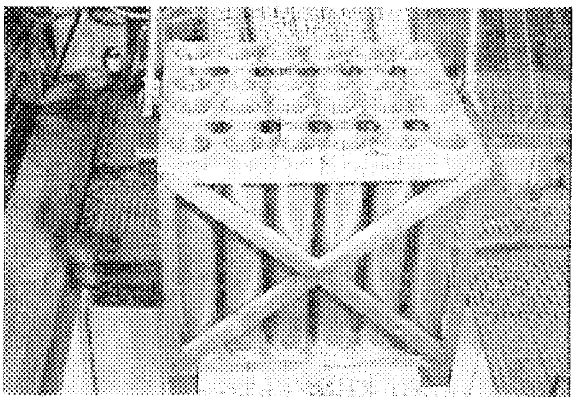


Fig. 17 (a) New irradiated fuel storage rack

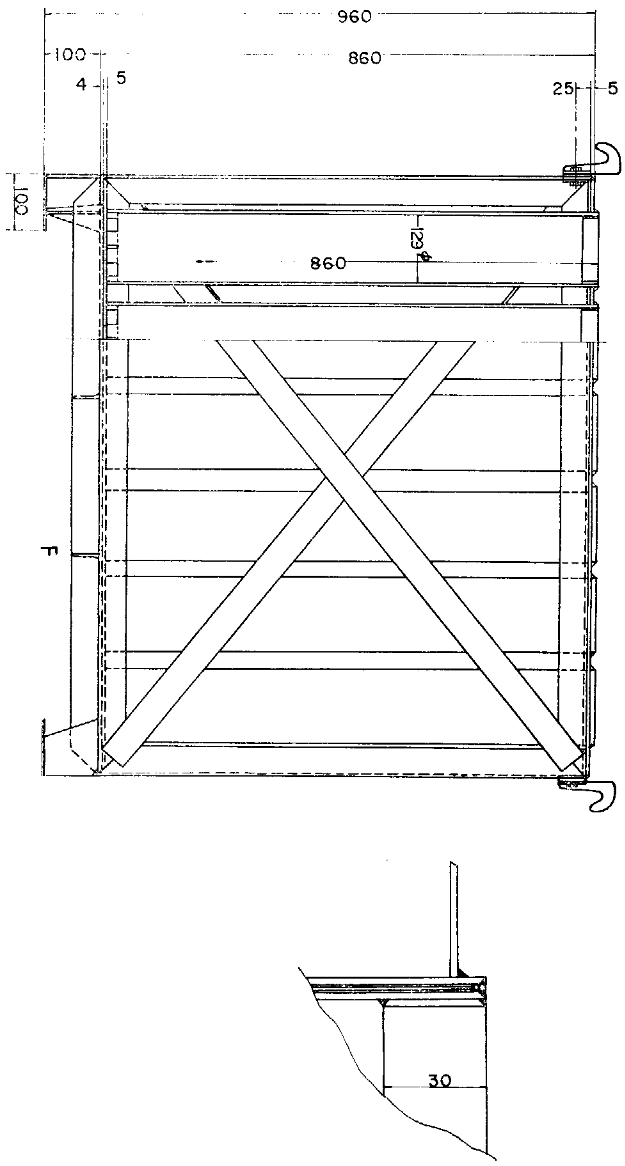


Fig. 17 (b) Irradiated fuel storage rack mentioned above were set in the pool, which made us easily to insert the irradiated fuels into the storage racks.

3. 4 Handling Tools

The following is our feelings and findings through the experiences on the facility.

(a) The handling tools for the pool facility should be so designed to handle easily in the vertical direction, especially.

(b) The maximum weight to be handled easily by the operater is about 5 kg and the proper grip diameter of the handlers is 30 to 35 mm or so. These facts should be in mind when designing the handling tools for the pool facility.

We did not realize above items deeply when designing and making the first handling tool (for handling the cut irradiated fuel) which was heavy and floated on the water surface by the float (**Fig. 19** (a) and (b)). This fact gave us much difficulty to handle this handling tool in the vertical direction which means it takes much time to grab the cut irradiated fuels and other materials in the pool. Then the new handling tool with the design criteria of less than 5 kg of the total weight using the aluminum mainly, was made, as shown in **Fig. 20** and **Fig. 21** (a).

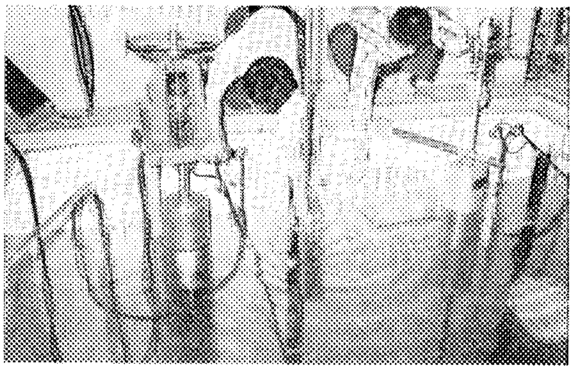


Fig. 19 (a) Fuel handling tool (Floating type)

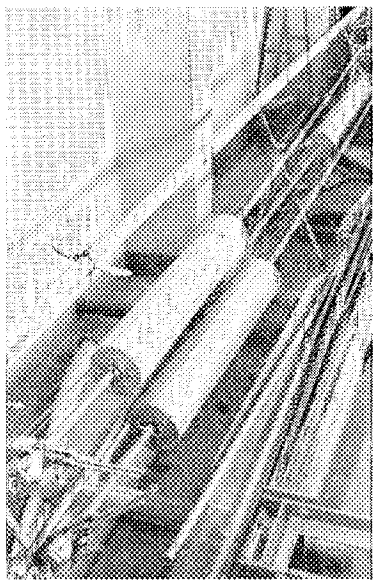


Fig. 19 (b) Fuel handling tool (Floating type)

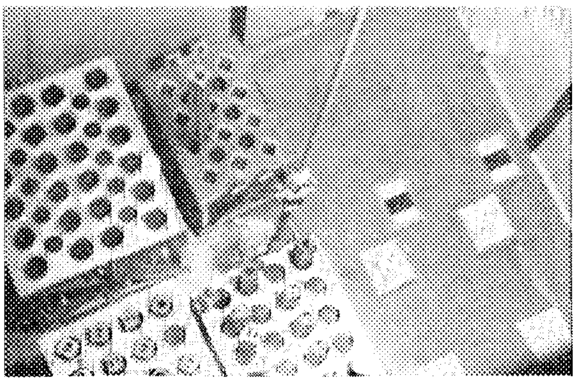


Fig. 21 (a) Handling fuel in pool

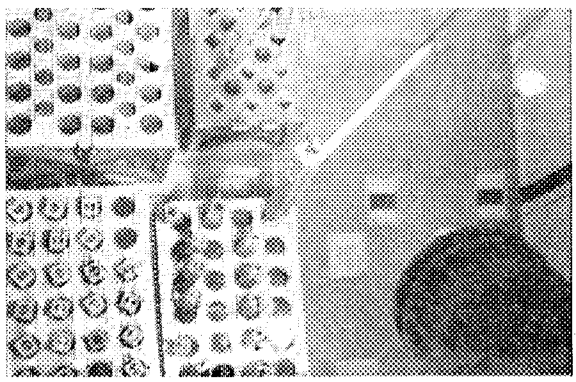


Fig. 21 (b) Handling fuel in pool

Another simple hook type handling tool is also used for handling uncut irradiated fuels (**Fig. 21** (b) and **Fig. 22**). It may be preferable that the locking mechanizm is equipped on the hook part in this type of the handling tool.

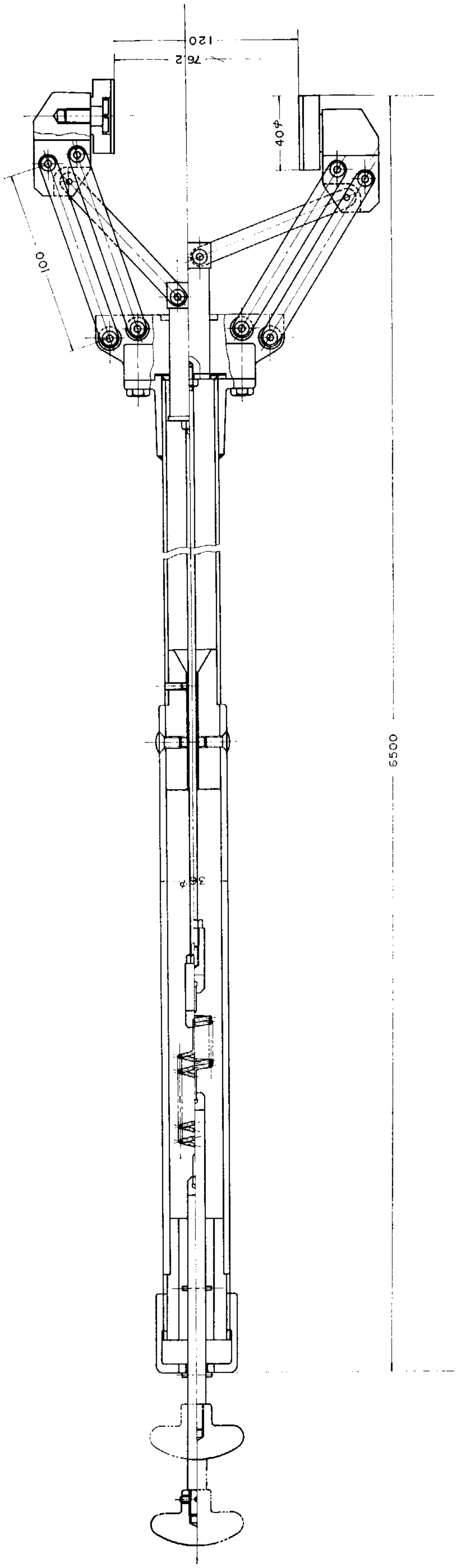


Fig. 20 Handling tool

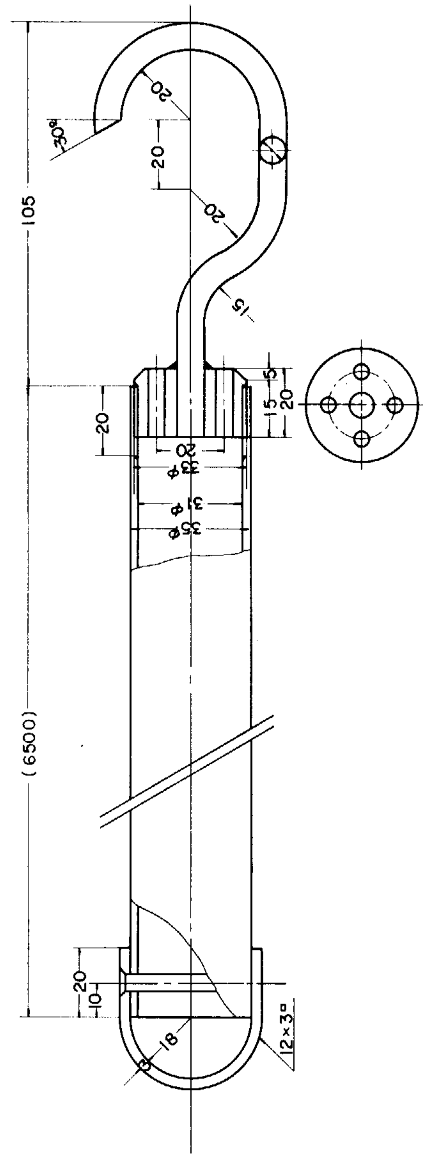


Fig. 22 Fuel handler

3.5 Gamma Irradiation

3.5.1 Gamma Irradiation Hole

Two gamma irradiation hole were constructed in the concrete pool wall for rather large things or materials which could not be irradiated in the pool water; and square shape of the hole was adopted with the consideration written in below.

(a) Easy to accomodate the materials or things to be irradiated,

(b) Plugs could be easily handled even with one hand, if the rollers be set at the bottom of the plug whose weight is about 1 ton.

The plug handling may be seen in **Fig. 23**.

3.5.2 Gamma Irradiation Can

Rather small materials or things could be put in the can which is set in the irradiated fuel storage rack. This gamma irradiation can is shown in **Fig. 24** (a) and **Fig. 24** (b)

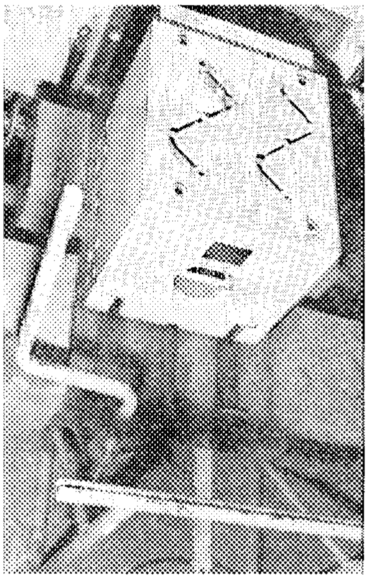


Fig. 23 Handling plug of gamma irradiation hole (S type ditch is for lead wire)

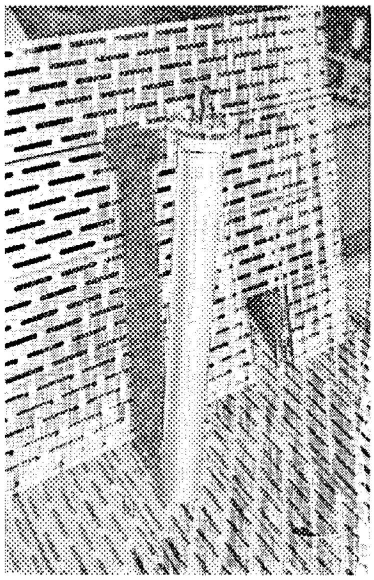
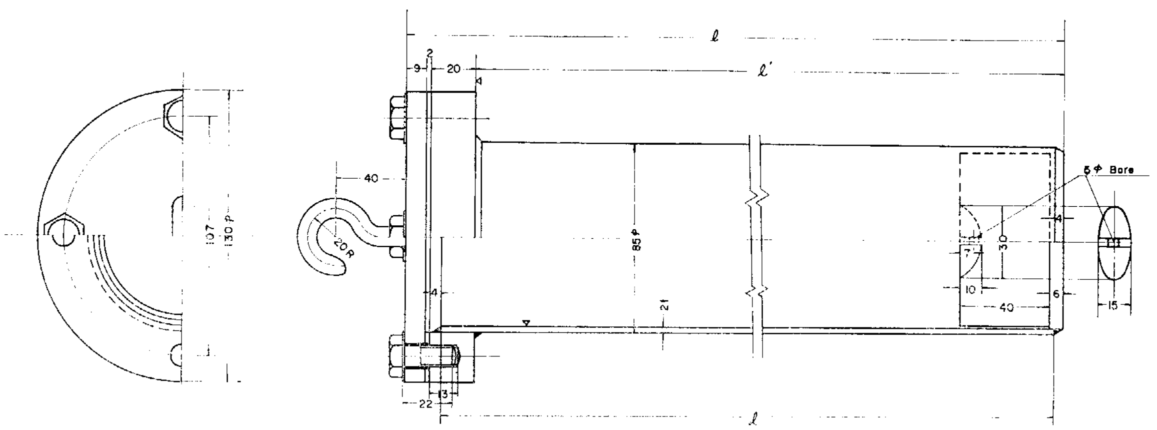


Fig. 24 (a) Gamma irradiation can and aluminum grating



	L	l	l'
long	790	775	759
short	590	575	559

Fig. 24 (b) Gamma irradiation can

3.6 Ruptured Fuel Can

When the irradiated fuel be ruptured in the pool, the ruptured fuel should be accomodated in the can, so that the radioactive fission products in the ruptured fuel may not disperse in the pool. Two types of the ruptured fuel cans were prepared for this purpose: the one is made of the stainless steel and the other is of aluminum.

(A) Stainless steel ruptured fuel can

This can is used when the ruptured fuel is stored for long time and the ruptured fuel can be inserted into the can without cutting. The outlook of the can may be seen in **Fig. 25**. The lid of the can consists of two parts; the part with the screw and part with the packing or neoprene (**Fig. 26** (a)) and they are connected by the pin joint. Therefore, the part with the neoprene would not be rotated while the former is screwed, and packing or neoprene may be protected against being torn.

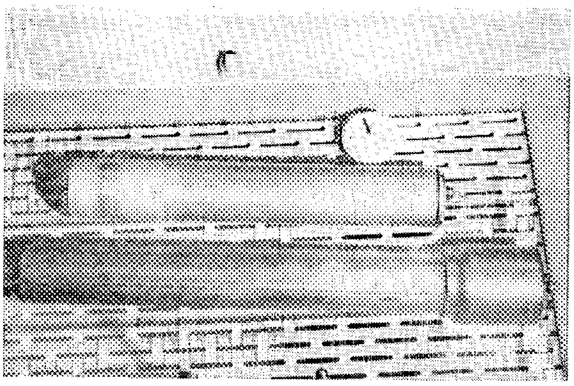


Fig. 25 Ruptured fuel can

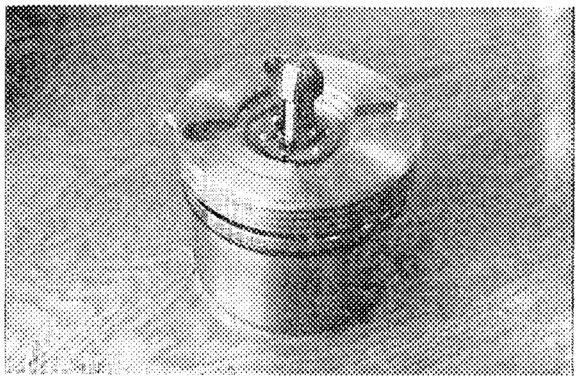


Fig. 26 (a) Lid of ruptured fuel can (Stainless steel)

(B) Aluminum ruptured fuel can

The aluminum ruptured fuel cans were made following the ICPP's (Idaho Chemical Processing Plant) irradiated fuel receiving criteria, which specifies the materials of the can, maximum dimensions of the can, etc.

The U shape hook is attached on the lid for handling the can easily with the hook type of the handling tool (**Fig. 26** (b)), and the triangle supports are set on the bottom of the can (inside) so that the natural cooling may easily be made (**Fig. 27**). The mechanism of rotating the lid and its handling tool are seen in **Fig. 28**.

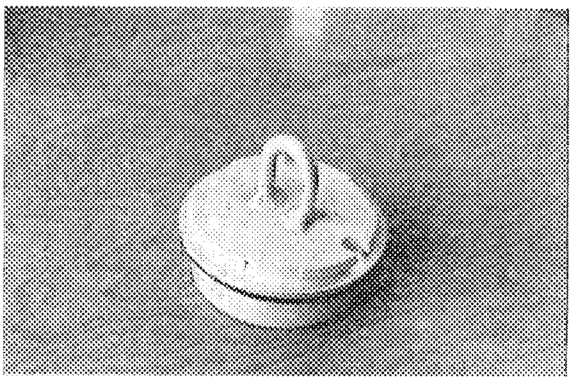


Fig. 26 (b) Lid of ruptured fuel can (Aluminum)

3.7 Irradiated Fuel Cutting Machine

The hacksaw (rotating type) of the cutting machine for the irradiated fuel was first made, however, some troubles occurred.

(a) The saw dusts were dispersed in the pool when the fuel (mock up) was cut, mainly

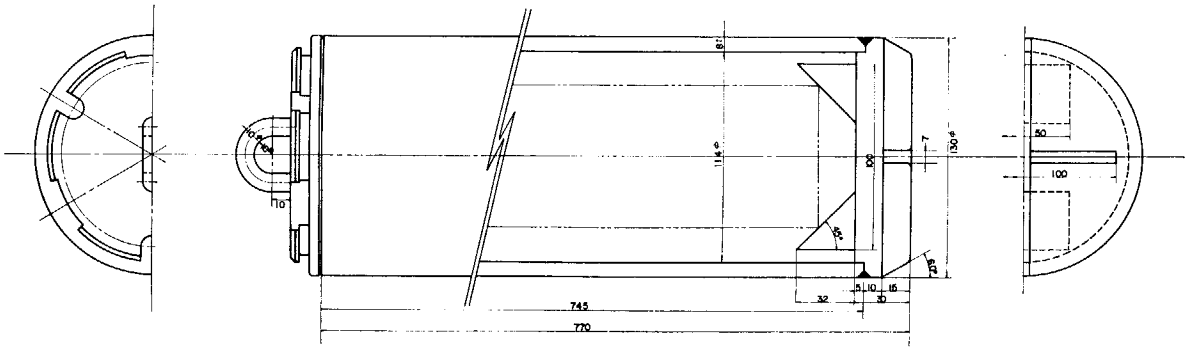
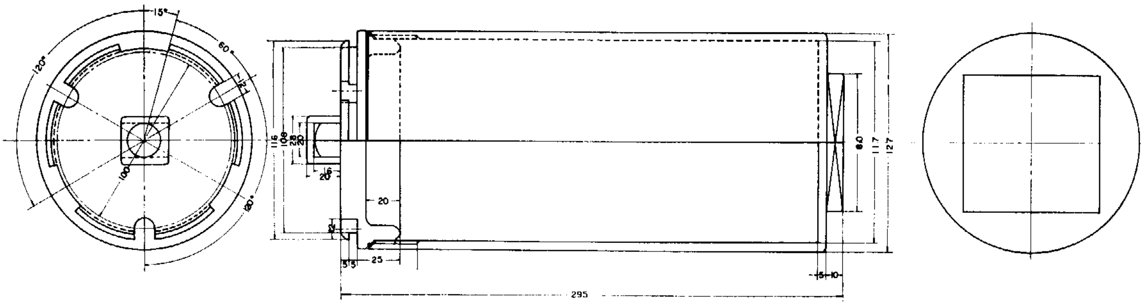


Fig. 27 Aluminum ruptured fuel can



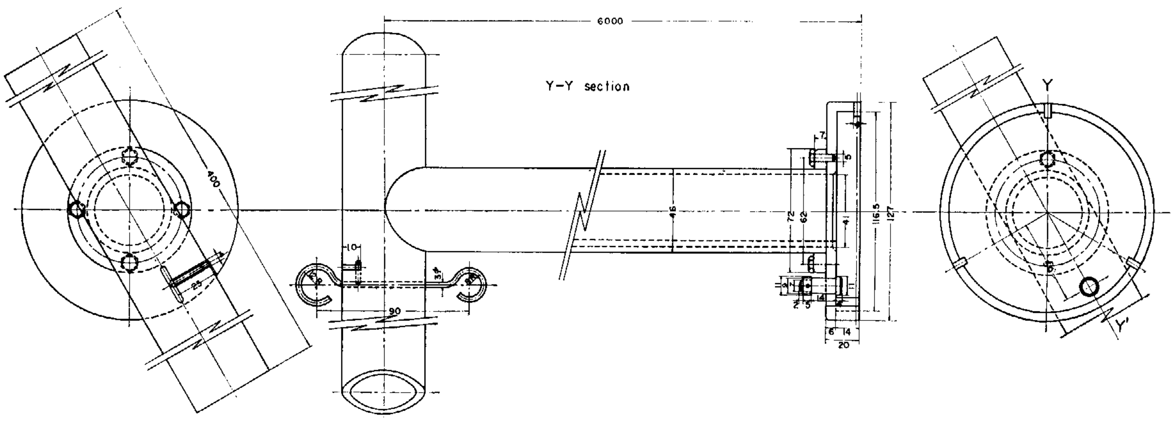


Fig. 28 Handling tool for rotating lid of ruptured fuel can

because of its cutting speed was high,

(b) The saw blade was soon rusted in the pool,

(c) Changing the blade was a big job, in our case, which was only made after the cutting machine was taken out of the pool.

About 2 m high walls were set around the cutting machine to keep the dispersed dusts inside the walls. However, the aluminum saw dusts could fly over the walls and they were dispersed all over the pool bottom, because of high cutting speed. The reciprotype cutting machine with rather low cutting speed is preferable for cutting MTR type aluminum cladding fuels to prevent the saw dusts dispersing. At the same time, it may be considered reasonable that the irradiated fuel cutting area is separated from the area where the irradiated fuels are stored, from the standpoint of contamination.

Acknowledgement

The authors wish to express their gratitude to Mr. O. HORIKI, Mr. H. TOMIOKA and other members who have been engaged in the JRR-2 irradiated fuel storage facility, for their cooporation in this work.