A description is given of the model of the indium-gallium loop of the IRT-2000 reactor, which is intended to produce a γ field with high dose power. The loop has been set up on the IRT-2000 research reactor in Tiflis. The use of the loop considerably enlarges the experimental capabilities of the reactor. The first data is given on the engineering use of the loop along with the formulas used in calculating the γ radiation power.

The question of producing a powerful source of pure γ radiation consisting of a reactor radiation loop was discussed by Yu. S. Ryabukhin and A. Kh. Breger in [1]. These authors together with E. N. Volkov and S. G. Tul'kes, a member of the staff of the Institute of Physics, Academy of Sciences, Georgian SSR, proposed a modification of the radiation loop using indium-gallium alloy [2] for the type IRT-2000 reactor described in [3]. This modification was not used for a number of engineering reasons.

The authors showed that the physical and constructional constants of the IRT-2000 reactor make it possible to get a γ radiation source equivalent to $10^4-10^5$ g of radium. Using liquid alloy makes it possible to have radiation set-ups of almost any configuration as well as to vary the dose power. Using the source described here considerably enlarges the experimental capabilities of the IRT-2000 reactor.

The γ carrier can be any one of the substances with the constants given in Table 1 [4].

In order to get constructional data as well as find the operating properties of the working liquids, which are the γ radiation carriers, a model of the radiation loop was set up in the Institute of Physics, Academy of Sciences, Georgian SSR, using a type of construction differing from that originally proposed in [2]. This is an experimental continuation of the theoretical and design work already done in the L. Ya. Karpov Scientific Research Physical Chemical Institute and the Institute of Physics, Academy of Sciences, Georgian SSR, together with the I. V. Kurchatov Institute of Atomic Energy, Academy of Sciences USSR, and the Institute of Physics, Academy of Sciences, Latvian SSR, in accordance with the general plan of work on the radiation loop.

It was decided at the start to set up the model of the radiation loop using indium-gallium alloy. The alloy was to be circulated in a closed system where it would be irradiated in the reactor and then the activated nuclei (mainly In$^{116}$) would be taken outside. Indium has a large activation cross section (145 barn). It is also convenient because it has a short half-life equal to 54 min and saturation of the activity is reached in several hours. At the same time, after the apparatus has been shut down, it can be got at after several days.

The work on the loop model was carried out on the apparatus shown diagrammatically in Fig. 1. The apparatus contains the following units:

1. The part which generates the activity in the alloy, consisting of a plate with slit-like grooves that the alloy circulates through (Fig. 2) and located in the active part of the test channel. The volume of alloy in the generator is ~ 130 cm$^3$, and the thickness of the alloy layer is ~ 2.5 mm.

The construction of the activity generator is similar to that described in [2]. This construction cannot be considered final, and it is intended in future to try out a generator made with tubes of the same cross section as the main tubing in the loop.
<table>
<thead>
<tr>
<th>Principal radiating isotope</th>
<th>Half-life of isotope</th>
<th>Predominate $\gamma$ energy, Mev</th>
<th>State of $\gamma$ carrier</th>
<th>Maximum specific $\gamma$ power, watts per liter</th>
<th>Energy accumulated per captured neutron, watt$\cdot$sec$^{10^{19}}$</th>
<th>Neutron absorption cross section of $\gamma$ carrier, cm$^{-1}$</th>
<th>Notes</th>
</tr>
</thead>
</table>
| Na$^{24}$                   | 14.94 hours         | $\begin{cases} 2.75 \\
1.37 \end{cases}$ | Liquid metal             | 20                              | 6.8                            | 0.122                           | t$_{m.p.}$ = 97°C, $\rho$ = 0.92 g/cm$^3$ |
| Mn$^{56}$                   | 2.584 hours         | 2.1                           | $36\%$ solution of MnSO$_4$ in water | 17                              | 1.44                            | 0.048                           | Solution close to saturation at $t = 20^\circ$C, $\rho$ = 1.44 g/cm$^3$ |
| Mn$^{56}$, Br$^{82}$        | 2.584 hours 18.0 min | 2.1                           | $60\%$ solution of MnBr$_2$ in water | 39                              | 1.57                            | 0.100                           | Solution close to saturation at $t = 20^\circ$C, $\rho$ = 1.9 g/cm$^3$ |
| Br$^{82}$                   | 1.5 days            | $\begin{cases} 1.3 \\
0.84 \\
0.77 \end{cases}$ | Liquid metal             | 54 min                          | 1.37                           | 7.2                             | $\rho$ = 1.2 g/cm$^3$ |
| In$^{115}$                  | 54 min              | $\begin{cases} 2.1 \\
1.49 \\
1.08 \\
0.41 \end{cases}$ | Liquid metal             | 54 min                          | 12.5% solution of In$_2$ (SO$_4$)$_3$ in water | 55                              | 2.2                            | t$_{m.p.}$ = 156.4°C, $\rho$ = 7.0 g/cm$^3$ |
| In$^{116}$                  | 54 min              | $\begin{cases} 2.1 \\
1.49 \\
1.37 \\
1.08 \\
0.41 \end{cases}$ | Eutectic alloy:           | 3600                            | 56% In                          | 4.8                             | t$_{m.p.}$ = 73°C, $\rho$ = 8.3 g/cm$^3$ |
| In$^{116}$                  | 54 min              | $\begin{cases} 2.1 \\
1.49 \\
1.37 \\
1.08 \\
0.41 \end{cases}$ | Eutectic alloy:           | 3150                            | 52% In                          | 4.2                             | t$_{m.p.}$ = 60°C, $\rho$ = 7.9 g/cm$^3$ |
| In$^{116}$                  | 54 min              | $\begin{cases} 2.1 \\
1.49 \\
1.37 \\
1.08 \\
0.41 \end{cases}$ | Eutectic alloy:           | 1300                            | 28% In                          | 1.7                             | t$_{m.p.}$ = 5°C, $\rho$ = 6.8 g/cm$^3$ |
| In$^{116}$                  | 54 min              | $\begin{cases} 2.1 \\
1.49 \\
1.37 \\
1.08 \\
0.41 \end{cases}$ | Eutectic alloy:           | 1100                            | 22.5% In                        | 1.66                            | t$_{m.p.}$ = 15.8°C, $\rho$ = 6.8 g/cm$^3$ |