BOILING OIL

BY

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One of the headaches of those who try to produce equipment for an all-ocean navy is that of keeping things neither too hot nor too cold.

A tiresome example is that of the oil in gunnery servo systems. In the design of the Oil Servo Units Marks 3 and 5, a temperature of 53° C. was selected as a reasonable ' high ' for tropical working conditions. The system was provided with electric heaters controlled to switch out at this temperature, the theory being that the heaters would be left on when at short notice and a temperature of about 53° C. would be maintained throughout. In the case of the Mark 5 Servo, temperature compensation was also fitted to the dashpot orifice so that the unit works reasonably uniformly between the temperature range 32°–53° C.

Unfortunately these precautions were, in the event, not enough, for it has been found that even in moderate ambient temperatures, about 30 minutes running of the mounting in simple harmonic motion is required to allow oil to flow through the heater tank and the servo-valve to heat it to the required temperature. On cold days it is quite impossible to reach 53° C. or even the modest 32° C. demanded by the Mark 5.

The causes of the trouble are, primarily, no circulation of oil through the heater tanks while shut down and when this is arranged by running the pump, too much oil in the dead ends of the servo units themselves.

Even if we were to consider mountings flipping about at high speed in all directions as a satisfactory stand by condition, it still appears that the heat dissipation from pipes and boxes is more than the heater is making up.

It is hoped to rectify matters by fitting a viscometric dashpot compensator to the Mark 3 Oil Servo Unit. This will ensure that the unit gives its designed response over a fairly wide range of Reynolds' numbers. Unfortunately, this modification will take time to design, test and carry out.

Mountings being modernised will be fitted with a pump arrangement which will allow continuous running, larger heaters and a small bleed hole to allow continuous circulation of oil through the servo units.

A simple trick which is up the sleeve, as it were, is to fill the system with OM-13 while in cold climates ; this gives a viscosity corresponding to that of OM-35 at 53° C., at about 29° C. which will be much more easily attainable. The viscosity index of this oil is not as good as OM-35, however, so the temperature is more critical.

As regards heat radiation from the pipes of the system, lagging has been considered but it is of doubtful value because either it might increase the dissipation due to the increase in area, or, if not, it might raise the temperature too high when working in tropics. Such doubts are difficult to ' lay ' by tests.

A letter from Messrs Vickers Armstrongs, Research Department, reproduced below, gave a new slant on the problem :

' It had been suggested that heating losses from piping would be reduced if flexible rubber hose were used instead of thin copper pipe.

'Polished copper pipe, $\frac{3}{4}$ in. bore $\times \frac{1}{16}$ in., $\frac{3}{4}$ in. bore dirty copper pipe and $\frac{3}{4}$ in. bore $\times \frac{3}{16}$ in. rubber hose were filled with hot water and the relative cooling rates determined as they cooled through 58° C. The pipes were mounted nearly horizontal in fairly still air in the shop. The dirty copper pipe lost half as much heat again as the polished one ; the rubber hose a little more than the polished copper pipe, the actual figures being :—

Polished copper pipe	1.00
Rubber hose	1.06
Dirty copper pipe	1.49

' Dare we suggest an issue of " blue-bell " as a palliative ? '

The author, mindful of the injunctions in other articles in the *Journal* against the ingress of abrasives into the inside of such system and weighed down by the thought of the years which separate him from the schooldays which the letter above recalls, is comforted by the thought that some progress has been made since the day when a faulty stop valve was found to be held open by a tin of ' blue bell ' under the valve.