

AVIATION SPIRIT SYSTEMS IN H.M. SHIPS.

The operation of aircraft under war conditions has emphasised the vital need for preventing water gaining access to the engines of aircraft. Although means are provided in air displacement petrol systems for ridding petrol tanks of any water that may have accumulated, experience has proved that it is not always possible to clear the systems of water under operational conditions, and even with the utmost care, water still finds its way in small quantities to the aircraft engines.

The possible sources of water finding its way into storage tanks and system are:—

- (a) From fuel received from petrol tankers or shore supply.
- (b) By leakage from surrounding flood water.
- (c) By condensation.

Water may also be found due to:—

- (d) Condensation in hoses.
- (e) Condensation in aircraft tanks.
- (f) By admission of spray through filler caps when fuelling aircraft tanks on flight deck.

With a view to overcoming these difficulties a Series Tank water displacement system has been evolved which will be fitted in 1942 fleet carriers, 1943 light fleet carriers and in new construction.

The advantages of the Series Tank water displacement system over other systems are:—

- (i) Valves and fittings are drastically reduced and operation is much simplified.
- (ii) Petrol delivery is taken from the top of the last tank of the group and it is improbable that the water-petrol cleavage line will ever approach this point.
- (iii) Avoidance of a large number of delicate instruments such as float operated liquid indicators, line level gauges and float operated discharge valves, which are of importance for the correct operation of the U.S.N. water displacement system.
- (iv) The only delivery pump required is operated on the salt water side and a pump handling petrol with possible associated troubles of vapour adjacent to leaky pump glands is avoided.
- (v) Operation of draining back is simplified.
- (vi) Considerable simplification and speeding up of existing methods of cleaning and ventilating of tanks prior to entry.

The Series Tank water displacement system comprises cylindrical storage tanks of existing design, tested to 100 lbs. per square inch pressure arranged in groups of four or more as convenient. The tanks, say numbers 1 to 4, are connected in series, water being supplied from an 11,000 gallon per hour air-driven salt water pump at a pressure of 50 lbs. per square inch to the bottom of Tank No. 1, thus displacing petrol from the top of Tank No. 4 through a meter to the petrol delivery lines to the hangars.

The salt water pump takes suction from a branch on the seacock provided for flooding the petrol tank compartment. Alternative salt water supply is provided from the firemain. An overboard discharge pipe with shut off valve

is led from the pump delivery pipe to the bottom of No. 1 Tank. The overboard discharge valve is left open when the system is not in use, thus catering for any expansion of the liquid due to change of temperature.

Filling and draining lines entirely separate from the delivery line are provided, thus ensuring freedom from contamination of the latter system in the event of taking in water from petrol tankers. When filling the systems, petrol is delivered to the top of Tank No. 4 and water is discharged overboard from the base of Tank No. 1. Test cocks are arranged at suitable positions on the four tanks led to a closed test vessel. These enable a check to be made on the approximate position of the water-petrol cleavage line, which it should be possible to estimate closely by the meters provided.

Provision is made for emptying and ventilating the system prior to cleaning of tanks by means of:—

- (i) Circulating salt water to overboard through a portable pipe connection.
- (ii) Blowing residual salt water overboard using L.P. air.
- (iii) Ventilating by circulating L.P. air through tanks.

Apart from the possible risk of corrosion, inherent in a water displacement system, and which it is hoped to overcome by the use of suitable corrosion resistant paints on the tank surfaces, the disadvantages are:—

- (a) A leaky tank or tank manhole joint will allow petrol to pass into the surrounding flood water when the tanks are under pressure with the resulting possibility of dangerous concentrations of petrol vapour in the petrol tank compartment. Such defects are, however, very rare and only one case has been reported.
- (b) The possibility of chemical action between leaded petrol and salt water. Laboratory experiments indicate that there is little to fear from this source. Should it occur it will be confined to a layer closely adjacent to the cleavage line which, as stated above, should never approach the delivery point.

The system is shown in the diagrammatic arrangement in Fig. 1 opposite.