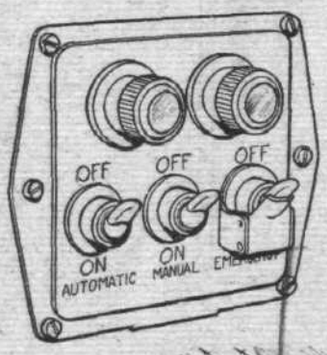
De-icing for To-day

The T.K.S. Fluid System Described : Ingenious Distribution and Regulation Methods : Automatic Protection

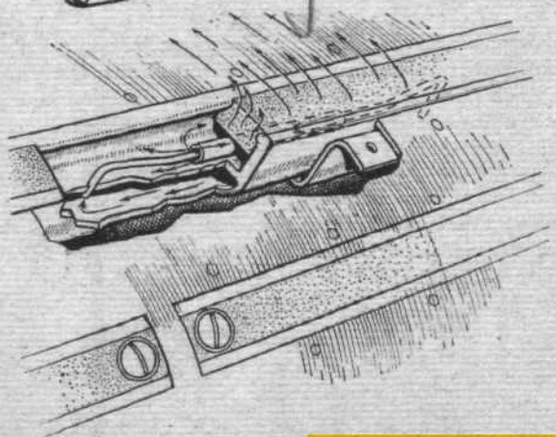
IT has become customary nowadays to consider that aircraft de-icing will eventually be done by thermal means, and certainly one or two projected civil designs, both here and in America, have been planned with the use of this system in view. Nevertheless, and whether or not thermal methods of protection eventually become the accepted practice for large aircraft capable of economically carrying the necessary equipment, a good deal of experimental work is still necessary before they can be considered to have "arrived."

In the meantime a considerably improved version of an older system is being fitted to nearly all the British civil transports now in course of prototype development or production. The present Air Registration Board regulations virtually require that all civil aircraft must be fitted with some form of aerofoil, airscrew and windscreen de-icing system, and, though the method to be used has been left to the discretion of the manufacturers, the latter are naturally going ahead with the installation of equipment which is now available and which has the capacity to do the job.

This equipment, the T.K.S. (of which the letters are made of the names Tecalemit, Kilfrost and Sheepbridge Stokes, thus indicating something of the origin of the components), can, as a matter of history, be fairly considered to be the direct heir to the Dunlop system, which was originally developed and tested by Farnborough. In it a special de-icing and anti-icing fluid was fed to porous overshoes in the leading edges.



The T.K.S. distributors and control panel in their latest form. The porous "spreader" is flush with the leading edge.



Endurances

The same principle is used to-day in the T.K.S. system, though the methods of distribution and regulation have been very much improved, and the fluid itself has been modified in its constituency to permit greater economy and endurance in operation. So much so that the equipment in an aircraft of the Tudor size has an endurance, at the normal rate of feed, of something like five hours or, with heavy icing emergency delivery, of more than an hour. Since the object of all meteorological reports and of all-weather flying is that of avoiding icing conditions as far as possible, such endurances should be more than ample. Incidentally, the total weight of the equipment carried is less than half that of the fluid, so it is obvious that, for shorter-stage journeys, the total figure concerned may be reduced accordingly. In the case of the Viking installation, for instance, the equipment itself weighs 145lb, while the fluid, when a maximum supply is carried, weighs 160lb.

Two major problems have had to be overcome in the course of development of the T.K.S. system. The first being that of regulating the flow at the surfaces so that the fluid will quickly reach all essential points and yet not be wasted, and the second that of initial regulation for different conditions.

The regulation and accurate dissipation at the surfaces is completed by special distributors which are built into the leading-edge structures in positions and in numbers according to the particular requirements. A large aircraft, for instance, might have triple lengths of distributor inboard, two at the mid-section, and one near the tip; while a single strip only might be required for the tailplane and fin leading edges.

The construction and operation of the distributor may best be followed from a study of the sketch on this page. It consists briefly of a radiused square-section metal tube which is divided into two longitudinal compartments by a central web. As the distributor is installed the rearmost compartment forms the primary feed. From this the fluid is led by capillary control tubes to the second compartment, into which a porous metal "spreader" is sintered. This porous distributor becomes, after the sintering process, actually part of the tube and forms part of the leading edge. The de-icing fluid—which may roughly be described as being a compound of alcohol, glycerine, glycol and glucose—seeps through the spreader evenly and runs over the surface at a known and controlled rate.

The relative viscosity of the fluid is of considerable importance and has been the subject of much development. In earlier attempts to obtain an even film of fluid on the wing surface, low-viscosity liquids were used because these were more easily distributed. Though adequate for the purpose, these earlier fluids were extravagant because the protective film could only be maintained by using high rates of flow; development of the present distributor enables a more viscous (and economical) fluid to be used.

Automatic Control

The pressure feed is maintained by means of an electrically-driven Tecalemit micro-pump, which is controlled automatically and is mounted directly below the fluid supply tank. In the latest version of the T.K.S., the electrical flow controller has been separated from the control panel itself and can be installed in any position in the aircraft, while the panel, which is now only a matter of four or five inches square, can be situated in the most convenient dashboard or other mounting, where it can be in continuous view.

There are three different "standards" of de-icing control, and these can be selected by three switches on the panel. The first can be described as being directly manual, since the supply is switched on or off at the will of the pilot, though there is a degree of automaticity since the initial supply of fluid is regulated to provide an ample and quickly-formed film.

The second "standard" is automatic. In this case the switch concerned is left on during flight, and a Smith automatic ice-detector brings the pump into action when icing conditions are met. This detector briefly consists of a small tube, mounted in the direct airflow, with the number of microscopic holes; at the first sign of ice formation, and long before any deposits appear on the aircraft structure, these holes are plugged by the formation and pressure-change causes an electric contact to be made. The de-icing

DE-ICING FOR TO-DAY

system then goes automatically into action, and the fact is notified to the crew by the lighting of a small green lamp on the panel.

The third "standard" is for emergency use, and provides something like five times the normal rate of flow so as to deal adequately with any extreme conditions which may be met. In this case a red light glows as a reminder to the crew that this maximum flow is being used.

So that no pulsation effects reach the distributors the rhythms of the pump deliveries must obviously be checked. In earlier installations the pulsations were damped out by means of a small rubber ball-valve in each delivery pipe, but the latest system makes use of the natural flexibility of rubber tubing, and the first few inches of pipeline from the pump are of rubber. Incidentally, it is interesting to know the pressures obtained at different temperatures and fluid viscosities. At +15 deg C, for instance, the delivery is at 4.65 lb/sq in; at zero it is 8 lb/sq in; and at −40 deg C it is 115 lb/sq in. Normally, icing conditions are only met between −10 and + 10 deg C.

Since no pump can be expected to provide very wide variations in delivery rate, the normal flow is regulated by introducing controlled periods of "on" and "off" in a time-cycle of 1 and 4 respectively except when the system is first switched on. The heavy emergency flow is produced by cutting out the "off" periods in the cycle and thus providing a continuous supply. The same fluid supply and pump is used to feed the airscrew slinger rings from which fluid is centrifugally directed to protect the leading edges of the blades.

CIVIL AVIATION NEWS

VIKINGS FOR I.N.A.

SIX Vickers Vikings have recently been ordered, through Airwork, the company's U.K. representatives, by Indian National Airways. The type being supplied to I.N.A. is the 24-passenger version with an operational crew of three and an air hostess.

NEW AIRCRAFT MODIFICATIONS

ANY doubts as to who is responsible for ordering and for carrying out modifications to new civil aircraft were dispelled on March 21st when Mr. Woodburn, the Parliamentary Secretary to the Ministry of Supply, in a reply in the House of Commons, said that it had been decided that all aircraft required by the public corporations operating civil air services should be ordered through the Ministry of Supply. He also explained that modifications to such aircraft prior to delivery are discussed by all concerned under arrangements made by the Ministry.

NEWCASTLE TO THE CONTINENT?

AN airport in North-East England suitable for direct flights to the Continent is envisaged by the Ministry of Civil Aviation. Mr. Ivor Thomas confirmed this when he met a deputation of Northern Labour M.P.s and representatives of the North-Eastern Airport Joint Committee recently. He added that a survey of the entire Tees and Tyne area had been carried out, and it showed that the extension of existing airfields was likely to sterilize large quantities of coal. The investigation was being continued, but, meantime, the two available alternatives were Woolsington, which was too small for Continental traffic and could, therefore, only be used for internal services, and Croft, which, although it could be used for direct flights to the Continent, was further away from Newcastle. In fact, it is only a few miles from Darlington.

B.O.A.C. MOVE

ALTHOUGH B.O.A.C. flying boat services are continuing to operate from Poole Harbour, the buildings which were formerly occupied there by the Corporation as a headquarters have had to be given up, as they are now due for return to their rightful owners, a tile company. For the time being, therefore, the B.O.A.C. headquarters has been moved from Poole to Hythe, and the passenger handling will be directed from a yacht club in Poole Harbour. B.O.A.C. are understood to be discussing with the Ministry of Civil Aviation, the Southern Railway and the Southampton Harbour Board, the eventual location of their flying-boat handling facilities.

SURPLUS AIRCRAFT ALLOCATION

SUCCESSFUL tenderers for surplus aircraft include sixteen air operators who have signified their intention of using the machines wholly or partly for charter work. This information was given on March 25th by the Minister of Supply in the House of Commons in reply to a question by Air Commodore Harvey. He also said that at least seven of the operators could be identified as having operated before the outbreak of war. They were:—

Air Taxis Ltd., Allied Airways (Gandar-Dower) Ltd., Herts and Essex Aviation Ltd., Hunting Aviation Ltd., Southern Aircraft (Gatwick) Ltd, Straight Corporation Ltd. and W. A. Rollason.

CAN GIANTS BE USED?—AN AMERICAN OPINION

SOME outspoken and even, from many points of view, almost reactionary views were expressed recently by the export vice-president of the Douglas Aircraft Company when chatting recently to one of our representatives who is at present touring the States. Major General Victor Bertrandias suggested that until scientific and mechanical means had been found to make real all-weather flying an accomplished fact, the medium-sized civil transport aircraft would still remain the best airline-operating proposition.

In spite of the fact that his company has recently flown and fully publicised their Globemaster, the Army transport version of the D.C.7 he thought that the 30-40 passenger aircraft was still a very much better all-round proposition. Bigger aircraft were not suited to any but the very best and largest airfields, and it was, he said, better to tie up one's money in smaller units—particularly as the handling of passengers at the rate of a hundred a time might prove to be quite a difficulty. While an aircraft such as the D.C.6 might cost something like £150,000 and take perhaps a year to develop, the very large aircraft might cost as much as £500,000 in development and other costs and would take twice as long to produce.

Major General Bertrandias said that

BIRD OF PEACE: Technicians busy on the second prototype of the de Havilland Dove. The plastic dome on the cockpit covering houses the D.F. aerial.