in the supply lines to the nozzles. Fine filtration is unnecessary except for the small quantity of fuel required for cleaning the whole system, which is withdrawn from the circuit and filtered to about six microns. The burner characteristics are such that the fuel pressure remains relatively high in relation to the maximum obtaining at ground level, ensuring constant distribution at extreme altitudes and fineness of control to maintain selected engine speeds.

Fuel flowmeters figured prominently at this year's S.B.A.C. show. Among them were two interesting designs placed by Elliott Brothers (London), Ltd., one of which would indicate flow rates up to 3,000 lb/hr and the other within a range of 420-24,000 lb/hr. The former model, which is particularly suitable for turboprop engines, consists of a transmitter (weighing 3 lb) to measure the rate of fuel flow through a metering chamber of the variable-orifice type by deflection of a hinged vane against a calibrated spring; angular deflection of the vane being proportional to fuel flow. The position taken up by the vane is transmitted by a magnetic coupling to a precision potentiometer, and the voltage picked off is fed to the input of an amplifier and thus to the cockpit indicators. At a safety feature, if the pressure drop across the transmitter exceeds a pre-determined figure of 0.5 lb/sq in, a relief valve allows fuel to by-pass the metering chamber.

The second design will measure fuel flow rates for any engine within the operating flow range. In this case, the transmitter, although also of the variable-area type, differs in that the measuring vane moves in a spirally cut chamber against a calibrated spring corresponding to fuel flow rates. The spiral chamber is so proportioned that the first 130 deg of vane rotation gives an indication over the remaining range of 100-400 lb/in compressed into the last 48 deg of vane rotation. At this point the deflection of the vane's rotation is effected by a microswitch, which means to two Autosyns. One provides a flow-rate signal—directly proportional to vane rotation—to a flow-rate indicator; the other is a linear transformer and is used for obtaining the total flow rate and fuel consumed. These systems provide a continuous indication of the rate at which fuel is being consumed by an aircraft engine at any time, together with the

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the total amount of fuel which has been consumed either by one engine or all the engines in the aircraft.

Fireproof Tanks, Ltd., have now manufactured a tank suitable for H.T.P. fuel. Dissimilar in appearance to the familiar Hycar/nylon tanks made by the company, the new tank is manufactured from F.V.C. sheet, which is high-frequency-welded at the seams and contains no shock-proofing fibres. Expanding metal poppers are used for attachment. This tank has been produced for a specific application, and will shortly be tried in the air. Development of the Hycar tanks has continued in the past year with a stronger rubber material embalmed the thickness, and therefore the weight of the tank, to be reduced.

A new fuel-flow proportioner was shown by the recently-formed Technical Development Division of the Gloster Aircraft Co., Ltd. Contained within a 9-in-by-4-in box, this unit is of the mechanical type, the two inlets each containing a diaphragm-operated control valve with a metering disc to operate a control servo mechanism. The proportioning ratio is determined by adjustment of the relative lengths of the metering-disc pivot arms.

The maximum fuel throughput is 1,000 gal/hr, and this flow through one inlet results in a pressure loss of 2 lb/sq in. Should the supply to one of the inlets fail, flow to the engine continues (at an increased pressure loss) from the other inlet against the resistance of a pre-set-maximum control head spring.

A feature of the Joseph Lucas (Gas Turbine Equipment), Ltd., stand this year was a complete Dart turboprop fuel system, consisting of a variable-stroke piston pump, the delivery of which is centrifugal fuel-pressure-servo controlled; a simple flow control to meter the engine fuel requirements by balancing the pressure drop across a throttle valve against barometric pressure; an acceleration control to prevent over-richening by maintaining a constant relationship between fuel and compressor-exit pressures; and a quartz-rod temperature control (working on the differential expansion of steel and quartz) which reduces the fuel flow to prevent continuous operation at the very high temperatures which may occur under cold, high-altitude atmospheric conditions.

The particular units on view had successfully completed 1,600 hr continuous operation and were scheduled for another 500 hr before major overhaul.

Although the effect of bends and elbows on pipe runs is well known it has rarely been as convincingly demonstrated as in the flow model on the Saunders Valve Co., Ltd., stand at Farnborough. The turbulence caused by bends and elbows of varying radii were immediately apparent, and the efficiency of various conventional types of valve was placarded. The much used "T" port fuel valve can rarely be more than 70 per cent efficient, a fact representative of a range of high-speed single-stage centrifugal-impeller pumps driven by submersible A.C. or D.C. motors which can be provided with alternative side or bottom tank connections. Such pumps will run at a designed speed of 5,500 r.p.m. and will deliver from 800 to 2,000 gal/hr. A larger type undergoing development is designed for a flow of 6,500 gal/hr at 12,000 r.p.m. and is to be air-driven by a bleed from the engine compressor. These pumps will operate at fuel temperatures ranging from -45 deg C to +50 deg C at altitudes up to 60,000 ft.

Lucas gas-turbine fuel systems are designed for low, moderate or high altitudes, the type of main control used being selected according to the operating requirements. In the medium-altitude fuel system for example, a barometric pressure control is used for obtaining the total flow rate due to altitude. Pressure selected according to the pressure/flow characteristics of the rest of the system. The engine speed is controlled manually by a throttle valve, which varies the pressure/flow relationship downstream of the barometric-pressure control—directly consequently the flow as well, since the barometric control maintains a constant pressure at the pump regardless of altitude.

In the high-altitude system, the "proportional flow control" unit incorporates the acceleration control in a pressurizing valve and dump valves. In this unit, flow metered to the engine is controlled by adjustment of a small by-pass flow according to ram pressure. The by-pass flow is multiplied by the throttle valve and hydraulic flow transformer so that, irrespective of altitude—approximately constant proportion of the maximum fuel requirement is provided at any fixed throttle angle. By suitable alteration of the multiplication ratio between the controlled by-pass flow and the throttle valve, governor and temperature-overspeed trimming is provided.

Fuel flowmeters of tried design but with detail improvements were exhibited by Multipoint and Zamperini, Ltd. In order to cater for widely differing aviation fuels, a density adjustment for fuels with specific gravities ranging from 0.74 to 0.82 has been added, along with an integral provision to give an indication of the total fuel consumed.

A P.V.C. tank for high-test fuel has been developed by Ferguson Tanks, Ltd. It is seen here installed for demonstration purposes in a transparent plastic box.