Chapter 4

PUMP, FUEL CH 4 SERIES

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

LEADING PARTICULARS

Pump, fuel, CH4 series	Stores Ref. 5UE/
Delivery rate	10 gallons per hour
Delivery pressure	100 lb. per sq. in.
Current consumption	4·25 amp.
Operating voltage	...26 volt
Weight	5 lb. 13 oz.
Electrical connections	2 pole Breeze Type plug

Introduction

1. The CH4 fuel pump is electrically driven, and is designed to deliver fuel at high pressure to the aircraft combustion heaters. The pump is installed in a vertical position at the bottom of the combustion heater fuel supply tank, with the pump inlet and encased electric motor immersed in fuel.

DESCRIPTION

General

2. The pump complete comprises three main sub-assemblies, the first being the motor unit, the second the portway casting, whilst the third is the pump base casting.

Motor unit assembly

3. The motor unit spigots into the upper face of the portway casting, and comprises machined end cases locating the stator and field coil assesmbly, brush gear with brushes, and armature assembly with shaft extension, driving the geared pump unit through a semi-flexible coupling. Two motor tie bolts clamp the end casings and stator together. The lower motor casing houses the drive end ball race, whilst the upper casing contains the commutator end bearing, which is pressed into a steel sleeve.

4. The inner race of the drive end ball race is locked to the armature assembly by a screwed ring incorporating a thrower, which flings off any fuel leakage past the metallic bellows gland. The commutator end bearing is locked to the armature shaft, or pump gear spindle, with a self locking nut. Both motor ball races are shielded and prepacked with anti-freeze high melting point grease.

5. The motor unit is totally enclosed in a flanged light alloy casing, and is sealed against the ingress of fuel by clamping a synthetic rubber joint ring in position with seating locking rings. The locking ring also serves to secure the motor in position in the top of the portway casting.

6. The motor is a flameproof, 28 volt d.c., two-pole, compound wound machine and is designed to give 19 oz. in. torque at 4,000 ± 100 r.p.m. at 26 volts, with a maximum current consumption of 4·25 amps. When operating at 29 volts the current should not exceed 4·25 amps.

7. To facilitate assembly the brush gear has been made of unit construction. The two brush boxes are secured to a bakelite carrier by means of two screws passing through radial slots, which allow for adjustment of the brush gear. These screws also secure the brush box retainer, and the commutator end bearing cover in position.

8. The armature shaft extending through the metallic bellows gland, carries the vapour assister complete with carbon insert, which makes a seal against the face of the bellows gland unit. The impeller helix is peened in position during assembly on the stem of the vapour assister. A square holed sleeve connects the end of the armature shaft to the pump unit central gear shaft.

Portway casting assembly

9. The portway casting comprises two faced circular ends, separated by two hollow pillars, one of which serves as a conduit for the electrical leads to the motor, while the other pillar serves as a gland drain. This casting houses the base of the motor unit and a metallic bellows fuel sealing gland which seats on a carbon insert in the vapour assister, and prevents ingress of fuel to the motor. The bottom face of this casting locates over the impeller helix bush and stud ring in the pump base casting, and the two are secured together with nuts and spring washers. A paper joint is fitted between the mating faces of the portway and pump base castings, and a vapour guide cone is arranged around the fuel inlet to carry away fuel vapour and air, evolved under certain flying conditions.

Pump base assembly

10. The pump base, which is the only part of the pump to project outside the fuel tank, has a machined faced flange; this flange is drilled with twelve, equally spaced, 2 B.A. clearance holes, for attachment of the pump to the fuel tank. A $\frac{1}{16}$ in. thick joint gasket is fitted between pump and mounting face of the fuel tank. Two $\frac{1}{4}$ in. B.S.F. extraction holes, 180 degrees apart are fitted in the pump flange to assist in breaking the joint, when the removal of the fuel pump is necessary. Moulded in the base casting is the $\frac{1}{4}$ in. B.S.P. fuel outlet, and $\frac{1}{4}$ in. B.S.P. gland drain, together with a flanged base, which holds the angled Breeze type plug for connecting an electrical supply to the motor. A recess is provided on the upper side of the casting, near the fuel delivery outlet, for a relief valve; also housed in the centre of the base casting is the pump unit.

Pump unit

11. The pump unit is secured in position by a flanged cover bolted to the pump base casting. Pumping is effected by two steel gears running in mesh between two steel plates,

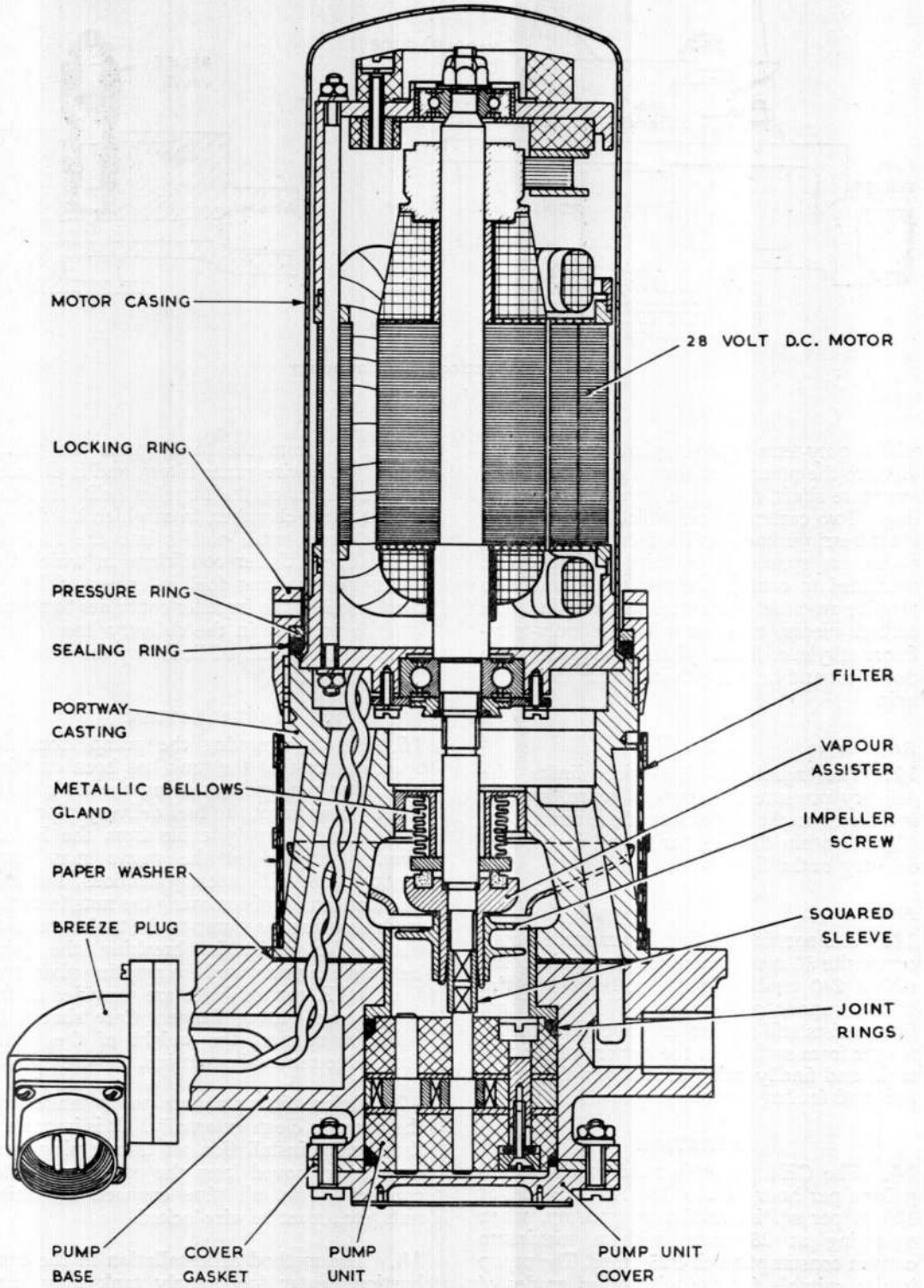

Fig. 1. Sectional view of pump

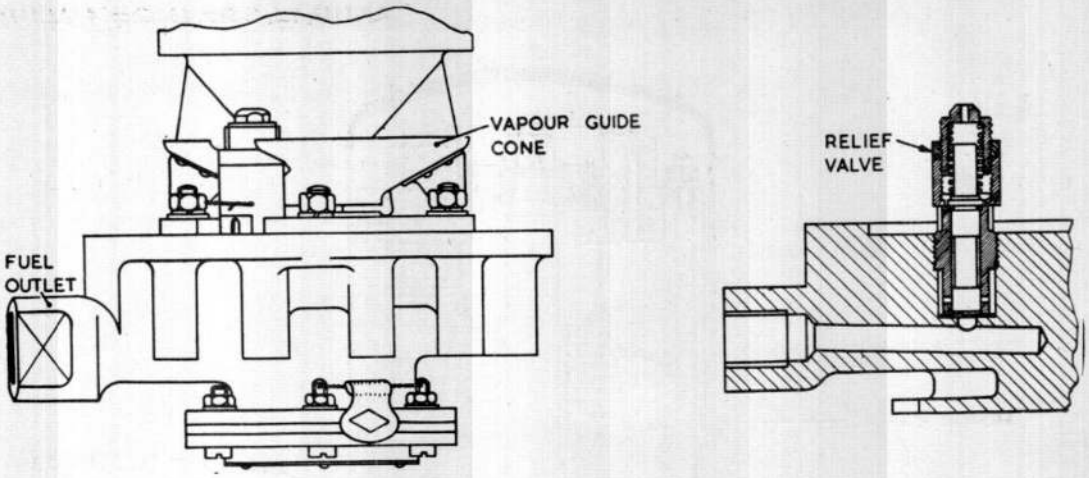

Fig. 2. Part sectional view of pump

with a poly-tetra-fluoro-ethylene facing. The drive to the pump gear unit is direct from the armature shaft, through a semi-flexible coupling. Two carbon pieces which serve as gear shaft bearings back up the faced plates, these plates are spaced by a third carbon piece, machined to contain the two gears, and also provide an outlet to the fuel delivery line. The carbon pieces, together with the poly-tetra-fluoro-ethylene faced plates and gears, are dowelled, and held together to form the pump unit.

Relief valve

12. The relief valve, which limits the delivery pressure to a pre-set figure, is fitted in a recess on the upper face of the pump base (*fig.* 2) within the fuel tank, and in the fuel delivery outlet line.

Filter

13. The portway casting is surrounded by a composite 50 mesh gauze filter, superimposed with a 240 mesh gauze filter, below the rim of the vapour guide cone. This additional filter assists still further in preventing foreign matter from settling at the bottom of the fuel tank, and finally being drawn into the pump unit and fouling the pump gears.

OPERATION

14. The CH4 pump is rated to deliver 10 gallons per hour of 100/130 AVGAS fuel at 100 lb. per sq. in. minimum pressure, when operating at 26 volts, with a maximum current consumption of 4·25 amps. The pump is also suitable for use with other grades of aviation fuel.

15. Fuel from the tank enters the pump through the wire gauze filters, and is directed by the action of the impeller helix into the geared pump chamber, from which it is forced through two small outlets into the fuel delivery line. Under conditions in which the pump is supplying fuel in excess of heater requirements, the impeller continues to rotate, but the pressure in the delivery line is held within pre-determined limits by the action of the relief valve.

INSTALLATION

16. Before removing the pump from the tank, ensure that the tank has been emptied by easing out and removing the tank drain plug. Disconnect the fuel delivery pipe, and the electrical supply cable from the Breeze plug. Removal of the pump may vary slightly with different applications, but will in effect consist of removing the nuts from the studs securing the pump to the tank mounting plate. To assist in breaking the joint between the pump and the mouting plate, two $\frac{1}{4}$ in. B.S.F. tapped holes are provided in the pump base casting flange. Care should be taken to support the weight of the pump during the removal operation.

17. Before fitting a new pump make sure the pump is clean externally. It is important that before installation all transit plugs and caps are removed from the pump, and after connecting up, all pipe connections, union nuts, etc., must be wire-locked.

18. The method of installation in the combustion heater fuel supply tank may vary slightly with different applications. Attach-

ment is by twelve 2 B.A. studs in the mounting plate surrounding the circular hole provided in the bottom of the fuel tank. Jointing material is used (in this case $\frac{1}{16}$ in. thick) between the tank mounting plate and pump base flange. The studded mounting ring, associated nuts, and jointing material for installation purposes are not supplied by the pump manufacturer.

19. The $\frac{1}{4}$ in. B.S.P. gland drain should be taken to atmosphere. Care must be taken to ensure that the end of the gland drain outlet pipe faces to the rear of aircraft, to prevent possible pressurization of the gland drain in flight.

SERVICING

Electrical test

20. A routine electrical check in accordance with the appropriate Servicing Schedule should be made to ascertain that the pump motor is operating satisfactorily. The pump must be renewed if there is any indication of erratic performance, such as excessive current consumption, or low insulation resistance. These tests are to be carried out only with motor on load. It is therefore essential that the pump is IMMERSED IN FUEL.

Operational test

21. Upon the satisfactory completion of the electrical test the pump should be tested for pressure and rate of fuel delivery in accordance with the appropriate Servicing Schedule. For the test equipment necessary, refer to the appropriate Aircraft Handbook. The fuel pressure should be approximately 100 lb. per sq. in. with a fuel delivery of approximately one gallon in 6 minutes. Failure to obtain this pressure and rate of delivery could be caused by a faulty motor, a damaged impeller, defective pump gear unit, or an incorrect loading on the bellows gland, and measures should be taken to eliminate the cause of failure.

Periodic inspection in service

22. In addition to the routine overhaul of the pump as laid down in leading particulars, it is advisable to make periodic inspections at approximate intervals of 100 hrs. flying time. These inspections should include an examination of all pipe connection joints to the pump for fuel leakage, which can be corrected by renewing joint washers. Check the electrical connection joint, and ensure that all nuts and screws are tight and locking wire intact. Examine the pump drain for leakage. The maximum permissible leak is two drops per minute with the pump running, and one drop per minute with the pump stopped. Any leakage in excess of these figures will necessitate removal of the complete pump for overhaul. The pump must be removed if there is any indication of erratic performance, such as excessive current consumption, low delivery pressure, or if the insulation resistance falls below 2 megohms.

Insulation resistance test

23. Using a 250 volt insulation resistance tester, test between any part of the electrical circuit and earth. The insulation resistance must not be less than 2 megohms.

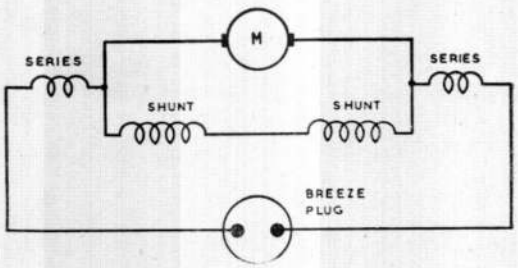

Fig. 3. Circuit diagram

41074 191448 2661 7/57 3500 CWSLtd2294 Gp539-2