TRN/AVI/1 # 2

C.S.

MISCELLANEOUS.
(Aircraft)
POSTAL AND TELEGRAPHIC
(Mails).

No. 239/31.

1931.

C. S. O.

SUBJECT.

1931.
7th August.

PROPOSED PURCHASE OF AN AEROPLANE FOR THE PURPOSE OF CONVEYING PASSENGERS AND MAILS BETWEEN STANLEY AND OUTLYING SETTLEMENTS.

Previous Paper.

MINUTES.

1-2. Letter to the Crown Agents. 11th August, 1931.

b.f. 22. 2. 32.
11. 12. 31

b.f. 11. 12. 31.
11. 8. 31

b.f. 15/3/32.
22/2/32.

3-7. Letter from the Crown Agents of 4/2/32.

Ag. C.S.
agree
J.O.G.
9-3-32

Y.E. Submitted. I am afraid cost at £12000 and heavy amount for maintenance makes it impossible to entertain the proposal.

2. The matter might be discussed in Executive Council. M. Craigie Halkett
8.3.32 Ag. C.S.

Subsequent Paper.

Clerk Exe. Co.

For next meeting of Council

McH
10. 3. 32.

Hon. Treasurer. McH 11. 3. 32.
Hon. P. M. O. J. D. M. 12. 3. 32.

Circulated for consideration at next meeting of Executive Council.

C. J. Jewell.
Clerk Exe Council.
11/3/32.

Extract from minutes of meeting of Executive Council held on the 22nd of March, 1932.

The Council agreed that it was impossible to proceed further with the proposal at present owing to the heavy cost of the aeroplane and its maintenance as quoted by the Crown Agents.

C. J. Jewell

Clerk of the Executive Council.

Letter to the Crown Agents, of 29/3/32. 8.

Hon. D.P.W.
Please see
J. M.
29. 3. 32.

~~Hon.~~ Col. Sec.

Noted thank you.

G. Roberts.
30.3.32.

P.A.
31/3/32

239/31.

11th August, 31.

Gentlemen,

I am directed to inform you that this Government has under consideration the matter of purchasing and maintaining an aeroplane primarily for the purpose of conveying passengers and mails between Stanley and the outlying farm settlements of the Colony.

2. I am to say that I shall be grateful to receive your advice generally in the matter both as to the apparent practicability of the proposal and as to its financial aspect, capital and recurrent.

3. I am to explain that, as you will no doubt recollect, Stanley and all the farm settlements are situated literally at ~~the water's~~ edge for the most part on sheltered creeks or arms of the sea and that in consequence the problem of landing grounds should be capable of easy solution by the use of float attachments.

4. I am also to explain that the greatest distance which would require to be covered within the limits of the Colony in any one flight is little over

100/

The Crown Agents for the Colonies,
4, Millbank, Westminster,
LONDON, S.W.1.

100 miles and that an aeroplane with a carrying capacity of some half-dozen passengers has been tentatively envisaged.

5. I am to add that I should be grateful to receive at the same time your advice in regard to the engagement of a pilot together with an indication of the salary and terms of engagement which he might reasonably expect.

I am,

Gentlemen,

Your obedient servant,

Colonial Secretary.

(7)

ALL COMMUNICATIONS
TO BE ADDRESSED TO THE
CROWN AGENTS FOR THE COLONIES.
THE FOLLOWING REFERENCE AND THE
DATE OF THIS LETTER BEING QUOTED.

15, W/Falkland Is. 3535

TELEGRAMS: "CROWN, LONDON."
TELEPHONE: 7730 VICTORIA.

CROWN AGENTS FOR THE COLONIES

4, MILLBANK,
WESTMINSTER,
LONDON, S.W.1.

4th February 1932

Sir,

I have the honour to refer to your letter No.239/31 dated 11th August informing us that your Government had under consideration the purchase of an aeroplane.

2. On receipt of your letter we placed your requirements before the Air Ministry and we are forwarding you herewith a copy of their reply dated 1st February together with appendices A and B. We are also forwarding you a catalogue showing the Westland Wessex 3-engined aeroplane which is the type recommended by the Air-Ministry as best suited to your requirements. The Westland Aircraft Works have also forwarded an estimate of the cost of operation of one of their machines fitted either with the 5-cylinder of 7-cylinder Armstrong Siddeley Genet Major engine. An instruction book for the above engines is enclosed herewith.

1.2.32

2

3. The cost of the annual operation of one machine as estimated by the Air Ministry is very high when compared with the estimate of the Westland Company. It will be observed however that the firm have assumed a thousand flying hours per annum whereas the Air Ministry assumption amounts to 383 hours only. It will also be observed that the Air Ministry have made allowance for the supply of 3 spare engines and spare parts for them to the

The Colonial Secretary,
FALKLAND ISLANDS.

HGT

value of £292; they have also included aircraft spares to the value of £570 and a spare float costing £380. There is an almost complete absence of provision for spares in the Westland estimate, the only item included being "two complete and two top overhauls and spares for three engines per annum" for which a sum of £100 is allowed. A further discrepancy between the two estimates is shown with regard to the cost of insurance for which the Air Ministry have allowed the sum of £804 against the sum of £445 assumed by the Westland Aircraft Company.

4. The discrepancies between the two estimates are very large but you will no doubt attach a greater value to the figures supplied by the Air Ministry owing to their disinterested nature.

5. We hope that the information now being sent you will be sufficient to enable you to come to a decision on this matter but we shall be glad to again approach the Air Ministry or the firms concerned on receipt from you of any further particulars regarding your requirements and the conditions under which the aeroplane will be required to operate.

I have the honour to be,

Sir,

Your obedient Servant,

[signature]

For Crown Agents

(6)

W/Falkland Is. 3535.

COPY.

FROM THE DEPUTY DIRECTOR OF CIVIL AVIATION TO THE CROWN AGENTS.

136008/31/C.A.4

AIR MINISTRY,
GWYDYR HOUSE,
WHITEHALL,
LONDON, S.W.1.

1st February, 1932.

FOR THE ATTENTION OF THE CHIEF ENGINEER (CONTRACTS)

AIRCRAFT FOR FALKLAND ISLANDS.

Gentlemen,

I am directed to refer to your letter dated 23rd September last, Ref. W/Falkland Is.3535, and subsequent correspondence on the above subject, and to inform you that as the result of detailed investigation of the circumstances explained it is considered that a Westland Wessex aeroplane with three Armstrong Siddeley 7-cylinder Genet Major engines would be best suited to the requirements of the Falkland Islands Government.

It should be explained that this aircraft has not so far been fitted with floats, but the Westland Aircraft Works consider that with minor modifications to the aircraft in its landplane form it should be possible to obtain an adequate performance with the aircraft constructed for floatplane work at a total all-up weight of 6,300 lbs. Details of such an aircraft, together with a skeleton estimate of the capital and operational costs involved are contained in the accompanying memorandum at Appendix A. Notes on the selection of sea aerodrome sites are also enclosed at Appendix B. The requirements for Class B aircraft as given in these notes would be applicable in this instance.

Before a final decision is made it is suggested that the attention of the Falkland Islands Government should be drawn to the area and depth of water required and an examination

/made

made locally of the proposed alighting places in the light of these notes. It is understood, however, that the Falkland Islands abound with natural harbours, and it is presumed that the use of a landplane has been ruled out on this account. Should, however, the type of country be suitable for the operation of a land machine, the choice of a suitable aircraft would not be so restricted and the same size of aircraft fitted with a land undercarriage would provide a higher pay load and be slightly cheaper to operate.

A descriptive pamphlet of the Westland Wessex land aircraft, together with a cost sheet prepared by the Company, and an instruction book for the Armstrong Siddeley Genet Major engine are also herewith at Appendix C. It will be noted that the costs prepared by the Company are lower than those prepared by the Air Ministry; this is in part due to the fact that the Company's estimates are on the basis of operation in Great Britain, and in part due to the provision of a certain amount of ground organisation having been included in the estimates of this Department.

Further I am to advise you that the estimates forwarded at Appendix A should not be regarded as final. This Department would, however, be pleased to supply further information upon receipt of details of the precise use to which an aircraft in the Falkland Islands would be put. Should, for example, a regular service be contemplated it would be necessary to engage further staff and possibly purchase a reserve aircraft.

The source of the enquiry has not been disclosed either to the Westland Aircraft Works or to Armstrong Siddeley Motors, both of which firms would no doubt be willing to answer any enquiries direct from the Governor of the Falkland Islands.

I am, Gentlemen,
Your obedient Servant,
(Sgd.) C.J. Collins
for Deputy Director of Civil Aviatio

Appendix A

Westland Wessex Float Plane.

Pay Load.

(1) Full fuel. Range at 85 m.p.h., consumption 25 gallons per hour (less 20% reserve) 272 miles.

Weight Bare	- 4,400 lbs.	
100 gallons fuel	- 780 "	
Oil 6 gallons	- 60 "	
Pilot	- 180 "	
Pay Load	- 880 "	= 5 passengers at 170 lbs. + 30 lbs. luggage.
Total all up weight	= 6,300 lbs.	

(2) 3/4 Fuel. Range at 85 m.p.h. consumption 25 gallons per hour (less 20% reserve) = 204 miles.

Weight bare	- 4,400 lbs.	
75 gallons fuel	- 585 "	
Oil 6 gallons	- 60 "	
Pilot	- 180 "	
Pay Load	- 1,075 "	= 6 passengers at 170 lbs. + 55 lbs. luggage, or 5 passengers + 225 lbs. luggage and mail.
Total all up weight	= 6,300 lbs.	

(3) ½ Fuel. Range at 85 m.p.h. consumption 25 gallons per hour (less 20% reserve) = 136 miles.

Weight bare	- 4,400 lbs.	
50 gallons fuel	- 390 "	
Oil 6 gallons	- 60 "	
Pilot	- 180 "	
Pay Load	- 1,270 "	= 6 passengers at 170 lbs. + 250 lbs. luggage and mail.
Total all up weight	= 6,300 lbs.	

Note. It will be seen that with a restricted petrol supply involving a smaller range, a pay load of 1270 lbs. can be carried. It is thought that most of the journeys contemplated would only require a small range. Seats for 7 passengers could be arranged if desired.

General Data.

1. Hours per annum on service say	365	
Add 5% for dead flying	18·25	383·25
2. Engine hours on service 383·25 x 3	1150	
Add 10% for ground running	115	1265
3. Petrol gallons consumed in 2 above at 8-1/3 gallons per hour (engine hour)	10544	
Add 5% for evaporation & wastage	511	11055
4. Oil gallons consumed in 2 above at 0.5 gallons per hour	633	
Add 20% for change of oil & wastage	127	760

Salaries and Wages.

1 Pilot	- 500	
1 Ground Engineer	- 234	
1 Labourer	- 130	864

Note. The above are the rates for Great Britain. They should be adjusted to equivalent rates for the Falkland Islands.
The terms of engagement are normally on a three year basis in the first instance.

Capital Expenditure.

1 Westland Wessex floatplane with 3 Armstrong Whitworth Genet Major 7 cylinder engines. Estimated price	- 5,700
Aircraft spares at 10% and 1 spare float (380)	- 950
Engines spare 3, at £486	- 1,458
Engine parts, spare at 20% on 3 engines	- 292
Cost of packing, shipment and erection say	- 250
Hangar 100' x 50' x 20' with annexe	- 2,500
Beaching Trolley	- 50
Moorings at main base	- 50
Workshop plant, tools etc. say	- 500
Contingencies	- 250
	£12,000

Annual Expenditure.

Direct Flying Costs.

Salaries and Wages	- 864
Flying Pay 383 hours at 5/-	- 96
Petrol 11,055 gallons at 3/10 gallon	- 2,119
Oil 760 " at 8/- gallon	- 304

Repairs and Maintenance.

Aircraft, including consumption of spares and additional labour at 15/- per hour	- 287	
Engines, including consumption of spares, renewal of engines and labour for overhaul etc. at 15/- per hour	- 950	1,237

Overhead Charges.

Insurance.

Aircraft 12½% on 5700	- 712	
Spares & Spare engines at 1½% on 2800	- 42	
Personnel £1,000 at 5%	- 50	804

Depreciation & Obsolescence.

Aircraft 20% on £5700	- 114	
" spares 20% on £950	- 19	
Engines spare 20% on £1458	- 292	
Engine spares 20% on £292	- 58	
Shipment 20% on £250	- 50	533

c.f. 5,957

Equipment.		b.f. 533	b.f. 5,957
Hangar 5% on £2,500	- 125		
Workshop Equipment etc. 15% on £500	- 75		
Moorings 20% on £50	- 10	210	743
Maintenance of Ground Equipment.			
Hangar 5% on £2,500	- 125		
Workshop Equipment 15% on 500	- 75		
Moorings 20% on 50	- 10		
Lighting & Power say	- 100		310
Interest on Capital.			
5% on £12,000			600
Contingencies.			423
			£7,500

Analysis of Costs.

		s. d.
1.	Cost per hour flown	£19. 12. 0.
2.	Cost per aircraft mile	4. 7.
3.	Cost per passenger mile (7 passengers)	8.
4.	Cost per ton mile (full load)	8. 1½.

Note. These costs would be reduced by about 20% if the flying hours per annum were doubled.

Appendix 'B'

NOTES ON THE SELECTION OF A SEA AERODROME.

The requirements for a sea aerodrome may conveniently be divided under two heads:-

Class A. Suitable for boat and float seaplanes.
Class B. Suitable for float seaplanes up to 7,000 lbs. total weight only.

Class A.

Alighting and taking-off area.- Except when the wind is light seaplanes prefer for choice to alight and take off dead into the eye of the wind. It should therefore be noted that the dimensions given must be provided for any wind direction which may be experienced locally

In order to cater for all types of sea aircraft it is desirable to provide an area of water on which the under-mentioned requirements are fulfilled for all directions of wind and all states of the tide:-

Length (parallel to the axis of the eye of the wind)	1,500 yards
Width	150 "
Depth	6 ft.

This is considered adequate for all normal requirements and developments expected during the next 20 years.

The approaches and the take-off from an area should be clear of all obstructions for a distance of at least a quarter of a mile. To ascertain whether an object constitutes an obstruction an imaginary line should be drawn at an angle of 6° to the horizontal from the perimeter of the take-off or alighting area. Any objects extending above this imaginary line should be considered as obstructions.

In every instance the taking-off and alighting area should be as sheltered as possible, bearing in mind the proviso regarding obstructions. A short sea presents no difficulties but a heavy swell is to be deprecated.

Mooring Area.- The mooring area should preferably not be more than half a mile distant from the alighting and taking-off area. No obstruction to the free passage of aircraft proceeding on the surface between these two areas should be encountered. The mooring area should be sheltered against strong winds and swell, clear of the fairway and free from surface traffic. At least 6 ft. of water at low water ordinary spring tides is required provided the area is well sheltered, otherwise an increased depth is necessary to preclude the possibility of the hull or floats of an aircraft grounding in the trough of the swell. Strong currents or tidal streams of over 5 knots should be avoided if possible otherwise boat work becomes very difficult. At least 100 yards swinging room clear of any other craft should be allowed for each aircraft. In this connection it should be noted that flying boats may ride head to wind when surface vessels near by are lying head to tide. The number of moorings required is of course dependent upon the volume of traffic. Notes on types of moorings can be supplied if required.

Shore Area.- The shore area should adjoin the mooring area and should be provided with the following facilities:-

/(a)

(a) slipway or crane.

(b) cradle or other apparatus suitable for carrying flying boats or floatplanes.

(c) power winches, etc. for hauling the cradle when loaded up the slipway.

(d) refuelling facilities

(e) hangar accommodation, if required.

When buildings are erected it becomes important that electric power, drainage and fresh water should be available. If a slipway is constructed this should have a gradient not steeper than 1 : 15 or preferably 1 : 20, it should be 50 ft. wide with 6 ft. of water over the end of the slipway at L.W.O.S.

Class B.

Class B requirements are generally similar to the above, but the stretch of water required is 500 yards long by 100 to 150 yards wide and depth 3 ft., with no obstruction for a further quarter of a mile in both the up the down wind directions.

Floatplanes may always be beached. The beach should not, however, be too steep above high water mark, and there should be no rocks in the vicinity. A sandy beach is best but mud or shingle can be used without damage to the floats. The beaching site should be at least 30 yards wide and extend 15 yards inland above high water mark.

Floatplanes may also be hoisted out by cranes. The jib must reach a point not less than 25 ft. from the quay or wall. Large flying boats, on the other hand, are not always constructed with swinging gear and in most cases it will be found that a slipway is less costly to construct and will handle all types of aircraft quite efficiently.

C.A.4.

27.1.32.

WESTLAND "WESSEX"

COST OF ANNUAL OPERATION FOR ONE MACHINE

ASSUMING 1000 HOURS PER YEAR

	5 cyl. Genet Major.			7 cyl. Major		
Depreciation on £4,065 and £4,500 capital outlay respectively at 20% per annum	£813.	0.	0.	£900.	0.	0.
Interest on capital at 5%	203.	0.	0.	225.	0.	0.
Hangarage	200.	0.	0.	200.	0.	0.
Insurance (including machine; flying and ground risk, third party, legal liability to passengers)	400.	0.	0.	445.	0.	0.
Personal insurance of pilot (for £1000 death and benefits)	35.	0.	0.	35.	0.	0.
Cost of pilot	600.	0.	0.	600.	0.	0.
Maintenance - 1 Ground Engineer at £4. 10. 0. per week	250.	0.	0.	250.	0.	0.
1 Labourer at £2. 10. 0. per week	150.	0.	0.	150.	0.	0.
Certificate of Airworthiness	5.	0.	0.	5.	0.	0.
Two complete and two top overhauls and spares for 3 engines per annum	100.	0.	0.	100.	0.	0.
Re-conditioning to be carried out after each 2000 hours; £500 per re-condition; therefore, at 1000 hours flying per annum	250.	0.	0.	250.	0.	0.
Total cost per 1000 hours/annum..	£3006.	0.	0.	£3160.	0.	0.
Cost per hour	£3.	0.	2.	£3.	3.	3.
Plus Petrol (18 and 24 gals. @ 1/5d per gallon) per flying hour	1.	5.	6.	1.	14.	0.
Oil per hour		3.	2.		4.	4.
TOTAL COST PER HOUR	£4.	8.	10.	£5.	1.	7.

		5 cyl. Genet Major.	7 cyl. Major
Cost per passenger hour with	5 passengers..	17.7/-s.	20.3/-s
" " "	6 "	14.7/-s.	16.9/-s
" "	7 "	12.6/-s.	14.5/-s
Cost per passenger mile at cruising speed with -	5 passengers	2.4d.	2.4d
"	6 "	1.9d.	2.0d
"	7 "	1.7d.	1.7d
Cost per ton mile, as goods machine, at cruising speed with	full fuel	1.9/-s	1.9/-s
"	2/3 "	1.5/-s	1.6/-s
"	1/2 "	1.4/-s	1.4/-s

Appendix 'C'

Speed with Safety and Comfort

The

WESTLAND WESSEX

THREE—ENGINED SIX SEATER

THE WESTLAND "WESSEX"

Three Engined Six Seater Cabin Monoplane

WESTLAND AIRCRAFT WORKS

(BRANCH OF PETTERS LIMITED, OIL ENGINE MANUFACTURERS)

Works: YEOVIL - ENGLAND

Publication No. 2021/2, August, 1931.

THE WESTLAND "WESSEX"

Three-Engined Six Seater Cabin Monoplane

THE advantage of air transport for pleasure and business purposes is being increasingly recognised, and the provision of suitable aerodromes adjacent to large towns and cities, which is being effected in all civilised countries, opens up opportunities, not hitherto available, for rapid transport from place to place, and will prove the solution of the problem created by the congestion of road traffic in the neighbourhood of all large cities.

The "Wessex" has been introduced to meet the increasing need for comparatively light, passenger carrying, freighter, or survey aircraft, with the highest possible standard of safety and comfort, but with a low initial price and economical running cost.

It especially caters in consequence for the requirements of medium-range air liners, serving as feeder to the main trunk routes; for private charter, and for the private owner or business man who requires greater capacity and comfort than the two-seater coupé can give, combined with immunity from anxiety.

The Westland "Wessex" is fitted with three engines, any two of which will maintain the machine in flight. Even should two engines cease to function the machine loses height very slowly, and the pilot has time to select the best possible landing ground without undue anxiety, ensuring a sense of security from accident which has a solid foundation, and is not obtainable with any single engined machine.

In the design of the Westland "Wessex" is embodied all the experience gained through many years of aircraft manufacture, and particularly that acquired in the design and construction of the now famous "Wapiti" military machine, of which large numbers have been delivered to R.A.F. Squadrons at home and in the Dominions, and which are giving every satisfaction.

GENERAL DESCRIPTION.

The Westland "Wessex" is a strut-braced semi-cantilever monoplane of the high wing type giving a high degree of visibility to the passengers: it can be supplied in two models—High Performance Model with 7-cylinder Genet Major engines, or Standard Model with 5-cylinder Genet Major engines.

Very comfortable accommodation is provided for :—

(1) Four passengers in the cabin, with lavatory and luggage compartments in the rear, or

(2) Five or six passengers in the cabin if the lavatory compartment is dispensed with,

(3) and in addition in either case pilot and navigator or another passenger in an enclosed pilot's cockpit.

Regularity of operation and reliability in all weathers, combined with the standard of comfort usually obtainable only in the largest air liners are the keynotes of the service rendered by the "Wessex."

POINTS OF "WESSEX" SUPERIORITY

(Performance data given herewith are obtained with the High Performance Model: for full data of both models see data sheet at the end of this brochure).

(1) *SAFETY.*

Maintains height with full load at 6,000 feet on any two engines; this height can be increased by 2,000 feet by the use of high-compression power units (fitted without extra charge). *With but one Engine in action, descent is so gradual that pilot has ample time to select landing ground.* Pilot can easily communicate with passengers although in a separate compartment.

High degree of visibility provided for Pilot.

R.A.F. 34 Section Wings combined with high wing monoplane design give control beyond stalling point.

Low landing speed with wide track undercarriage and brakes, giving quick pull up.

(2) *COMFORT.*

Smooth running of Genet Major engines, combined with method of mounting, results in complete absence of vibration or surging.

Interior finish and passengers' accommodation of highest standard. Triplex sliding windows. Heating and Ventilation at passengers' control. Lavatory compartment totally screened off from cabin in flight, while remaining easily accessible. Luggage racks, arm rests, spacious cabin, etc., etc.

(3) *ECONOMY AND PAYLOAD.*

This is easily high enough to make the "Wessex" a profitable proposition for Airlines. *Petrol consumption of three 7-cylinder Genet Major Engines is about 24¾ gallons an hour (or 18 gallons in the case of 5-cylinder engines), while* five passengers (or seven if lavatory is not required) can be taken, at a cruising speed of over 100 m.p.h.

(4) *RELIABILITY AND EASE OF MAINTENANCE.*

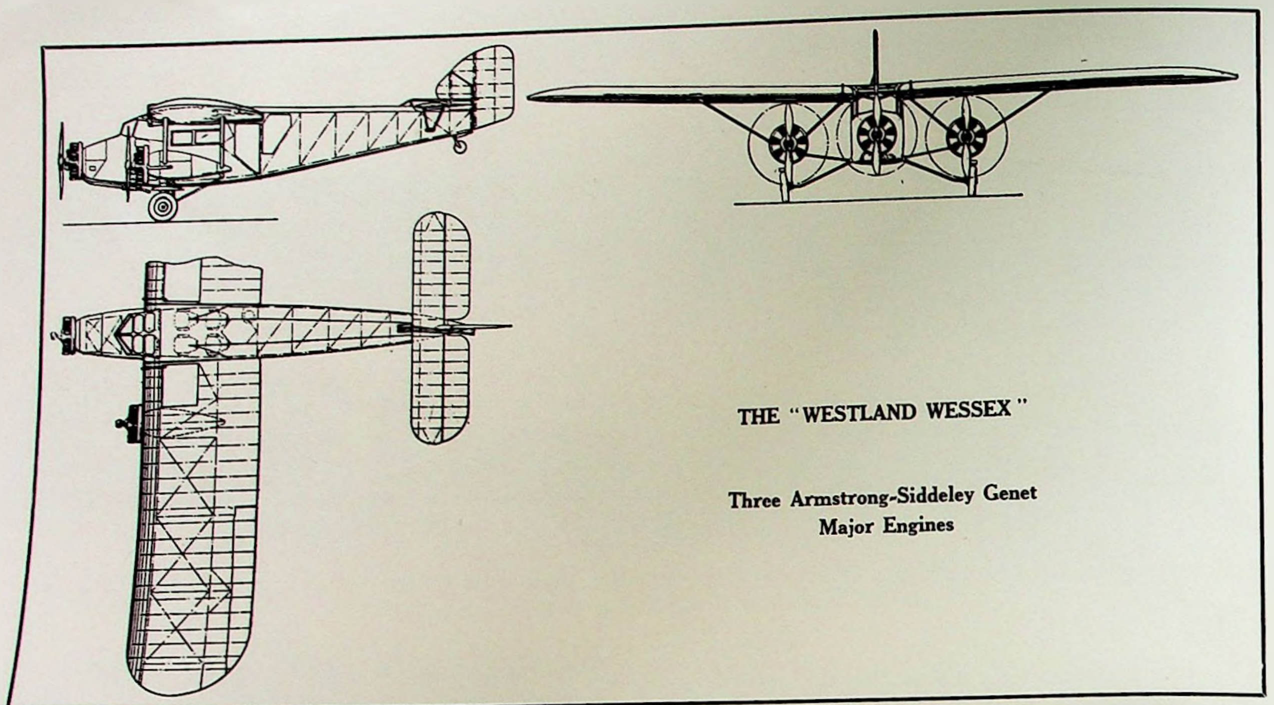
Braced monoplane construction eliminates the necessity of constant rigging adjustment. Power units easily accessible.

(5) *SUITABILITY FOR SURVEY WORK.*

Wide track undercarriage and excellent downward view obtained from cabin, and pilot's cockpit, combine to render the "Wessex" ideal for survey work. A well-known air survey expert says: "Wessex is a very comfortable and serviceable machine, capable of being used for survey as well as transport."

(6) *RUDDER BIAS GEAR AND TAIL ADJUSTMENT GEAR.*

This enables pilot to remove feet and hands from controls in flight, thus relieving him from all strain. If one engine cuts out, bias gear is fully operative and takes rudder loads off the pilot.



THE "WESTLAND WESSEX"

Three Armstrong-Siddeley Genet Major Engines

Points of "Wessex" Superiority (*Continued*)

(7) VISIBILITY.

Passengers obtain an excellent view owing to high monoplane wing and small size of outboard engine nacelles.

Pilot is located in front of the wing, *with new type of windscreen which gives a high degree of visibility and can be* opened up in bad weather if necessary.

(8) *A TURN INDICATOR* is fitted as standard.

SPECIFICATION

FUSELAGE.

The fuselage consists of three main sections, namely :—

(1) The forward portion, of composite construction, which accommodates the pilot and mechanic, or additional passenger, and with which is incorporated the front or central engine mounting and cowling, instrument board, controls, etc.

(2) Middle or cabin section, which is of wood construction, and which accommodates (*a*) four passengers in comfort, together with an entrance lobby and lavatory compartment, or (*b*) six passengers if the lobby and lavatory compartment are not required.

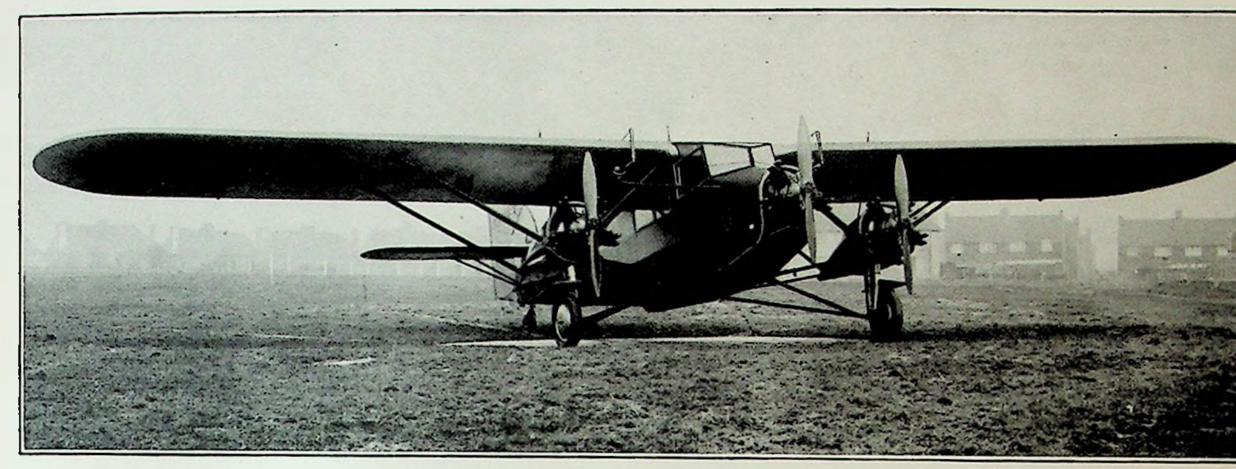
(3) The rear portion of the fuselage in which is incorporated an ample luggage compartment.

This is of metal construction, being of square section duralumin tube with flitch-plate and tubular rivet joints on the well-known Westland principle.

WINGS.

The wing structure is in two sections, and is of wooden construction with rigid type internal bracing, arranged to accommodate two 50 gallon (227.5 litre) fuel tanks. Built-up box spars of three-ply and spruce are employed, the main ribs being of spruce and of the Warren girder pattern.

The wing ribs are of simple design, and are easy to repair or replace should this at any time be necessary. The wings are fabric-covered.



Specification (*continued*)

The wing section selected is R.A.F. 34 in which the movement of the centre of pressure is very limited ; the aircraft is thereby rendered stable at all speeds, and is highly controllable at and near the stall, thus giving freedom from involuntary spins.

EMPENNAGE AND CONTROLS.

The fin and tail plane are of wooden construction as are the planes wings, but the ailerons, rudder and elevators are of tubular duralumin spar type with pressed-out sheet metal ribs. All surfaces are fabric-covered. The controls are well co-ordinated, and the machine can be flown hands and feet off on all three or even on any two engines only (see Rudder Bias Gear). All working joints in the control system are provided with large bearing surfaces and nipples for grease gun lubrication which can easily be reached through conveniently arranged inspection doors.

WESTLAND PATENT RUDDER BIAS GEAR.

A special rudder-trimming device is provided within easy reach of the pilot. This permits the "Wessex" to be flown hands and feet off the controls thus relieving the pilot from all strain. Even if one engine cuts out, the gear is fully operative and takes the rudder loads —a boon to pilots when engine trouble is encountered on an extended flight.

UNDERCARRIAGE.

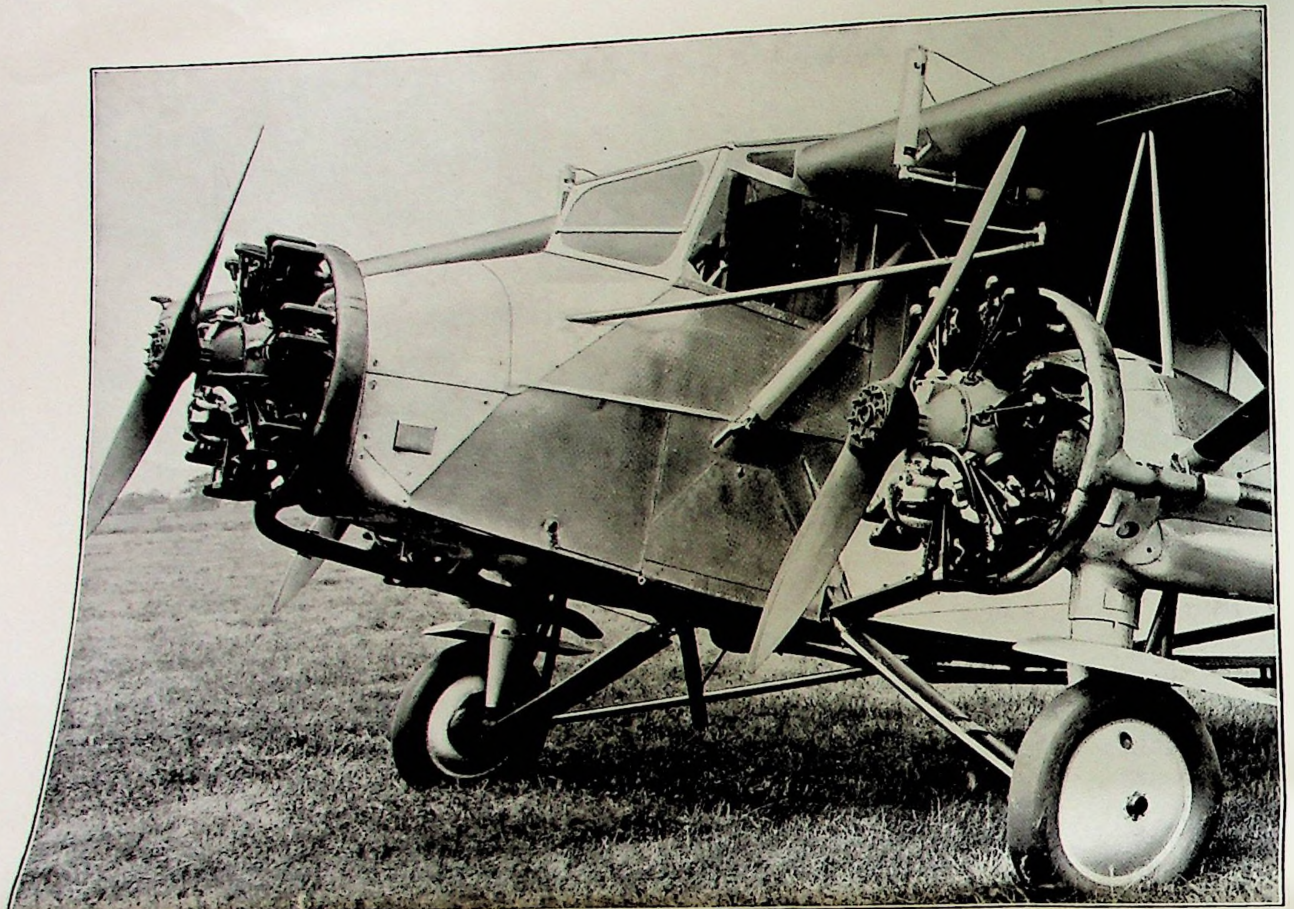
The undercarriage gives great breadth of wheel track, and is designed to hinge about the bottom longerons of the cabin portion of the fuselage. The shock absorption system (which is of the oleo type) conveys the forces brought into play in landing, through the medium of the bracing struts, in the best possible manner, to the wing roots and strut attachments of the wings. The very wide track ensures steady landings in all weather conditions, and is particularly suited for landing on rough surfaces and in districts where aerodromes are not yet first-class. Efficient mudguards are provided.

WHEEL-BRAKES.

Bendix-Perrot wheel-brakes are standard, being operated by a hand-lever in the pilot's cockpit, with compensating gear introduced in the braking system.

TAIL WHEEL.

A swivelling and self-centring tail-wheel is fitted with a low pressure type tyre, and greatly facilitates both ground handling of the machine and manoeuvrability when taxying.



Specification *(continued)*

POWER UNITS.

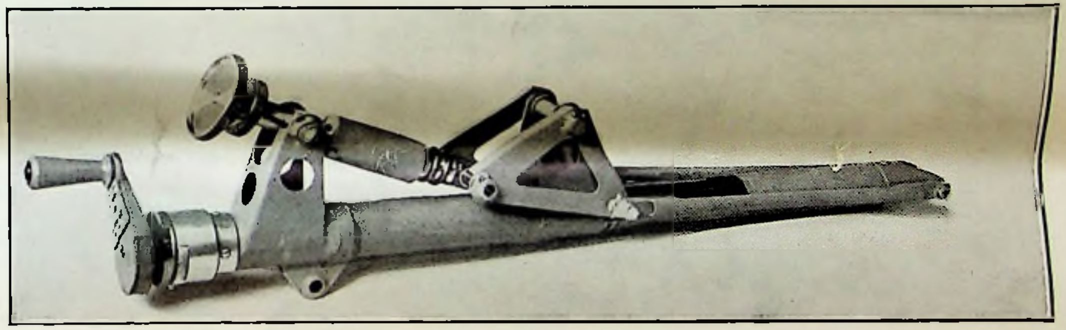
These are either three Armstrong-Siddeley, ungeared Genet Major 140/149 H.P. 7-cylinder radial engines, or alternatively three Genet Major 105/110 H.P. 5-cylinder radial engines. High-compression engines can be installed if necessary, for working at higher altitudes. The ceilings would then be increased by 2,000 feet.

The mountings of the two outboard engines are located at the two points of convergence of the wing struts and chassis outrigger-struts. The torque reaction in the case of the outboard engines is taken by an inverted vee attached to a floating link.

A $3\frac{1}{2}$ gallon (16 litre) oil tank is installed in the rear of each of the three engines, though 3 gallons (13.4 litres) per engine is the normal supply. The oil temperature is regulated by means of adjustable louvres which admit air through longitudinally constructed tubes in the tanks themselves. The fairing of the nacelles has been well carried out, with minimum obstruction to the view from the cabin windows.

The outboard engines are rubber mounted, and the design has arranged for elimination of propeller overlap. The three power units are extremely smooth running, so that in view of the cumulative effect of the design details in respect of the engine installations, there is none of that unpleasant "surging" or vibration so often found in multi-engined aircraft; the "Wessex" is consequently extremely pleasant to fly both from the pilot's and passengers' point of view. Noise is reduced to a minimum by effective silencing of the engines.

A Wessex utilised for the conveyance of live stock. *(Picture News Service.)*



The Westland Patent Rudder Bias Gear as installed in the Wessex cockpit.

Specification *(continued)*

Hand turning-gear is fitted, thus ensuring easy starting with the operator standing on the ground.

CABIN.

The entrance to the cabin does not necessitate steps, as the door sill is not high from the ground.

Passengers enter through a lobby, which is convertible during flight into a separate lavatory compartment, by means of an ingenious folding door, the lavatory being as effectively screened off when passengers are entering or leaving the aircraft as when it is occupied in the air.

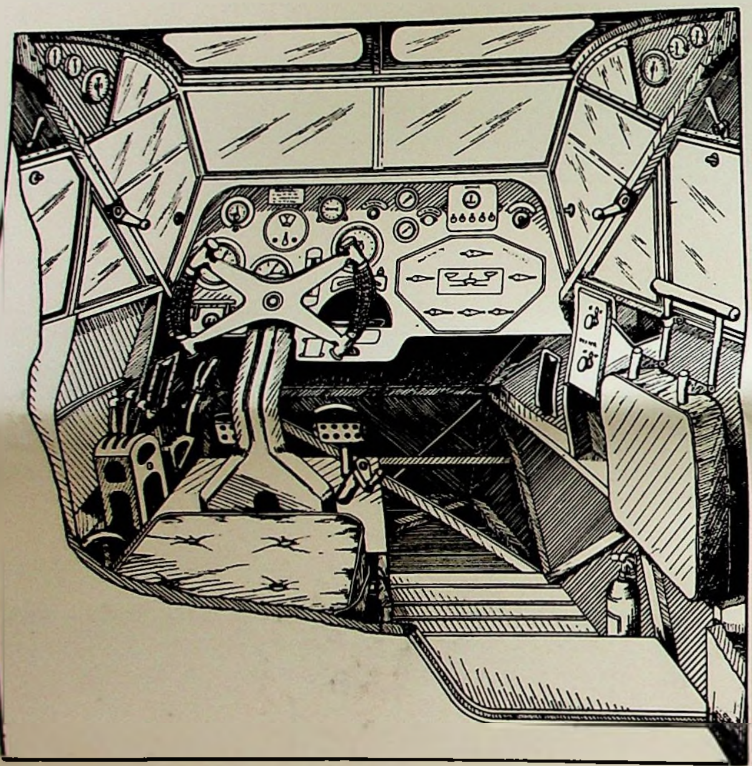
The volume of the cabin is 108 cubic feet (3 cu.m.) The dimensions being height $68\frac{1}{2}$"—59" (1.7m.—1.5m.), length $67\frac{1}{4}$" (1.7 m.), width $43\frac{5}{8}$" (1.1 m.), and is luxuriously furnished and upholstered with light luggage racks and sliding windows of unsplinterable glass. Four comfortable arm-chair seats facing forward are provided with headrests, or alternatively they can be placed in couples vis-a-vis, if requested when placing the order.

The lavatory can be eliminated

and two extra passengers' seats incorporated if desired. This, however, must be stated when placing the order. A door in the front of the cabin communicates with the pilot's cockpit, and a sliding window is provided; there is an extra passenger or navigator's seat alongside the pilot.

PILOT'S COCKPIT.

This is enclosed and weatherproof and is provided with a hinged transparent skylight, which may be used as a means of exit in case of emergency. Sliding Triplex windows on both sides afford an uninterrupted view in all directions, while the front screens on the pilot's side can be opened in flight to give a clear view if rain or sleet obscures them.



Interior of Pilot's Cockpit.

There is ample room for the installation of the latest Marconi wireless equipment either of the dual or pilot-operated type.

The instrument board is mounted at a convenient angle, and well lighted. The three engine control levers are mounted adjacent to the left hand of the pilot, as is also the tailplane adjustment wheel.

Turn-Indicator. A turn-indicator is standard and is mounted in a prominent position on the instrument board.

Westland Patent Rudder Bias Gear. This is standardised (see earlier paragraph), and the control handle is on the pilot's right-hand side.

Wheel-Brakes. The brake-lever is on the left hand of the pilot adjacent to his left knee.

Pilot's Seat. The pilot's seat is adjustable for height.

LAVATORY.

The lavatory compartment has a capacity of 38 cubic feet (1.1 cu.m.). This accommodation is provided at the rear of the cabin, and is screened off from the entrance lobby by suitable folding doors, so arranged that when the lavatory is in use the whole of the entrance lobby becomes available, and the cabin is entirely partitioned off.

EMERGENCY EXIT.

A ripping-panel and ring is provided in the roof of the lavatory compartment.

HEATING AND VENTILATION.

A ventilator-and-heater-box is fitted in both the cabin and pilot's cockpit, and can be regulated by the occupants to obtain the temperature desired.

No special clothes are necessary for pilot or passengers.

LUGGAGE.

A rear luggage compartment of 38 cubic feet (1.1 cu.m.) capacity is provided, the principal dimensions being 3′ 4″ (1.01 m.) high by 3′ 2″ (1 m.) long and 3′ 7″ (1.09 m.) wide.

A front luggage locker of 3.2 cubic feet (.09 cu.m.) capacity for heavy compact articles is provided in front of the cabin.

FUEL SYSTEM.

Two 50 gallon (227.5 litre) tanks are situated in the root of each wing: flow is thence by gravity to a common distributor-box and thence, still by gravity to the engines.

Either tank alone is capable of feeding all three engines in any attitude of the aircraft: and complete control of the fuel system is mounted on the dashboard of the pilot's cockpit, whereby the supply can be turned on or off at various points in the system as required.

A Boiler-type graduated contents-gauge is fitted on the leading edge of the main plane in front of each tank, being clearly visible to the pilot.

PROPELLERS.

The aircraft is equipped with three two-bladed wood propellers. Metal propellers can be quoted for if required.

NIGHT FLYING EQUIPMENT.

Full night flying equipment, consisting of the following, can be fitted as an extra if required :—

a. Navigation Lamps.
b. Holt Flares.
c. Downward Identification Lamp.

Provision is also arranged for the installation, if required, of a fore and aft level; which, together with a turn indicator, is a desirable instrument for night flying.

CORROSION.

Special care has been exercised with regard to the protection of all metal parts. All duralumin fittings are anodically treated. All tubes are internally cleaned and treated with hard Tungue oil varnish. All important steel fittings are cadmium plated.

INSTRUMENTS.

Subject to alteration or special arrangements the following instruments are provided as standard :—

For Cockpit.

1 Air Speed Indicator. Smith's Mark IV.A. Calibrated 40/160 miles per hour. (64/256 Km.p.h.).

1 Altimeter. Smith's type A.V.563. 0-15,000 ft. (0-4,573 m.) with single scale.

1 Cross level. Smith's type. Mark VII. A.V.724.

1 Compass. Hughes. Mark P.4.

1 "Time of Flight" Clock. Smith's type. A.V.681.

1 Revolution Indicator. Smith's Mark V. Type A.V.503. 600 to 2,600 R.P.M. and geared 4-1.

1 Flex Drive. (6 mm. Inner member) for Revolution Indicator 5′ 6″ long, (1.68 m.).

1 Oil Pressure Gauge. Smith's type A.V.407. 0-160 lbs. per square inch (11.27 kg. per sq. cm.) with ¼ B.S.P. connections suitable for rubber covered pipes.

1 *Oil Temperature Gauge. Smith's Type A.V.437. Calibrated 30/100 degrees Centrigrade, with* 10 feet (3.04 m.) of capillary tubing.

1 Turn Indicator.

For Wing Engines.

2 Revolution Indicators. Smith's Mark V. Type A.V.503, 600 to 2,600 R.P.M. and geared 4-1.

2 Oil Pressure Gauges. Smith's Type A.V.407. 0-160 lbs. per square inch (11.67 kg. per sq. cm.) with ¼ B.S.P. connections suitable for rubber covered pipes.

2 Oil Temperature Gauges. Smith's Type A.V.437. Calibrated 30/100 degrees Centigrade.

For Cabin.

1 Air Speed Indicator. Smith's Mark IV.A. Calibrated 40/160 miles per hour. (64/256 Km.p.h.).

1 Altimeter. Smith's Type A.V.563. 0-15.000 feet (0-4,573 m.) with single scale.

1 "Time of Flight" Clock with flanged case, nickeled and silvered dial.

GENERAL NOTE.

The details, illustrations and particulars given in the above specification are subject to modification as improvements are introduced from time to time, and must be taken as approximate only.

Westland Wessex 3-Engined 6-Seater

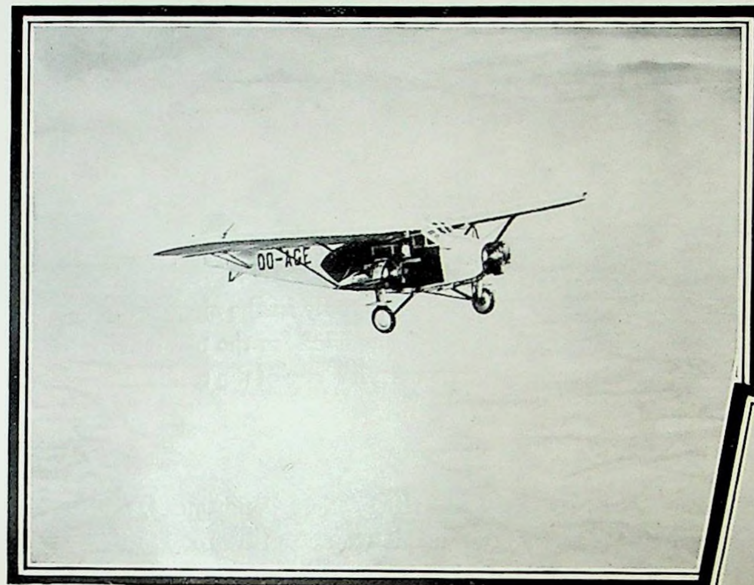
S.S.640 | S.S.640

	3 Armstrong-Siddeley Genet Major, 5 Cyls.		3 Armstrong-Siddeley Genet Major, 7 Cyls.	
ENGINES.	309 B.H.P. at 2200 R.P.M. 330 B.H.P. at 2420 R.P.M.		423 B.H.P. at 2200 R.P.M. 447 B.H.P. at 2420 R.P.M.	
PERFORMANCE DATA.	ENGLISH.	METRIC.	ENGLISH.	METRIC.
Maximum Speed at Ground Level at Maximum R.P.M. ...	108 M.P.H.	174 Km./p.h.	118 M.P.H.	190 Km./hr.
Speed at Ground Level at 2,200 R.P.M. (normal) ...	95 M.P.H.	153 Km./p.h.	105 M.P.H.	169 Km./hr.
Speed at Ground Level at 2,100 R.P.M. (cruising) ...	90 M.P.H.	145 Km./p.h.	100 M.P.H.	160 Km./hr.
With Full Fuel — Duration ...	5½ Hrs.	5½ Hrs.	4 Hrs.	4 Hrs.
With Full Fuel — Range ...	520 Miles	838 Kms.	420 Miles	676 Km.
With 2/3 Fuel and Passenger Pay Load of 1,347 lbs. (610 Kgs.) — Duration ...	3¾ Hrs.	3¾ Hrs.	2 Hrs. 40 Mins.	2 Hrs. 40 Mins.
With 2/3 Fuel and Passenger Pay Load of 1,347 lbs. (610 Kgs.) — Range ...	350 Miles	560 Kms.	280 Miles	450 Km.
Rate of Climb. Ground Level ...	530 Ft./Min.	162 M./Min.	680 Ft./Min.	207 M./Min.
Time of Climb to 1,000 Ft. (610 M.) ...	2 Mins.	2 Mins.	1.7 Mins.	1.7 Mins.
5,000 Ft. (1525 M.) ...	12 Mins. 30 Sec.	12 Mins. 30 Sec.	9.1 Mins.	9.1 Mins.
10,000 Ft. (3050 M.) ...	34 Mins. 30 Sec.	34 Mins. 30 Sec.	25.0 Mins.	25.0 Mins.
Absolute Ceiling (Full Load) ...	12,300 Ft.	3750 M.	14,900 Ft.	4550 M.
Service Ceiling at 100 Ft./Min. (30.5 M./Min.) ...	10,000 Ft.	3050 M.	12,700 Ft.	3880 M.
Absolute Ceiling—Two Engines (Full Load) ...	4,000 Ft.	1220 M.	6,000 Ft.	1830 M.
Stalling Speed ...	52 M.P.H.	83 Km./p.h.	53 M.P.H.	85 Km./hr.
Maximum Speed on Two Engines (Full Load)	90 M.P.H.	145 Km./p.h.	98 M.P.H.	157 Km./p.h.
Fuel Consumption at Cruising Speed ...	18 Galls./hr.	82 Litres/hr.	24¾ Galls./hr.	112 Litres/hr.
Landing Run with Brakes (Wind 5 M.P.H. 8 Km./p.h.) ...	163 Yards	149 M.	210 Yards	192 M.
WEIGHT DATA.				
Bare Weight of Aircraft ...	3495 Lbs.	1586 Kgs.	3755 Lbs.	1705 Kgs.
Fixed Equipment (including Instruments) ...	74 ,,	34 ,,	74 ,,	34 ,,
Tare Weight of Goods Machine ...	3569 ,,	1620 ,,	3829 ,,	1739 ,,
Tare Weight of Passenger Machine ...	3670 ,,	1666 ,,	3930 ,,	1785 ,,
Movable Equipment for Passenger Machine ...	101 ,,	46 ,,	101 ,,	46 ,,
Fuel and Oil (Fuel at 0.778 Spec. Grav.) ...	845 ,,	383 ,,	845 ,,	383 ,,
Pilot ...	170 ,,	77 ,,	170 ,,	77 ,,
Pay Load as Goods Machine ...	1166 ,,	529 ,,	1156 ,,	524 ,,
Pay Load as Passenger Machine ...	1065 ,,	483 ,,	1055 ,,	478 ,,
Total Weight of Machine ...	5750 ,,	2609 ,,	6000 ,,	2723 ,,
GENERAL DATA.				
Wing Area ...	490 Sq. Ft.	45.5 M².	490 Sq. Ft.	45.5 M².
Wing Loading ...	11.7 Lbs./Ft².	51.1 Kg./M².	12.25 Lbs./Ft².	59.7 Kg./M².
Power Loading (on normal B.H.P.) ...	18.6 Lbs./H.P.	8.44 Kg./C.V.	14.3 Lbs./H.P.	6.43 Kg./C.V.
Span ...	57'—6"	17.5 M.	57'—6"	17.5 M.
Length ...	38'—0"	11.55 M.	38'—0"	11.55 M.
Height on Skid ...	9'—6"	2.9 M.	9'—6"	2.9 M.
Chord ...	9'—6"	2.9 M.	9'—6"	2.9 M.
Wheel Track ...	15'—0"	4.56 M.	15'—0"	4.56 M.
Volume of Cabin ...	108 Cub. Ft.	3.06 M³.	108 Cub. Ft.	3.06 M³.
Volume of Entrance and Lavatory ...	35 Cub. Ft.	0.99 M³.	35 Cub. Ft.	0.99 M³.
Volume of Luggage Lockers (Front and Rear) ...	42 Cub. Ft.	1.19 M³.	42 Cub. Ft.	1.19 M³.
Fuel Capacity ...	101 Galls.	460 Litres	101 Galls.	460 Litres

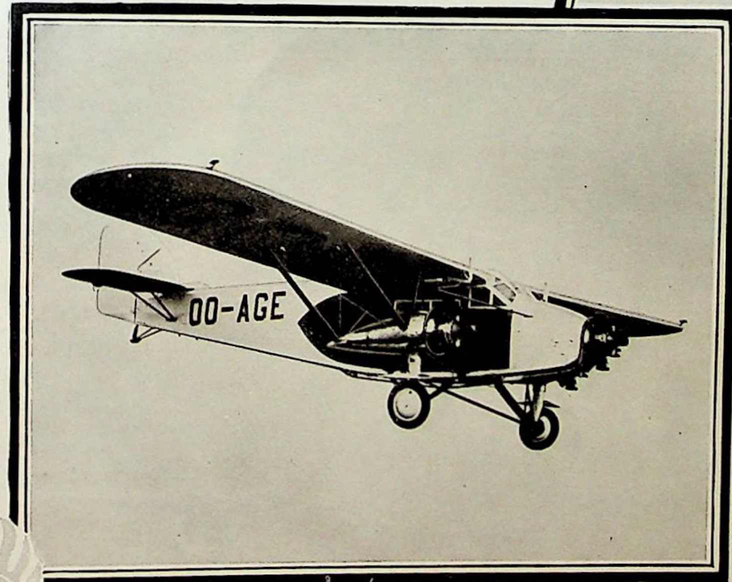
Our performance figures are confirmed by official Air Ministry tests at Martlesham Heath for the grant of the Airworthiness Certificate for the type machine under standard atmospheric conditions: where climatic or altitude conditions differ from standard, the makers should be consulted as to the effect on performance.

NOTE.—Extra equipment to be deducted from pay load. The effect of extra resistance of wireless gear and navigation lights upon performance will be to reduce speeds by approximately 2 M.H.P.

Westland Aircraft Works - - - Yeovil, Som.



Photos by "Flight."



One of four Wessex Machines supplied to Sabena Air Lines for use in Belgium.

CONDITIONS OF SALE.

1\. All offers are made subject to aircraft and/or parts remaining unsold at the date of receipt of order.

2\. **TESTS.**

The aircraft will be flight-tested at our Aerodrome for a period of 30 minutes by our pilot at our expense before being handed over.

The purchaser may attend personally, or send any independent person to represent him at such tests at his expense. If the purchaser or his representative wishes to fly in the aircraft during this test, he may do so at his own risk. Failure to arrive at the time specified for the test may lead to the test being carried out in the absence of the purchaser. The carrying out of the test is subject to weather or other conditions over which we have no control.

3\. **GUARANTEE.**

The aircraft are manufactured under our A.I.D. Approved Inspection Department, and a Certificate of Airworthiness is supplied to the purchaser, beyond this we accept no responsibility whatever.

4\. **DELIVERY.**

The normal method of delivery of aircraft is by handing over to the purchaser at our Aerodrome ready for flight by him or his representative, but not supplied with fuel or lubricating oil.

Time of Delivery.

Within the time specified in our acceptance of order, provided

(*a*) That no delay takes place in approval of drawings and submission of any necessary data to proceed, and

(*b*) That no delays arise due to other contractors' defaults, labour disputes, fire, accidents, strikes and other causes beyond the manufacturers' control.

5\. **CONSEQUENTIAL LOSSES AND CANCELLATION.**

We take no responsibility for consequential losses of any kind, neither can we accept cancellation of orders.

6\. **PACKING.**

If desired we will pack the aircraft or component parts for transport at an extra charge. It is understood that in such cases our responsibility ends from the moment we have loaded the packing cases on to transport vehicles, whether Railway or otherwise, at our Works.

7\. **TERMS OF PAYMENT.**

Our terms of payment are one-third with order, the balance payable after acceptance of aircraft or component parts at our Works.

8\. **COMPONENTS AND SPARE PARTS.**

These are manufactured under the same conditions of Inspection as complete aircraft, and the certificate of our A.I.D. Approved Inspection Department is to be accepted as evidence of satisfactory manufacture and beyond this we have no responsibility whatever.

WESTLAND AIRCRAFT WORKS

(BRANCH OF PETTERS LIMITED
OIL ENGINE MANUFACTURERS)

YEOVIL — — ENGLAND

Stephen Murray & Co. Ltd.
The Viking Press Yeovil

Instruction Book for Armstrong Siddeley Radial Aero Engines

Genet Major
[7 cylinder]

INSTRUCTION BOOK

FOR

ARMSTRONG SIDDELEY RADIAL AERO ENGINES

GENET MAJOR
7-Cylinder

ARMSTRONG SIDDELEY MOTORS LTD.

COVENTRY, ENGLAND

LONDON: 10, OLD BOND STREET, W.

Telephone: COVENTRY 4051.
Telegrams: "Sidarm, Coventry."

Telephone: Gerrard 9755, 6, 7 and 8
Telegrams: "Armsidco, Piccy, London"

Codes used: Bentley's, Bentley's Second, A.B.C. (5th Edition), Motor Trade (S.M.M.T.)

E.100/6/31

Leading Particulars of the Genet Major (7-cylinder) Engine.

Type	Air cooled, Radial, Plain
Number of Cycles	4
Number of Cylinders	7
Compression ratio	5 to 1
Direction of rotation	L.H. Tractor
Bore	4.25″ (108 mm.)
Stroke	4.5″ (114.3 mm.)
Swept Volume	446 cub. ins. (7.32 litres)
B.H.P. normal at sea level : Rated	140
Actual	145
Maximum B.H.P. at maximum R.P.M. at sea level	155
Normal engine R.P.M.	2200
Normal propellor R.P.M.	2200
Maximum propellor speed above normal	10%
Number of valves per cylinder	2
Valve Gear	Cam Ring, Tappets, Push Rods and Rocker Arms
Cylinders	Barrel : Forged Steel. Head : Aluminium Alloy
Ignition	Fixed
Magnetos	2 B.T.H. S.G.7-1 (one fitted with impulse starter
Sparking Plugs	K.L.G. 665LR
Carburettor	One Claudel Hobson A.V. 55 A.
Oil pressure	60 lbs. per sq. inch = 4.22 Kg. per sq. cm.
Pitch circle diameter	15.5″ (0.3937 m.)
Diameter of holes	$\frac{11}{32}$″ (8.73 mm.)
Number of holes	21
Overall diameter of flange	16.25″ (0.412 m.)
Engine weight	315 lbs. (143 Kg.)
Overall measurements :—	
Diameter	38.15″ (.95 m.)
Length	38.8″ (.99 m.)
Packing measurements :—	
Length	48″ (1.2 m.)
Width	45″ (1.125 m.)
Height	42″ (1.06 m.)

CHAPTER I.

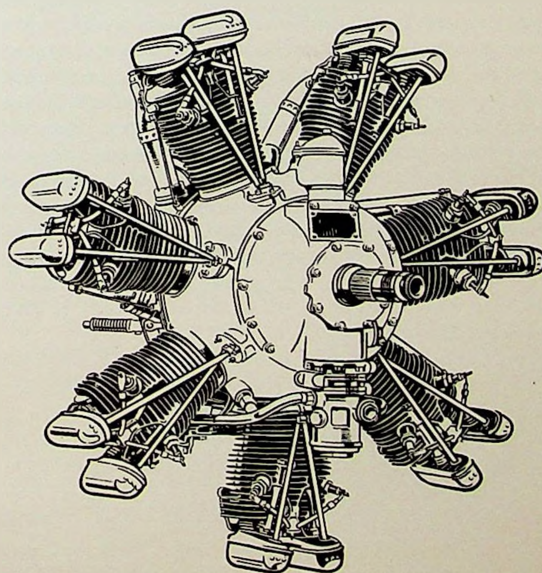
General Description of the Genet Major (7 cylinder)

The Genet Major is one of the well-known range of Armstrong Siddeley aircooled radial engines. Being rated at 140 h.p. it occupies a position between the 100 h.p. 5-cylinder Genet and the 150 h.p. Mongoose.

The engine has seven cylinders, the vertical cylinder being situated at the bottom. Being of the radial type it scores on the ground of accessibility, simplicity and ease of maintenance, three important features as far as the pilot or engineer is concerned. Being directly aircooled the added weight and complication of the water cooling system are eliminated. Facts and figures relating to the engine are given on page 2.

THE CONSTRUCTION OF THE ENGINE.

Each cylinder is machined with its fins from a steel forging, its lower end being screwed into a steel adaptor and located in the aluminium crank-case and locked there with a double cone locking ring and screw. This method of attachment is very quickly undone and also distributes the



The front of the 140 h.p. Genet Major engine showing the accessible position of plugs, valve gear and oil pump unit.

pressure of the explosion over a large area of the crankcase. The aluminium alloy semi-spherical heads are shrunk, screwed and locked into the cylinders, an external fin providing additional security. This patented method of attaching the head to the barrel ensures a gastight joint and good thermal contact and is standard on all Armstrong Siddeley engines. The bronze bushes for the sparking plugs and valve seats are screwed and shrunk into the head, a pair of plugs being fitted on the front face of the head and the valves being inclined. The valves are made of HR1 which is quite proof against pitting and maintains its strength at the highest temperatures. The valves are therefore interchangeable. The valves are returned to their seats by duplex valve springs, which enable a spring of small rate to be accommodated in a small space. Push rod return springs are fitted while each valve is operated by a rocker arm, the necessary means of adjustment for clearance being provided on the arm and locked by a transverse screw which it is very important to keep tight.

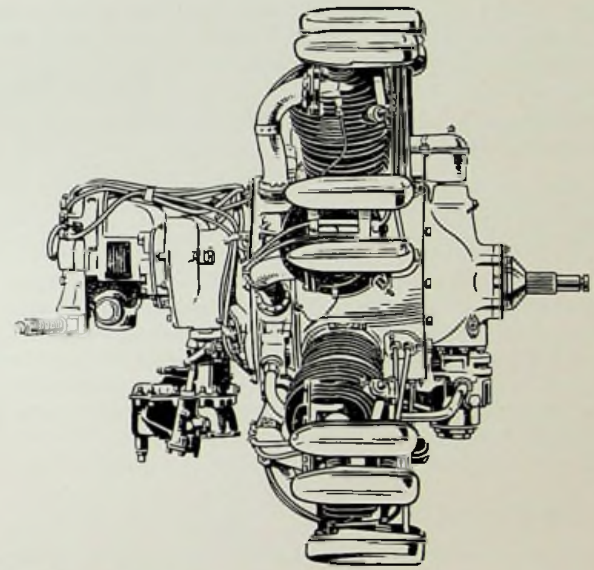
ROCKER ARM DETAILS.

The rocker arm is carried on two rows of ball bearings, shims being fitted to take up sideplay. These bearings are lubricated by a grease gun, the arm itself being enclosed in a light pressed case fitted with a spring-on streamlined lid. The rockers are carried on brackets taking their support from the lower part of the cylinder head and connected by cross pieces which also form guides for the cables. The lower halves of the rocker covers form a support for the bracket and are attached to the head at a point adjacent to the valve ports which are situated at the back of the head. The rocker arms are operated by tubular push rods which are fitted with case-hardened ends sweated into position. The lower end is ball shaped while the top end is flat. Screwed into the rocker arm there is a bush with a loose pad formed of two cylindrical surfaces at right angles to each other, which by providing a universal motion and line contact at this point eliminates wear.

The push rods are controlled by roller ended tappets and a slow speed cam ring driven at an eighth engine speed from the crankshaft through the medium of two satellite wheels. The inlet and exhaust cams are set parallel on the cam ring, the exhaust being to the front and the ring revolving in the same direction as the crankshaft.

The mixture is provided by a Claudel Hobson A.V. 55-A carburetter mounted at the rear of the engine. It then passes into an annular chamber formed by the rear cover where a fan driven direct from the crankshaft distributes it equally to all cylinders. The carburetter is fitted with interconnected altitude and throttle controls and is designed so as to have its principle parts easily accessible.

The ignition system comprises two B.T.H. S.G.7-1 magnetos, one being fitted with an impulse starter. There is a splined coupling between the rear end of the crankshaft and the front end of the rear drive shaft which is housed in the rear cover. A gland is fitted to prevent oil from reaching the rear drive chamber and there is a spiral on the magneto coupling to



Side view of the Genet Major 7-cylinder showing the position of the carburettor, magneto and oil pump.

return oil that works its way past the bearings. The rear drive shaft carries a centre gear wheel which incorporates hand starting dogs. This wheel drives two other gears at 1¾ speed, these gears being provided with a fine adjustment coupling for synchronising the timing. There is an oil plug at the top of the timing cover and oil should be filled up until it reaches the level of the drain tap. The centre gear wheel is mounted on a single ball race while the outer gear wheels are fitted with two races each. The magnetos are flange fitted to the timing case, their contact breaker ends facing rearwards in a most accessible position.

THE LUBRICATION SYSTEM.

The lubrication system is of the dry sump type, the pump unit, which is mounted on the front cover in a very accessible position, incorporating the pressure and scavenge pumps which are driven by bevel gearing from the crankshaft. The scavenge pump is of 50% greater capacity than the pressure pump. The suction pump draws the oil from a sump in the crankcase on each side of the bottom cylinder and passes it through a cylindrical filter in the pump itself. The oil then reaches the tank from which it travels to the pressure pump, through a multiple disc fine gauze filter and then through the centre of the pump driving spindle and through a hole into the centre of the crank and so to the crankpin. To prevent too great a pressure being built up a release valve is incorporated in the system. Both filters are very easily accessible and can be cleaned in a few moments. The tachometer drive is by worm gear from the pump shaft.

The following oils are suitable for use with the Genet Major engine: Castrol R (Summer), Castrol C (Summer or Winter), Golden Shell (Winter), Joy's P.4 Mineral (Summer or Winter), Vacuum B (Summer), Vacuum BB (Winter), Marvelube A.7 (Summer), Veedol Aero X Heavy (Summer), Silvertown P.4 Mineral (Summer or Winter), Vacuum Aero H and Mobiloil R (Winter).

A petrol primer is fitted and connected to a ring pipe on the rear of the engine. Pipes lead from this ring to the induction ports of each cylinder. When the pump is operated by hand, atomised petrol is fed into the ports.

The crankshaft, which is short and stiff, is carried on two roller bearings, the front one being fitted in the crankcase and the rear one in the rear cover, these bearings being situated fore and aft of the webs of the crank which is, therefore, thoroughly well supported. A third dual purpose bearing is fitted in the front cover to take the thrust of the propellor. Housings for the two roller bearings are shrunk and locked with nut lugs. Steel balance weights are bolted to the crank, thus following standard Armstrong Siddeley practice.

MASTER ROD ASSEMBLY.

The master rod and one half of the master ring are formed in one steel forging machined all over. To this rod are attached two of the auxiliary rods which, like the master rod are of "H" section. The cap half of this rod carries four more auxiliary rods. A split flanged steel bush lined inside with white metal constitutes the crankpin bearing and is pegged securely in position. The case hardened steel wrist pins are located in the master ring by the four master rod bolts securing the master rod to the cap half. The lower end of the connecting rods run on fully floating bronze bushes while the hollow gudgeon pins at their upper ends are similarly equipped and prevented from lateral movement in the "Y" alloy pistons by means of circlips which expand into the piston bosses. The pistons have dished tops and are machined all over. There are two pressure and one scraper ring above the gudgeon pin and one scraper ring below it, an arrangement which accounts for the engine's economy and freedom from sooting up troubles.

THE CRANKCASE AND COVERS.

The rest of the engine consists of the crankcase and front and rear covers. The crankcase is a very substantial and well-ribbed construction and accommodates the mouths for the cylinders and tappet guides and the wall carrying the front main bearing. Its rear face is open and is sealed by the mixing chamber. The latter incorporates ports for accommodating the lower ends of the inlet pipes and the housing for the rear main bearing. As already explained the magneto timing case is located behind the induction chamber, the housing for the ordinary type of worm gear hand starter where this is fitted being bolted up to the magneto timing case. The front cover incorporates the faces for the attachment of the oil pump and breather.

The breathing system is interesting because the breathing passage between the crankchamber and the breather itself is arranged in such a way as to avoid the valve timing case. The breather itself consists of a light aluminium labyrinth.

Like other Armstrong Siddeley engines every part is subjected to the most rigorous test and careful scrutiny, special Inspection Departments having been created for this purpose. Every engine and every engine development has to pass the Armstrong Siddeley system of tests in addition to the usual British Air Ministry Type Tests which ensure that the finished product will obtain the highest degree of reliability in service. All components are strictly interchangeable and no hand fitting is necessary, a result that has been attained by the careful study of design and by the excellence of the machine shop methods employed. Owing to the fine limits enforced in the machining process and the abolition of hand fitting, the engines are uniform and do not vary in horsepower. A standard compression ratio is used and no attempt is made to obtain exceptional power for special engines by the use of a compression higher than that which may be normally used.

CHAPTER II.

Stripping the Genet Major (7-cylinder)

With the engine front face uppermost remove the wire carriers from the cylinder heads and spring off the valve spring covers by pushing them forward and freeing them from the peg in the lower half. Remove the sparking plugs. Depress the valve springs and lift out the push rods complete with their return springs. In the case of valves which are open the crank must be turned to allow the valves to seat themselves before the push rods can be withdrawn.

Note. Each push rod is numbered at its end which adjoins the crankcase, I standing for inlet and E for exhaust. The numbers refer to the cylinders which are numbered in a clockwise direction when facing the front of the engine and start with the lowest cylinder as Number 1. The cylinders are numbered on their inlet port flanges. The tappet guides and crankcase are also numbered.

REMOVING CYLINDERS AND PISTONS.

Disconnect the short primer pipes from the primer ring and cylinder heads. Remove the induction pipes, noting that it should only be necessary to loosen the lower ring nuts unless the packing needs renewing. Loosen the cylinder locking screws and then tap the screw head and ring with an aluminium drift to loosen the cylinder locking ring.

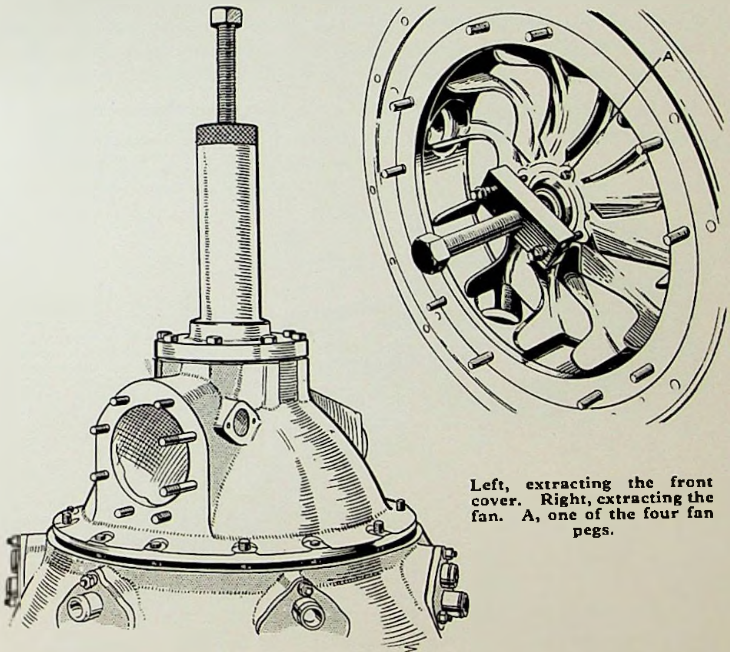
Insert a feeler in the sparking plug holes to find which pistons are at top dead centre and unscrew their cylinders. Turn the crank to bring other pistons to top dead centre and remove their cylinders.

With the tang end of a file remove the front circlip of each piston and push the gudgeon pin up through the piston from below leaving the other circlip in the piston. The pistons (which are numbered on the crown) and the small end bushes are now free.

Place a tray under the engine to catch the waste oil and turn the engine into a horizontal position. Disconnect the H.T. cables from the distributor and draw them free from the crankcase. Remove the nuts holding the B.T.H. S.C. 7-1 magnetos to their brackets and withdraw the magnetos. Note the port magneto is fitted with an impulse starter while the starboard one is plain. Remove the nuts holding the hand starter to the magneto bracket and withdraw the hand starter.

Remove the magneto bracket from the rear cover, noting that the two positioning bolts must first be tapped rearwards. Remove the rear cover by tapping the magneto driving casing. Remove the split pin, nut and tab washer which locate the fan locking nut and then remove the split pin and nut

opposite. Unscrew the fan locking nut with a tubular castellated spanner, the other end of the crank being held firm during the operation. Extract the fan as illustrated, using the studs from which the nuts have just been removed.



Left, extracting the front cover. Right, extracting the fan. A, one of the four fan pegs.

The fan has a steel centre secured by two bolts. The two fan gland locating pegs, which also pass through the steel centre, are locked with castellated nuts. The fan gland is ground on to its seat on the steel centre of the induction case. It is located by two pegs and floats on four springs which must not be lost when the fan is removed. The function of the gland is to prevent the oil from the crankcase passing along the crankshaft into the fan chamber.

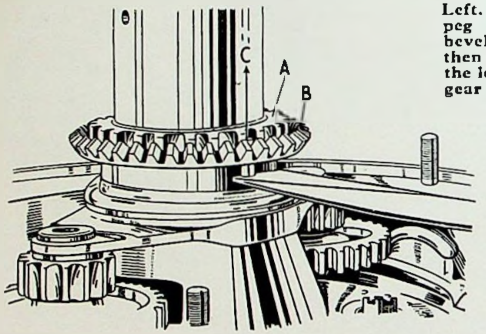
With the engine forward face uppermost remove the oil scavenge pipes and then the pumps from the front cover, noting that the tachometer drive must be withdrawn before the pump can be pulled off.

Unscrew the thrust locking nut from the front end of the crankshaft which must be held firm during the operation with the aid of a piece of wood passed through the small end of the master rod.

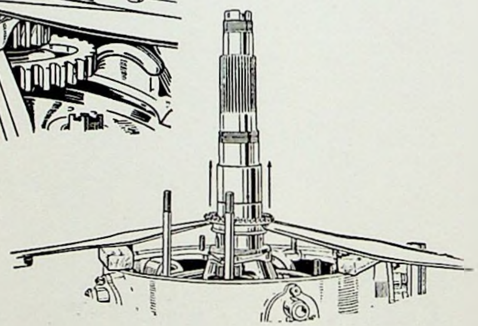
Remove the thrust cover plate and then extract the front cover as illustrated on the previous page. A steel shim which is ground to size is found in the cover plate, its function being to centralize the crankshaft.

Pull the stationary timing gear off its studs.

Pinch up and knock out upwards the split taper peg locating the pump drive bevel gear on the centre locknut and remove the latter with a castellated box spanner. Extract the pump drive bevel gear and lift out the cam and the roller race below it.



Left. Levering up the split peg C which secures the bevel gear locknut A and then after having unscrewed the locknut extract the bevel gear B as shown below.



With the engine rear face uppermost remove the split pins and nuts from the master rods. Extract the induction case from the crankcase, then tap the four bolts out of the master rod. Remove the rollers from the rear race. Tap out the two outside wrist pins in the cap half which should be supported from below during the operation. Remove the two outside auxiliary rods and lift out the cap half.

Lift out the crank and then the master rod.

Remove the anchor pins and withdraw the auxiliary rods.

Remove the tappet housings and tappets from the crankcase.

Remove the circlips locating the two wrist pins in the cap half and extract the pins. The two remaining wrist pins in the master rod are then tapped out.

STRIPPING THE CYLINDER.

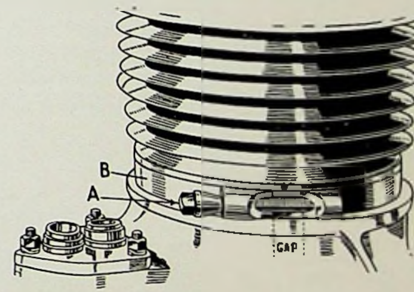
Remove the split pins and nuts from the valve rocker spindles and tap out the spindles, having first turned their flat heads round to clear the lower half of the cover. Lift the rockers out, noting that a large and a small shim are fitted on each side of the rocker, the small shim being on the outside and the large shim acting as a dust cap for the rocker ball bearing.

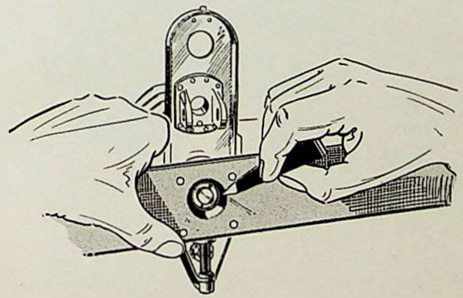
Place the cylinder on a wooden block to hold the valves up and with a special tool depress the valve spring and poke out the split cones locating the spring collar on the valve stem. Remove the collar and duplex springs and the valves are then free.

To remove the rocker gear cover withdraw the split pins from the rocker bracket, undo the nuts at the top and bottom of the bracket and twist the rocker bracket out of the boss on the cylinder.

Remove the split pin from the valve cover plungers which are then free. Remove the split pin and nut from the flange boss and lift off the lower part of the valve spring cover.

To remove a cylinder loosen the screw A which tensions the locking ring B, give its head a tap to free the ring and then unscrew the cylinder. The gap should be approximately ⅛".





How to remove the split taper cones that secure the valve spring collar on the the valve stem. The spring is depressed by a strip of metal suitably drilled and the cones are then pushed out with a pointed instrument. During this process a specially shaped block of wood is inserted in the cylinder to support the head of the valve.

STRIPPING THE PUMP.

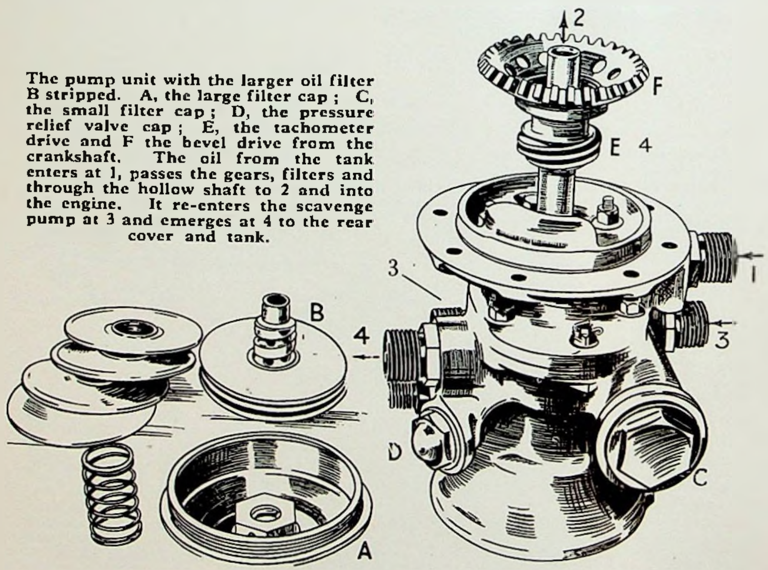
Remove the split pins, nuts and spring washers from the studs and bolts holding the two parts of the pump body together.

Remove the small circlip and tab washer from the strainer cap, taking care that the circlip does not spring off during the operation.

Grip the pump in a vice with the aid of clamps round the spiral thread on the driving shaft and undo the relief valve plug, spring and plunger, the last named being extracted with a tapered piece of wood. Remove the small oil strainer cap and strainer.

Holding the pump in a vice by the top body remove the large circlip on the oil strainer cap, taking care that the spring does not jump off. Remove the locking washer and top oil strainer cover, the latter being started by a sharp tap on the end of the spanner.

Turn the cover into the pump so as to drain off the oil from the strainers and then remove the strainers, spring and strainer sleeve from the cap.



The pump unit with the larger oil filter B stripped. A, the large filter cap ; C, the small filter cap ; D, the pressure relief valve cap ; E, the tachometer drive and F the bevel drive from the crankshaft. The oil from the tank enters at 1, passes the gears, filters and through the hollow shaft to 2 and into the engine. It re-enters the scavenge pump at 3 and emerges at 4 to the rear cover and tank.

Again grip the pump by the spiral on the driving shaft and knock out the two dowel pins that locate the two halves of the pump body. Tap the two halves of the body apart with a hide hammer. Lift out the driven gear and spindle.

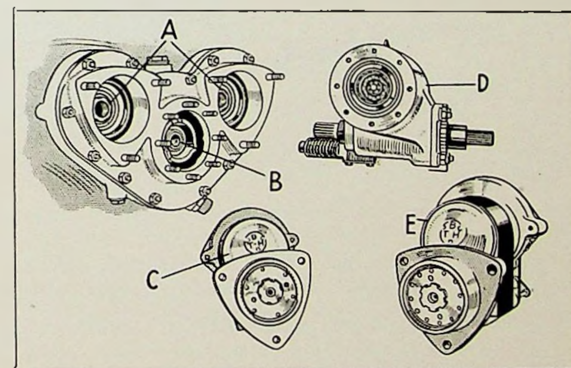
Tap the driving spindle flush with the top of the driving gear and then with an aluminium drift carefully tap the spindle through the gears. The spindle is now free.

Lift out the dividing plate and with the aid of the driven spindle extract the pressure gears from the pump body where they may be held by the oil. Drain the pressure pump body of oil.

THE OILING SYSTEM.

The oil flows from the tank to the suction side of the pressure pump where it is filtered. From there it passes through the driving spindle of the pump and enters an annular passage in the front cover bearing. The crankshaft is drilled radially to correspond with this groove in which the oil is retained by the bushes having a running fit on the crankshaft. The oil enters at the front end and passes through the crank where some oil escapes into the cam bearing from a hole at the front end and so feeds the timing gear, while the rest lubricates the master rod bearing. The overflow emerges between the master rod and crankshaft and lubricates the running parts by splash. From here it enters the crankcase and reaches a small chamber from which it is drawn through two external pipes leading to the scavenge pump. It passes through the filter and flows via an external pipe to the bottom of the oil chamber in the rear cover where it helps to warm the mixture and is cooled at the same time. From the top union in the rear cover an external pipe conveys the oil back to the tank.

Note. The inlet to the rear cover is on the starboard side.



How the magnetos, C and E, and hand starter D, are fitted. A, sleeves carrying the magneto drive gear bearings ; B, nut retaining the main driving gear. Magneto C, which fits the nearside flange, is fitted with an impulse starter.

STRIPPING THE HAND STARTER.

First unscrew the spring nut which is split pinned to the spring plunger rod and remove the spring. Remove the split pin and nut on the end of the spring plunger pin which is then driven out. Remove the split pin and nut from the operating lever and withdraw the lever from the operating crank to which it is keyed. Remove the key and the nuts on the bracket and free the bracket.

Remove the nuts from the cover and tap the cover free of the body. Remove the starting jaw from the body.

Remove the nuts holding in the worm shaft and bearing and draw out the worm shaft and then the worm.

The assembly of the handstarter is straightforward, the directions given above being followed in the reverse direction.

STRIPPING THE REAR DRIVING SHAFT.

Remove the split pin which locks the end nut to the rear drive shaft and unscrew the nut. The rear drive shaft can then be tapped through the case. Remove the circlip locking the bearing, the case being grooved to allow the circlip to be lifted. Then tap out the bearing and the gear which will come with it.

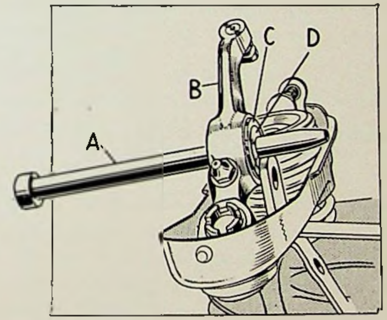
To remove the magneto driving gears remove the split pin and nut from the spindle. Thread an extractor into the spindle and withdraw it rearwards.

CHAPTER III.

Assembling the Genet Major (7-cylinder).

FITTING THE VALVES AND VALVE ROCKERS.

The lips of the valves, which are interchangeable, are marked IN and EX for identification. They are inserted in the guide and held up by a block of wood placed in the cylinder while the duplex springs are depressed to allow the split taper cone to be inserted in the collar as shown in the illustration. The stem of the valve is grooved to match grooves on the taper cones, the tension of the spring wedging the cone against the inside of the collar which is similarly tapered.



A taper pin A is used to ensure the centralisation of the shims C and D with the hole in the rocker B.

Grease the ball bearings of the rockers and fit a large and small shim on each side of the bearing. With the aid of a guide bar press the rocker arm down into position, lining it up with the hole in the bracket by passing a guide bar through the bracket and rocker holes.

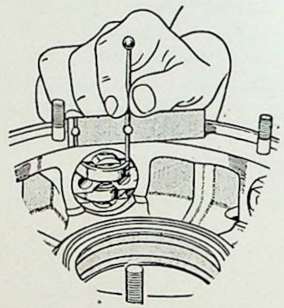
Note. Before fitting the bearing pins a taper lead may be inserted to ensure the shims being central, otherwise they may be bent when the parallel pin enters. Insert the rocker bearing pins and secure them with nut and split pin.

BUILDING THE TAPPETS.

The tappet is pushed into the guide, the roller is added and then the pin which is prevented from lateral movement by the housing. The movement of the tappet in the guide is restricted at one end by a circlip which is fitted last and at the other by the roller. **Note.** Both guides and crankcase are numbered. Check the rollers for alignment with a depth gauge noting that there is clearance in the guide stud holes to allow for this. Secure the guides in the crankcase, treating the face joint with shellac and making sure that the joint is clean.

MASTER ROD AND CRANK CLEARANCE TEST.

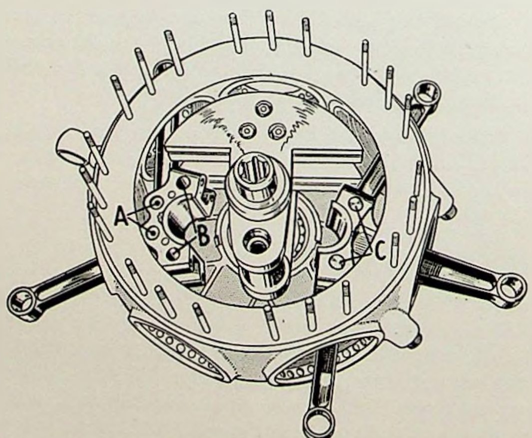
To test the clearance between the master rod bearing and crank place a piece of paper micrometered to 5/1000 inch on the master rod bearing and assemble the master rod and cap half on the crank. If the clearance is satisfactory the master rod should be stiff to move round the crank. Lateral clearance should also be tested for limits, see "Fits and Clearances." Strip the master rod from the crank and remove the paper.



Squaring up the tappet guide rollers in the crank case. There is sufficient allowance in the tappet guide holes to secure correct alignment.

ASSEMBLING THE MASTER ROD.

Insert the bushes in the smaller ends of the auxiliary rods and insert the smaller ends in the webs of the master rod where they are supported by floating anchor pins tapped into position so that the grooves in their sides correspond with bolt holes in the master rod.



Showing how the cap half and master rod are disposed in the crankcase to allow the entry of the crank. A are the plain wrist pins while B and C are located by grooves and bolts.

Next draw the two centre anchor pins in the cap half through the smaller ends of the auxiliary rods, noting that these pins are fixtures with circlips at each end and do not float like the others.

Place the rear face of the crankcase upwards on the bench and note the position of the figure 1 stamped on the web of the crank, bolt hole of the master rod and the corresponding part of the cap half, all of which should be adjacent in the assembly.

Insert the master rod in the crankcase mouth of No. 1 cylinder. The two auxiliary rods fitted to the cap half are then inserted in the crankcase mouths for Nos. 4 and 5 cylinders.

Insert the rollers in the inner race of the front bearing of the crankshaft and drop the shaft carefully into position steering the balance weights past the cap half and master rod as shown in the sketch.

Insert the two outside auxiliary rods with their bushes in the cap half, taking care that the grooves in the anchor pins line up with the holes in the webs of the cap half as described above.

Oil the crank, master rod and cap half bearings and secure the master rod and cap half with the master rod securing bolts which also locate the anchor pins. In screwing up the nuts it is desirable to tighten opposite corners. In split pinning the nuts, the head of the pin must go into the castellation and the legs must be twisted round the nut which necessitates the pins being twisted 180° around their axes before being split. This is necessary owing to the small clearance in the crankcase. Insert the rollers in the rear main bearing. Shellac the front face of the induction cover and fit the cover temporarily on the crankcase.

FITTING THE TIMING GEAR.

Turn the engine over, its forward face being uppermost. Fit the cam drum roller race on the crankshaft and press all the tappets outwards to enable the cam drum to be fitted on the race.

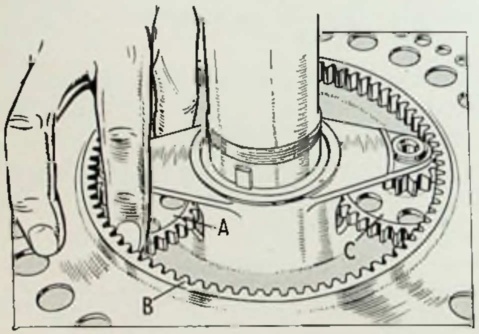
Note. An arrow is stamped on each timing gear and when the drum is fitted and the timing gear is meshed with the crank shaft gear these arrows should be disposed at right angles to one another to ensure the correct amount of back lash between the timing gears and stationary gear.

Place the stationary gear on the crankcase studs and turn the crankshaft until the stationary gear engages with the smaller gears. **Note.** The stationary gear must be fitted with its flat side undermost.

Test the gear for back lash by rocking the timing gears and turning the crank round intermittently to ensure that the back lash is correct all the way round. The correct amount of back lash is between 15/1000 inch and 20/1000 inch.

TIMING THE VALVES.

Fit the timing plate to the crankshaft, and the bush, piston, gudgeon pin and circlip to the master rod. Screw No. 1, i.e., the bottom cylinder into its adaptor in the crankcase, keeping the master rod and its piston fully out of the crankcase to facilitate the closing of the rings as the cylinder enters. The cylinder should be set with its ports approximately parallel with the rear face of the crankcase. Fit the pointer to a tappet stud and the centre finder in the sparking plug hole.

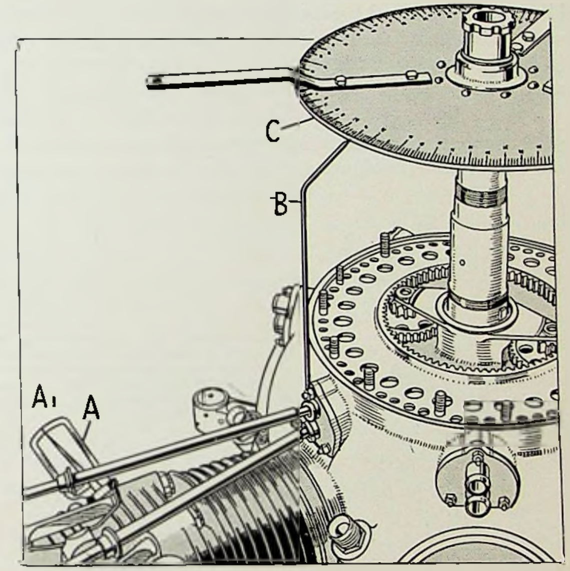


Testing the back lash between the stationary gear B and the planet gears A and C.

Find approximate top dead centre by moving the crankshaft and watching the centre finder finger. Then set the pointer to zero on the timing disc. To check, move the timing disc 20° from zero in one direction and mark the position of the finger of the centre finder. Move the timing disc 20° past zero in the other direction and the finger in the centre finder should register with the position already marked. If the centre finder finger does not take up its original position, note the reading on the timing disc when it does. Reset the pointer to half the error, that is, if the second reading shows 24° instead of 20°, the pointer should be set to 22° and register 22° on the other side of zero when the centre finder finger takes up its original mark. Therefore when the pointer registers zero on the timing disc the piston is at top dead centre.

Fit the push rods, and adjust the rocker clearance to .013" having made sure that the tappets are not rising. Move the crankshaft and disc in a clockwise direction as seen from the front of the engine, until the inlet valve commences to open. Lift the stationary gear out of mesh and turn the crankshaft in a clockwise direction as seen from the front until the pointer registers 10° before top dead centre on the disc. Then the stationary gear should be moved round on the studs until it meshes easily with the other gears.

Then check the valve timing. The inlet valve should open on 10° before top dead centre and the exhaust valve should close 20° after top dead centre. If there is any error the valves must be retimed. The illustration shows how the centre finder, timing disc and pointer are fitted.



Timing the valves with the aid of the centre finder A, its finger A1, the pointer B and the timing disc C.

Remove the push rods, centre finder, cylinder, timing disc and pointer. Remove the piston, gudgeon pin and bush.

Fit the thrust washer on the crankshaft, bevel upwards, noting that the washer is ground to suit the pump gear back lash.

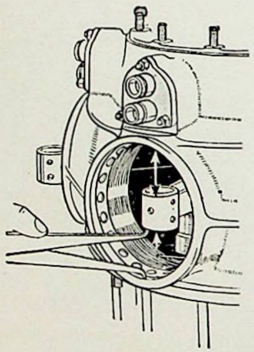
Tap on the crankshaft bevel gear and secure it with a lock nut and split taper peg. The lock nut should be driven up tightly.

Before the front cover can be fitted, a shim and the front thrust race must be added, while a second shim is fitted in the thrust cover plate, the two shims governing the centralization of the crankshaft. **Note.** When stripping the front cover the front shim should be tied to the cover plate and the rear shim to the cover.

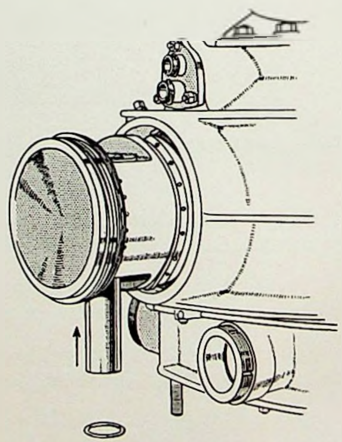
CENTRALIZING THE CRANK.

To test the centralization of the crank take two 50/1000 inch shims and fit one on either side of the thrust bearing. Fit the thrust bearing in the front cover and drive it up on the crank. Add the cover noting that a 4/1000 inch pull is allowed between the faces and that this joint should be shellaced. Then measure with internal callipers the clearance between each side of the master rod small end and the inside of the mouth of the crankcase. These distances should be equal. If they are not, shims of the right thickness should be fitted on either side of the thrust race. The illustration shows how the centralization is checked.

Add the crankshaft front lock nut which pulls the crankshaft up into position. Check the centralization of the crank as already described.



Determining the centralisation of the crankshaft by measuring the distances between the small end of the master rod and sides of the crankcase adjacent to the adaptor. They should be equal.



Fitting a piston.

Add the pump unit checking the back lash of the gears through the hole for the tachometer drive. If the back lash is unsatisfactory strip off the front cover and bevel gear and fit a washer under the bevel gear. Recheck the back lash and fit the tachometer drive.

Fit the pump scavenge pipes.

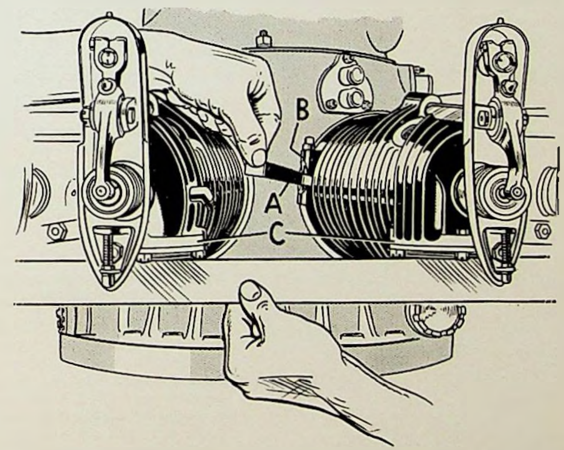
Fit the gudgeon pin bushes, gudgeon pins and pistons securing the gudgeon pins with circlips and noting that the scraper rings of the piston should have their bevelled edges facing away from the crankcase. The

piston crowns are numbered and correspond with numbers stamped on the mouth of the crankcase. See that the gudgeon pins float in the piston bosses.

Space the gaps in the rings equally and oil the pistons and bores of the cylinders. Before screwing the cylinders into the cylinder adaptors make sure that the adaptor pegs are in position and that the locking rings are fitted on their correct cylinders. The cylinders as already noted are numbered to indicate their correct position in the crankcase.

The locking ring screws should be positioned to the exhaust side of the cylinder free of the push rods so as to facilitate their tightening up.

Line up the cylinders by laying a straight edge along the valve ports, lining one pair of cylinders at a time as shown in the sketch.



Showing how the alignment of the cylinders is checked by laying a straight edge on their valve ports C. A is a gauge for checking the gap in the cylinder locking ring B.

SETTING THE ADAPTORS.

Tighten all the locking ring screws and then test the gap in the locking ring which should vary between $\frac{1}{8}$" and $\frac{3}{8}$" as illustrated. If the gap is too large or too small mark on the crankcase where the centre of the cylinder, i.e., the rocker bracket wire clip registers, and remove the cylinder. Mark the adaptor to correspond with the mark on the crankcase and remove the adaptor peg. Move the adaptor round until its mark is in line with the tappets. Re-peg the adaptor, refit the cylinder and adjust its alignment as before. Tighten the locking ring screws.

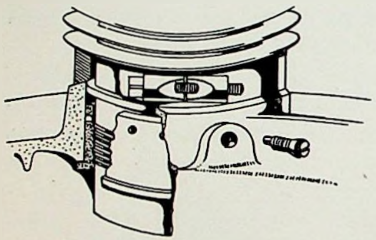
Fit the induction pipes and their joint washers.

Add the short primer pipes.

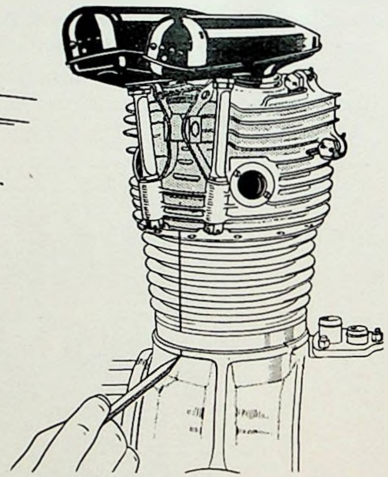
FITTING THE FAN AND FAN GLAND.

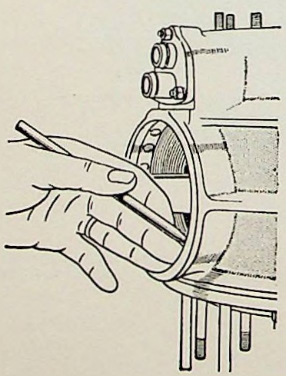
Turn the engine over with its rear face uppermost.

Fit the fan shim on the crankshaft and grind the fan gland with fine grinding paste on to the steel face of the induction casing, so as to make the gland oil-tight.



RESETTING A CYLINDER





Left. Top.—Cylinder attachment to crankcase.

Right.—If when the ring is tight the gap is too big or too small and the cylinder does not line up correctly, mark the crankcase to correspond with the centre of the cylinder, when the cylinder is partially screwed up and the gap is the correct measurement.

Left. Bottom.—
Then mark the adaptor opposite the mark just made on the crankcase so as to ensure the correct position of the cylinder when the adaptor is reset.

If a new fan has been fitted the clearance between the fan and induction case must be checked by pressing some plasticine on to the face of the case, adding the shim and then pressing the fan into position when it will compress the plasticine. A section of the plasticine should be measured to indicate the clearance, which should be between .040″ and .050″.

Fit the four coiled springs in the fan gland which is then mounted on the pegs which locate it on the fan, and fit the fan on the crankshaft.

Add the fan nut which should be locked tightly until a serration registers with one of the pegs. Then fit the tab washer, nuts and split pins on to the pegs.

THE REAR COVER.

Under ordinary conditions there should have been no need for the magneto driving gears and rear shaft to have been stripped. If they have been removed their assembly is effected as follows.

First fit a ball bearing in the vernier side of the magneto drive gear. Enter the spindle, head uppermost, through the bearing, fit a small aluminium distance piece round its stem and drive the second bearing into the other side of the gear. Enter the spindle with gear into the rear cover so that its thread protrudes through the back, then draw it into position with a nut.

Repeat the process with the second gear.

Note. The head of the spindle is internally threaded to enable the spindle to be extracted from the case.

The rear driving shaft is then pushed into position from the fan side of the case. There is a spring-loaded gland in the case which ensures a gas-tight joint. Fit a distance washer bevel face forward on the rear driving shaft. Add the bearing which is circlipped in the rear cover and fit the driving gear which is combined with the hand starter dog and locked up by a castellated nut and split pin on the rear thread.

Fit the distributor covers.

FITTING THE REAR COVER.

Add the magneto bracket to the rear cover, using shellac on the faces. Fit this unit to the crankcase, noting that the rear driving shaft and magneto driving gears are alread fitted in the cover.

Fit the H.T. cables between the distributor and the plugs. Each has a sleeve at each end carrying the number of the cylinder to which it applies. The red sleeves fit the starboard plugs and the black the port as viewed from the rear of the engine. **Note.** The firing order of the cylinders, which is given on the engine plate, is 1, 3, 5, 7, 2, 4, 6.

THE SMOKE TEST.

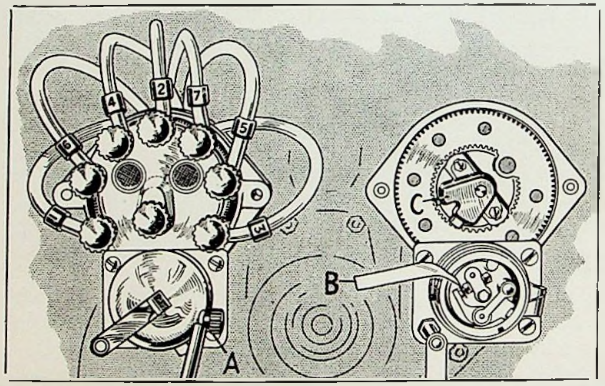
To ensure that the joints in the inlet pipe are free from air leaks they should be tested in the following manner : A cylindrical container is made with one end blanked off and the other end open and fitted with an open flanged end which can be bolted up to the face of the heater box. A short length of metal tubing is let into the plate which seals the other end of the container. Oily rag is ignited and stuffed into the container in a smoking condition and the container is bolted up to the heater box. A small supply of compressed air is allowed to enter the container via the tube and after filling up the induction system, the smoke will indicate by leakage if any of the induction joints are not air-tight. Those that fail to meet this test must be tightened or refitted.

TIMING THE B.T.H. S.G. 7-1 MAGNETOS.

With the engine placed as in the aircraft fit the timing disc and pointer, insert the centre finder in No. 1 i.e., the bottom cylinder, and find top dead centre as already described. Turn the disc in the direction of rotation, i.e., clockwise as viewed from the front of the engine, until both valves of No. 1 cylinder are closed and the piston is on the compression stroke. Turn the timing disc until the pointer registers 33° before top dead centre on the compression stroke.

Fit the impulse magneto first on the port side. Turn the armature shaft in the direction indicated by the arrow on the fixed plate at the driven end until the distributor points to 7 o'clock and the platinum points are just breaking. The magneto is then slipped over the studs on the magneto bracket and engaged with its driving gear.

Repeat the process with the starboard magneto.



Showing (left) how the cables to the distributor are numbered and (right) the correct position for the distributor brush C when the timing is being set for No. 1 cylinder. The method of determining when the platinum points are separating by means of the insertion of a piece of paper B between them is also illustrated. A is the earth wire connection.

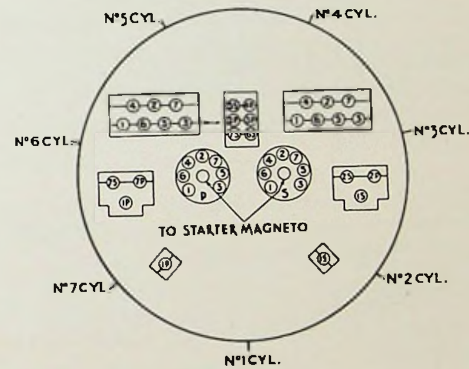
To check, turn the timing disc until the pointer registers say 36°. Insert a thin piece of paper between the platinum points which will grip the paper. The gap at these points should previously have been set to between .010″ and .012″ when the contact breaker arm is fully in the cam. Then tap the disc slowly round in its proper direction, i.e., clockwise as viewed from the front of the engine, until the platinum points free the paper and note the pointer reading. If the timing is correct the pointer should register 33° before top dead centre. If the reading is otherwise, retime the magneto. Repeat the process with the other magneto.

Tighten the magneto housings on to their bracket.

SETTING THE VALVE CLEARANCE.

Add the push rods which are marked on their ball end, the outer tappets taking the exhaust and the inner, i.e., those nearer the cylinder, the inlet. Turn the engine until both tappets of the cylinder in question are right down in the crankcase. Then set the exhaust valve clearance to

20/000 inch and the inlet to 10/1000 inch, the adjustment being effected by loosening the pinch bolt in the end of the rocker and adjusting the cup. The clearance is measured between the striker pin and valve head. Repeat the process on all cylinders. Fit the plugs, terminals and valve rocker covers.



The wiring diagram of the Genet Major (7-cylinder).

CHAPTER V.

Genet Major Installation

OIL TANK.

The oil tank should be placed so that its base is no more than one foot below the level of the oil pump and its top no more than one foot above the oil pump when the machine is on the ground. The bottom wall of the oil tank should be in the slip-stream of the propeller and the oil thermometer should be positioned to reach the actual flow of oil. The capacity of the tank should be greater than 1½ gallons, as a certain amount of oil is required for cooling purposes.

PETROL TANK.

The carburetter will function between heads of 10½″ and 7′ 6″, and the petrol tank should be arranged accordingly.

IGNITION CONTROL.

Ignition is fixed. One magneto is fitted with an impulse starter to secure easy starting.

REVOLUTION INDICATOR DRIVE.

A drive is provided, at one-fourth engine speed, for a standard "Elliott" type revolution indicator. This drive is situated in the front cover, just above the oil pump and on the port side.

PRIMING.

A priming pump is supplied. This is fitted in the cock-pit of the machine and draws its petrol from the main petrol supply pipe. A special "T" piece is provided for fitting it to the supply pipe. A filter is fitted on the delivery side of the pump and petrol passes through this to the distributor ring, which is fastened on the rear cover of the engine and supplies nozzles fitted in the inlet ports of the cylinder heads.

FUEL.

A mixture of 80% Aviation Spirit and 20% Benzol is advised. Specific gravity between .76 and .764, and aromatic content (by volume), 30% to 35%.

The consumption of fuel is approximately 7 gallons per hour at normal cruising speed.

OIL.

Castrol "R" is recommended (for other oils see page 6). Specific gravity, .94 to .96. The oil consumption should be between 2 pints and 4 pints per hour.

CHAPTER VI.

Important Dimensions and Settings

CYLINDER NUMBERING.

The cylinders are numbered from 1 to 7 in the direction in which the engine runs (clockwise facing the front), No. 1, which is the cylinder in which the master connecting rod works, being at the bottom.

VALVE TIMING.

To time the valves, set the valve clearances to .013″ and time No. 1 cylinder as follows :—

Inlet opens 10° early and closes 60° late.
Exhaust opens 65° early and closes 20° late.
A tolerance of $\pm$ 3° is permissible.

The valve clearances are then reset to Inlet .010″ and Exhaust .020″.

IGNITION.

The firing order is 1, 3, 5, 7, 2, 4, 6. Ignition is provided by two B.T.H. S.G.7-1 magnetos, which are set to give a timing of 27° before top dead centre. A tolerance of 1° either way is permissible, provided that the two magnetos are within 1° of each other. The magneto contact breaker gaps should be between .010″ and .012″.

The sparking plugs used are K.L.G. 655LR, and the gaps of these are set between .012″ and .015″.

CARBURETTER.

The type fitted is Claudel Hobson A.V. 55–A. This has a choke of 45 mm. diameter, and jets : main, 700 c.c's. per minute ; pilot, 150 c.c's. per minute, and power, 85 c.c's. per minute.

OIL PUMP.

The oil pressure should be between 60 lbs. and 100 lbs. per square inch. Should the pressure fall below 60 lbs. per square inch, the relief valve should be removed and cleaned. The relief valve is set to blow off at 85 lbs. per square inch.

The rise in temperature of oil in passing through the engine is between 5° and 10° C.

The outlet temperature should on no occasion exceed 70° C.

CHAPTER VII.

Field Instructions for Installation and Running the Genet Major

FILLING THE OIL TANK.

Whilst the engine is running under load there are about 1½ pints of oil in the crankcase in state of mist. When filling the tank previous to a flight, due allowance must be made for this, and for frothing and expansion.

In cold weather, the main storage tank should be filled with warm oil previous to a flight.

CLEANING OIL FILTERS.

To clean the feed filter, remove the cap at the bottom of the pump body, when the filter gauzes will come away. There are seven of these gauzes, and for cleaning they should be washed in benzol.

The scavenge filter is situated on the port side of the oil pump body with the cap facing forward. To clean, remove the cap and the filter can then be extracted by the fingers.

CLEANING AND ADJUSTING THE RELIEF VALVE.

The relief valve is situated on the starboard side of the pump, just below the scavenge oil pipe union, and to remove the same, the small cap should be unscrewed, when spring and valve can easily be taken out.

OIL PRESSURE GAUGE UNION.

This is situated on the port side of the pump, directly opposite the relief valve.

TO MOUNT THE AIRSCREW HUB ON THE SHAFT.

1. Insert the blade of a screw-driver into the slot of the rear cone, so as to expand it. Mount in position on the crankshaft, seeing that its jaws engage the dogs on the crankshaft lock-nut, and tap the cone home with a tubular drift.

2. Place hub on the splined end of the shaft and place the split cone so that the internal groove fits over the flange on the lock-nut. Insert these parts as one unit in the airscrew hub and screw the nut home on the crankshaft with the special spanner, S.R.16252.

TAKING DELIVERY.

One tablespoon full of oil is placed in each cylinder before despatch. All sparking plugs should be removed and each piston brought to T.D.C. in turn and the oil removed with the aid of a small syringe.

Remove blanks from exhaust ports and check tappet clearance: Inlet .010″; Exhaust .020″. Then replace the spark plugs loosely to prevent dust and grit entering the cylinders whilst installing.

When ready to fit the carburetter first clean externally and remove all blanks. Remove blank from induction port on rear cover before erecting the carburetter.

The throttle stop on the carburetter and the link rods are adjusted at the manufacturer's works, and should not be interfered with. Fit the carburetter and connect up to cockpit control and check travel of quadrant in the cockpit. The throttle lever movement in the quadrant should be such that its travel is greater than the altitude control lever travel, otherwise mixture control at cruising speed will be insufficient. At closed throttle position the altitude control lever should have a slight forward movement to ensure the throttle being positively shut.

Before connecting up the fuel pipe line to carburetter, thoroughly flush out and check flow and quantity of fuel. The amount of fuel passed should not be less than 100% increase above the maximum demand of the engine at full throttle. Next connect the fuel pipe line to carburetter, remove the plugs in carburetter jet well and check for free and unrestricted flow, finally replacing jet well plugs.

Connect up all oil pipes after removing blanks and insuring that pipes are thoroughly clean. The feed pipe at this stage can be left loosely connected.

Fit the propeller and check for track, which should be true within a limit of 2 mm. between each blade.

Next connect up the main and hand starter magneto switches, and make sure that earth wire is effective by check with small lamp.

Remove all spark plugs, disconnect delivery oil pipe, prime pump and pipe. Then connect up, making sure that the joint is good. Spin the propeller while the plugs are out of the cylinder, which procedure will get rid of any surplus oil that may have drained into the lower cylinders' induction pipes. Finally drain out the exhaust pipes.

Wash off all oil from the spark plugs, check the gaps which should be .012″, and replace in their respective cylinders.

Finally spin the engine by hand until oil pressure is reading on pressure gauge, **taking care that the switches are in the off position.**

The engine is then ready for the preliminary running.

INITIAL RUNNING—PRELIMINARY.

1.—Examine all external nuts, see that they are quite tight and safely locked.

2.—Check over the engine controls, note that magnetos and hand starter magnetos are correctly fitted and make contact.

3.—Check valve clearances and re-adjust where necessary.

4.—See that the propeller is tight on the hub and that the hub is properly tightened up on the propeller shaft, and all nuts and tab washers locked.

5.—Charge each rocker fulcrum pin bearing with grease and grease push rod ends.

6.—Remove plugs, clean where necessary and set gaps ·012" to ·015", Be sure and smear the threads with graphite grease when replacing.

7.—Examine the fuel and oil system ; see that the engine oil filters and petrol filters are clean, and that the machine tanks are filled with suitable fuel and oil as recommended.

8.—Drain the oil sump, turn on the oil, and rotate the engine by hand until a pressure is showing on the gauge.

STARTING THE ENGINE.

Turn on fuel and oil, making sure that the cocks are positively held in the open position.

Set the throttle about one eighth open and earth both ignition systems.

HAND STARTING.

Starting from cold, give about six pumps from the KI gas primer pump at the same time giving engine about six complete turns. To facilitate starting one magneto is fitted with an impulse starter which accelerates its armature. After sucking in and priming, switch on and pull the propellor down smartly to start the engine. It is unnecessary to swing the propellor in the usual manner of the swinging contact. Instead, feel the engine on to compression with the propellor slightly above the horizontal position. Then give the pilot "switch on" and pull the propellor down smartly, standing well clear of it.

If conditions are very cold, give primer an extra couple of pumps as engine kicks off.

If engine is warm proceed as above, but give one complete turn only, accompanied by about two pumps from primer.

Great care should be taken not to jerk a warm engine over compression in case it fires even with the magnetos switched off.

Note that the engine rotates clockwise, looking at the propeller. Turn off primer after use.

Note.—In cases where the hand turning gear is fitted, the same procedure can be carried out except that the turning will be carried out continuously, and the gear automatically thrown out of gear when the engine starts.

AFTER STARTING UP.

Having started the engine and especially if from cold the speed maintained should not exceed 900 r.p.m. for five minutes. During the period the oil pressure should be noted. At first a high pressure will be built up owing to the cold condition of the engine and the increased viscosity of the lubricating oil. As the engine warms up, the oil pressure will gradually drop to a settled pressure which should not be less than 60 lbs. per square inch. Note that the relief valve which is set at the works to blow off at 85 lbs. per square inch should not be used as a method of adjusting the oil pressure.

If there is any tendency for the oil pressure to fall below 60 lbs. per square inch when the oil is thoroughly warm, the joints in the system should be examined for possible air leaks and corrected.

After running as above, and with a satisfactory oil pressure, the engine may be accelerated slowly to full throttle. In opening up there should be no excessive vibration at any speed. If vibration is in evidence, the engine should be shut down immediately and the propeller hub and engine plate mounting carefully examined. Flights should not be attempted until the cause has been found and remedied.

Full throttle period on the ground should not exceed one minute's duration, as the engine does not receive its normal cooling until in flight.

In cases where a rich mixture is suspected, the altitude control may be used as a check preparatory to changing the main jet, but for a few seconds only.

AFTER PRELIMINARY RUN.

After a preliminary run, especially on a new or recently overhauled engine, it is advisable to shut down and examine the following :—

Note.—Shutting down should be effected by turning off the petrol, in preference to switching off, as the former method will ease re-starting.

1.—There should be no oil or petrol leaks and all joints should be tight.

2.—The cylinders should all be fairly hot, and the securing rings at the base of the cylinder tight under these conditions.

3.—The propeller and hub should be tight.

4.—The crankcase, sump, front cover, etc., should be felt by hand, and their temperature should be reasonable.

5.—The lubrication system should now be drained, the filters cleaned, and the tank refilled with clean oil.

FAULTY RUNNING.

The following are probable causes of faulty running or lack of power :

1.—Faulty carburation.
2.—Defective ignition.
3.—Poor compression.
4.—Unsuitable or badly fitted propeller.

1.—Faulty carburation may be caused by :—

(*a*) Weak mixture due to a choked jet or fuel pipe, a stuck up float or faulty joint in the induction system.

(*b*) Rich mixture due to a stuck up needle valve, or excessive head in the case of a large machine with the tank in the wings.

When investigating carburation troubles, if practicable, the engine should be run up in the dark with open exhaust, the colour and condition of the flame affording a reliable guide to the offending cylinders. It might be stated that—a deep blue flame denotes a rich mixture—a bluish copper coloured flame denotes normal mixture—a bluish greenish flame denotes a slightly weak mixture and a lemon flame a very weak mixture, but of high temperature.

Carburetters are normally supplied tuned up and this setting will be found best for all round running and general use and should not be altered unless the operating conditions are exceptional, in which case, the main jet should be adjusted as required.

2.—Defective ignition may be due to :—

(*a*) Faulty plug, oiled up or incorrect gap.

(*b*) Faulty H.T. leads or switches.

(*c*) Contact breaker stuck up, fouled or incorrect gap. The gap should be between .010" min. and .012" max. The platinum contacts must be kept free from oil, which will oxidise and prevent electrical contact being made. They may be cleaned with very fine emery cloth, but a file should never be used.

(*d*) Moisture or dirt on the distributor segments or faulty gap.

The correct clearance between the distributing electrode and the segments should be .016" to .02". The pitch of the adjusting screw for moving the electrode is such that a quarter turn moves the electrode approximately .004".

Note. If the engine has been stored in a damp place or has been exposed in the open for a lengthly period the magnetos should, if possible, be placed in a warm place and slowly dried off before using. If this is not possible, thoroughly clean away all moisture from the distributor with a clean rag soaked in petrol.

When investigating ignition troubles remember that the port magneto is wired to the port plugs and the starboard magneto, to starboard plugs.

3.—Poor compression may be caused by :—

(*a*) Incorrect tappet clearances. These must be checked with the engine cold.

(*b*) A valve sticking in its guide or a seized tappet.

(*c*) Badly seated valve.

(*d*) Faulty spark plug or gas starter non-return valve stuck up. The latter can usually be easily traced, if the cylinder is firing at all, by the appearance of the pipe feeding the non-return valve ; if the valve is blowing this pipe will be discoloured.

(*e*) Broken or faulty piston rings.

To check compression try one cylinder at a time, that is remove one plug from each of the other cylinders.

4.—Unsuitable or badly fitted propellers may give low r.p.m. at full throttle, or set up excessive vibration in the engine or machine.

When investigating engine trouble see that the throttle is fully open and the ignition switched off.

GENERAL RUNNING.

The following is a summary of the important points to note and of the general procedure to be adopted.

Running up the Engine.

1.—Always fill up with the approved fuel and oil and use suitable filters ; do not expect the small filters included in the installation to do all the work.

Remember that apart from the amount of oil necessary for each hour's flight there must also be enough for satisfactory circulation, as the pump circulates 2½ gallons per minute.

2.—Make sure that oil cock is turned on.

3.—If the engine has been standing for some time remove the plugs from the bottom cylinders and clean if necessary, as these plugs sometimes become fouled with oil.

4.—Start up ; keep engine revolutions down below 900 r.p.m. for several minutes, till engine warms up and the oil pressure steadies. If the pressure fluctuates or falls below 60 lbs. per square inch shut down and investigate.

5.—Open engine up steadily to full throttle ; never run at full throttle for longer than one minute on the ground and do not accelerate suddenly.

IN FLIGHT.

In flight particularly with a new installation the following points concerning the engine should be noted.

AFTER EVERY FLIGHT.

The engine should be wiped down. The importance of thorough cleanliness cannot be over-estimated.

All external working parts should be liberally oiled ; there are not many—the carburetter, control levers, links and pins, the valve stems and the valve rocker arm.

The ball ends of the tappet rods should be smeared with graphite paste.

AFTER EVERY TEN HOURS' RUNNING.

Remove the sparking plugs, clean them, and re-set the gaps where necessary to .012"—.015". Test all the plugs in a pressure tester and reject any that fail to spark at 90 lbs. per square inch.

Clean both oil filters, making sure that the cone seat in the pressure filter is clean before replacing.

Clean the petrol filter in the base of the carburetter.

Clean any other filters in the petrol system.

AFTER EVERY TWENTY HOURS' RUNNING.

Clean the contact breakers and adjust the gaps. Check the tappet clearances and adjust where necessary. Examine the cylinder locking rings when the engine is hot and tighten if necessary. Examine the holding down nuts of the valve rocker brackets and tighten if necessary.

AFTER EVERY 200 HOURS' RUNNING.

The cylinders should be detached, decarbonised and the valves ground in. A special tool holder, S.R.16324, is provided to grip the valve stem while carrying out this operation.

All carbon should be removed both from the tops and from the inside of the pistons. The piston rings should be removed and the high grooves cleaned.

Check the strength of the valve springs and replace any springs which together are less than 61 lbs. in their "valve open" or 28 lbs. in the "valve closed" position.

After 400 hours running it is necessary to completely strip the engine and examine all working parts.

SPECIAL NOTICE.

In installations where the oil tank is situated above the centre line of oil pump it is important that **oil cock is shut after flight** to prevent syphoning of the oil through pump into crankcase during long periods of standing.

In installations where the oil tank is situated below the oil pump the importance of good joints in the feed pipe line cannot be sufficiently emphasised, **as air leaks in this pipe line result in loss of oil pressure.**

Genet Major. Schedules of Fits and Clearances.

CAM GEAR.

Part.		Clearance New Inches. Maximum.	Clearance New Inches. Minimum.	Allowance when worn Inches.	Remarks.
Cam Ring Unit	Maximum permissible clearance on diameter between gear on crankshaft and timing gear housing bush	.003	.0005	.005	
Tappets	Maximum permissible clearance on diameter of tappet in guide ..	.001	.00025	.002	
"	Maximum permissible side clearance on roller in tappet	.005	.001	.007	
"	Maximum permissible clearance on diameter of roller pin in tappet and roller	.0015	.0005	.003	
"	Maximum permissible end clearance on roller pin in tappet guide ..	.010	.005	.015	
Timing Gears	Maximum permissible back lash in any pair of timing gears	.012	.008	.020	

REAR COVER, INDUCTION FAN AND PIPES.

Fan	Clearance between fan and back of rear diaphragm	.050	.040	.040 to .050	

CRANKSHAFT.

Part.		Clearance New Inches. Maximum.	Minimum.	Allowance when worn. Inches.	Remarks.
Shim	For thrust bearing	—	—	—	Ground to suit.
Crankpins	Maximum permissible ovality of crankpins	.00025	—	.0015	
"	Minimum permissible diameter on crankpins after regrinding ..	1.99925	1.9985	1.975 fit Z	
Crankshaft	Maximum permissible crankshaft end float (total)	.005	.003	.010	
Main c/shaft bearings	Maximum permissible clearance on diameter between rollers and outer races	.0025	.002	.004	
Crankshaft	Maximum permissible error of centring of crankshaft in the engine body	.020	—	.020	Low, to allow thrust to centralise as a tractor.
"	Maximum permissible clearance on diameter between crankshaft and front cover bushes	.0045	.003	.010	
C/shaft Bevel Gear	Maximum permissible backlash between crankshaft bevel gear and pump bevel gear	.010	.004	.015	
C/shaft Bevel Gear Washer	Thickness of crankshaft bevel gear washer	—	—	—	Ground to suit gear.

PISTONS AND CONNECTING RODS.

Gudgeon Pin Bush	Maximum permissible clearance on diameter of gudgeon pin bush in small end	.00225	.0005	.0035	

PISTONS AND CONNECTING RODS—Continued.

Part.		Clearance New Inches. Maximum.	Minimum.	Allowance when worn. Inches.	Remarks.
Master Rod Bearing on Crankpin	Maximum permissible end float of master rod bearings on crankpin. .	.00825	.00425	.010	
Master Rod and Auxiliary Rods	Maximum permissible end float of auxiliary rods between faces of master rod	.014	.008	.015	
Master Rod Bearing and Crankpin	Maximum permissible clearance on diameter between master rod bearing and crankpin	.0045	.00275	.008	
Master Rod Bearing	Maximum permissible ovality of master ring bearing within maximum permissible clearance ..	—	—	.003	
Wrist Pin Bush	Maximum permissible clearance on diameter of wrist pin bush in auxiliary rod	.0015	.0005	.0025	
Wrist Pin	Maximum permissible clearance on diameter of wrist pin in auxiliary rod bush	.0015	.00075	.0025	
Auxiliary Connecting Rods	Maximum permissible error of alignment between wrist pin and gudgeon pin bores of auxiliary connect-rods (per inch of mandrell) Parallelism .. .. .. Twist	 .001 per inch .0015	 — —	 .001 per inch .0015	It is essential that all care is taken when dealing with bores of connecting rods to ensure that errors of alignment, especially as regards parallelism are kept to the minimum.

PISTONS AND CONNECTING RODS—Continued.

Part.		Clearance New Inches. Maximum.	Minimum.	Allowance when worn. Inches.	Remarks.
Master Rod	Maximum permissible errors of alignment between big end wrist pin and gudgeon pin bores (per inch of mandrell) :				
	Parallelism	.001 per inch	—	.0025 per inch	
	Twist	.0015	—	.0035	
Wrist Pin	Minimum permissible diameter of wrist pin	—	.68725	.687	Diameter Dim.
Piston	Maximum permissible clearance on diameter between cylinder walls and skirt of piston. SR.20803 ..	.0235	.0215	.032	Top of skirt.
		.0195	.0175	.028	Bottom of skirt.
Piston	Maximum permissible ovality of piston	.001	---	.004	
Piston	Maximum permissible wear of piston, excluding ovality	—	--	.003	
Compression and Scraper Rings	Maximum permissible gap in compression and scraper rings . ..	.010	.004	.015	*Note for Repair :—* Use oversize rings where necessary.
Rings (Compression)	Maximum permissible clearance between side of piston rings and grooves	.012	.0105	.015	1st ring.
		.0095	.008	.0125	2nd ring.
Rings, Scraper	Maximum permissible clearance between side of scraper rings and grooves	.0065	.005	.010	
Rings	Size of gap to which all new piston rings are to be fitted	.010	.004	.010 to 004.	

PISTONS AND CONNECTING RODS—Continued.

Part.		Clearance New Inches. Maximum.	Minimum.	Allowance when worn. Inches.	Remarks
Gudgeon Pins	Maximum permissible clearance on diameter of gudgeon pin in its bosses	.00175	.0005	.0035	
Gudgeon Pin	Minimum permissible diameter of gudgeon pin	—	.93625	.9355	
Piston	Maximum permissible side float of piston on gudgeon pin bush ..	.064	.052	.075	
Piston	Maximum permissible side float of auxiliary rods	.168	.140	.250	
Gudgeon Pin	Maximum permissible clearance on diameter of gudgeon pin in G.P. bush	.00175	.0005	.0035	

CYLINDERS AND VALVES.

Cylinder	Maximum permissible size of cylinder bore	4.2505	4.2495	4.2535	
Cylinder	Maximum permissible ovality and lack of parallelism of cylinder bore, the greatest dimension to be within the maximum permissible size ..	.001	—	.0035	
Inlet Valve Guide	Maximum permissible size of inlet valve guide bore up to ½" from outer end	.4335	.4325	.4385	

CYLINDERS AND VALVES—Continued.

Part.		Clearance New Inches. Maximum.	Minimum.	Allowance when worn. Inches.	Remarks.
Inlet Valve	Minimum permissible diameter of inlet valve stem	.430	.429	.427	
Inlet Valve Guide	Maximum permissible clearance of inlet valve guide up to ½" from outer end	.0045	.0025	.0115	
Inlet Valve	Maximum permissible ovality of inlet valve stem	—	—	.001	
Inlet Valve Guide	Maximum permissible ovality of bore of inlet valve guide up to ½" from outer end	—	—	.0065	Reamered in cylinder when fitted.
Exhaust Valve Guide	Maximum permissible size of exhaust valve guide bore up to ½" from outer end	.4335	.4325	.4385	
Exhaust Valve	Minimum permissible diameter of exhaust valve stem	.425	.424	.4205	
Exhaust Valve	Maximum permissible clearance of exhaust valve in guide up to ½" from outer end	.0095	.0075	.018	
Exhaust Valve	Maximum permissible ovality of exhaust valve stem	—	—	.0015	
Exhaust Valve Guide	Maximum permissible ovality of bore of valve guide up to ½" from outer end	—	—	.0065	Reamered in cylinder when fitted.
Cylinder Valve Guide Socket	Maximum permissible size of bore of valve guide socket to permit standard size guide to be fitted ..	—	—	.625 fit A	

CYLINDERS AND VALVES—Continued.

Part.		Clearance New Inches. Maximum.	Minimum.	Allowance when worn. Inches.	Remarks.
Cylinder Valve Guide Socket	Maximum permissible size of bore of valve guide socket to permit standard size to be fitted to oversize guide	—	—	.627 fit A	
Valve Guides (both)	Outsize diameter	.627	.626	—	
Valve Ports	Maximum permissible error of alignment of faces of valve ports ..	Nil.	Nil.	Nil.	
Valve Clearance (Inlet)	Valve to rocker clearance (cold) ..	.011	009	.011 to .009	Cold.
Valve Clearance (Exhaust)	Valve to rocker clearance (cold) ..	.021	.019	.021 to .019	Cold.
Valve Clearance (Inlet and Exhaust)	Valve to rocker clearance (hot) ..	—	—	—	.013 Hot.
Rocker	Maximum permissible side movement on rocker when assembled in bracket	—	—	.015	

MAGNETO AND DRIVE.

Magneto Gears	Maximum permissible backlash on magneto drive	.006	.004	.010	
Contact Breaker	Magneto contact breaker gaps ..	.012	.010	.012 to .010	

OIL PUMP.

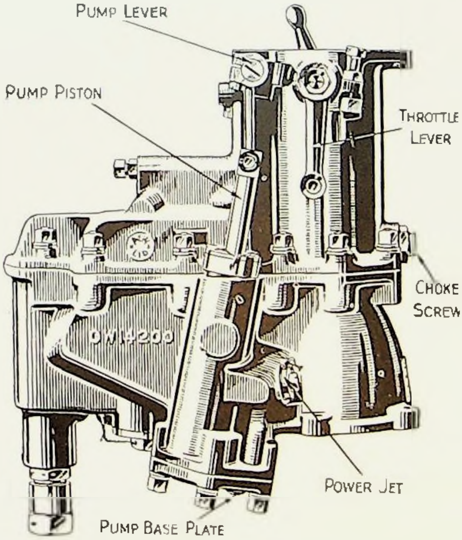
Driving Spindle Shaft	Maximum permissible clearance on diameter of driving spindle in each bush	.0025	.00075	.0035	

OIL PUMP—Continued.

Part.		Clearance New Inches. Maximum.	Minimum.	Allowance when worn. Inches.	Remarks.
Driven Spindle	Maximum permissible clearance on diameter of driven spindle in each bush and pinion	.0015	.0005	.0035	
Pump Pinions	Maximum permissible clearance on diameter between pinions and walls of pump casing	.00325	.001	.004	
Pump Pinions	Maximum permissible backlash in oil pump gears..	.012	.008	.015	
Shim	In oil pump body	—	—	.008	
Shim	In oil pump body	—	—	.010	

CLAUDEL HOBSON AERO CARBURETTERS.

These carburettors have been designed to operate on high efficiency aero engines. They are completely pressure balanced, and the range of mixture control for altitude is enough to meet all requirements up to at least 30,000 ft., but for use in machines unlikely to attain great altitudes, the percentage of altitude control is cut down to 20 per cent. by decreasing the area of the slot in the altitude control plug.

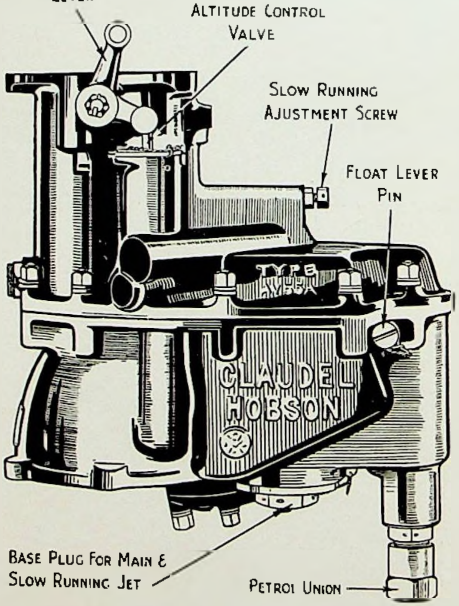


General view of the AV.55A Carburetter.

This demand for a great range of altitude control calls for extreme care in design and a special altitude control system, in order to avoid any suddenness of action, and to ensure that equal increment of movement of the altitude control lever shall give equal and progressive weakening of the mixture.

Further, it is essential for convenience in flying, that for a given position of the altitude control lever, the mixture shall be weakened by the same percentage at all throttle positions. The pilot will then only have to alter the position of his altitude control lever with change of altitude, and not for different throttle positions at the same height.

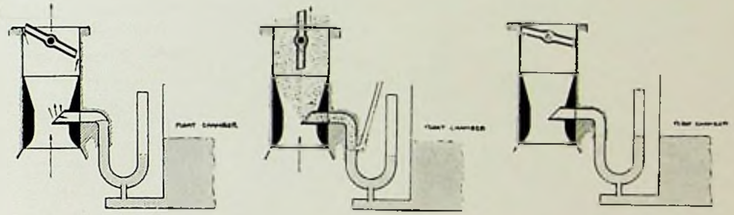
Because of the amount of altitude control required at great heights, it is imperative that there shall be an interlocking gear, which will shut the altitude control valve when the throttle is closed for a dive, to ensure that the engine will open up again. On engines which are likely to cruise at altitudes at part throttle for long periods, it is necessary for fuel economy that the interlocking gear does not begin to close the altitude control before the half throttle position, and the differential linkage and lost motion device on the Claudel-Hobson AV.48 carburettor is designed with this end in view. In some cases the interlocking gear is arranged on the engine or machine instead of on the carburetter.



General view of the AV.55A Carburetter.

DIAGRAMATIC DESCRIPTION.

Series Types AV.40A, AV.48 (C, CR & D), A1.48A, AV.55A.



The diffuser explained. Left. A "U" tube is filled with petrol by the jet up to a constant level as maintained by the float chamber. The throttle is closed, the pressure on the exit of the "U" tube is at atmosphere, and being balanced by the air pressure on the other limb of the "U" tube, the petrol is at the same height in both limbs.

Centre. The throttle is partly open and air passing through the choke; consequently the pressure in the choke is less than atmosphere, while the free end of the "U" tube remains at atmospheric pressure; therefore the fuel in the "U" tube will be driven out into the choke tube.

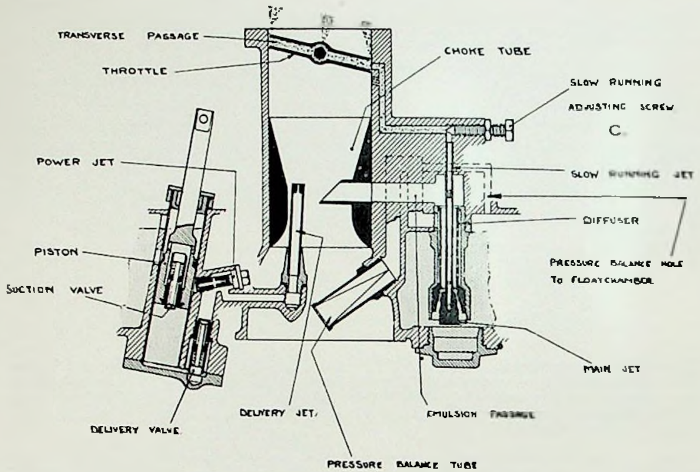
This operation of the "U" tube by pressure difference is generally called "suction." It will be seen that the petrol will pour out into the choke entirely unatomised. One of the purposes served by diffuser air is to break up and atomise the fuel before it gets into the choke.

Right. Showing a pipe supplying air below the ordinary fuel level in the "U" tube. Air will be driven in and mix with the petrol as shown.

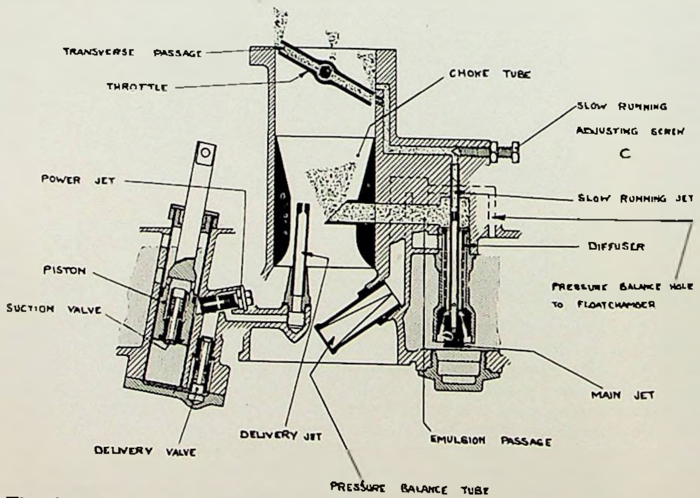
ADJUSTMENT INSTRUCTIONS.

IDLING OR SLOW RUNNING (*See diagram on next page*).

The idling or slow running jet feeds the slow running mixture to a hole situated in the side of the carburetter body opposite the edge of the butterfly throttle. The feature of the slow running in this carburetter is the use of a passage situated in the throttle, which registers in the closed position with the slow running hole. It will be seen that the mixture is drawn not only past the edge of the throttle when the latter is a little way open, but is also drawn through the passage in the throttle, or as we style it, the "transverse hole." A portion of the mixture emerges from the throttle adjacent to the other side of the carburetter bore. There is a small hole in the centre of the throttle through which emerges a further portion of the slow running mixture. It will be seen that by this means, the mixture is not fed entirely to one side of the induction system, but more or less evenly throughout the whole area. Also due to the fact that the depression increases on the transverse hole throughout the early part of the throttle movement, the "flat spot"—which is so prevalent on other types of butterfly throttle carburetters—is obviated.



Here, the carburetter is shown in the slow running idling conditions, the diffuser is inoperative, and petrol is flowing from the slow running jet, being mixed with air from the holes in slow running tube. It is then ejected beside the throttle, and via the transverse passage into the centre and other side of the carburetter uptake. There are two small air bleeds shown below the throttle which at idling dilute the fuel mixture in the slow running passage by admitting air.



The throttle is now slightly open, the slow running and transverse tubes are still functioning and the diffuser beginning to act. It will be noted that the first row of depression holes are uncovered, and air is proceeding via these holes to mix with the petrol and form an emulsion.
In the throttle position shown the two air bleed holes that are shown in the previous drawing as below the throttle, are now masked by the throttle. Air therefore cannot enter ; on the contrary, mixture is drawn out from them into the transverse passage and thus the mixture made a little richer here than would otherwise have been the case.

The adjustment of the slow running mixture is carried out by means of a change of jet and the admission of a certain quantity of mixture, which is controlled by the adjustment screw C.

The control of the quality of the main mixture supply is carried out by means of changing the main jet. This adjustment can be made by removing the main jet plug and then withdrawing the main jet from the diffuser housing.

FULL THROTTLE POWER JET (*See diagram on next page*).

The power jet is situated at the side of the carburetter and is integral with the outer plug. The control of the supply as to timing is by means of a port in the pump sleeve which registers at full throttle, or nearly so, with the passage communicating with the power jet and thus allows petrol to enter. Another feature of this carburetter is the injector pump for assisting in very rapid acceleration. It is of the usual two valve type, and its sole purpose is to force a spray of fuel through the nozzle in the choke tube in advance of that which would be given by the engine suction during sudden depression changes.

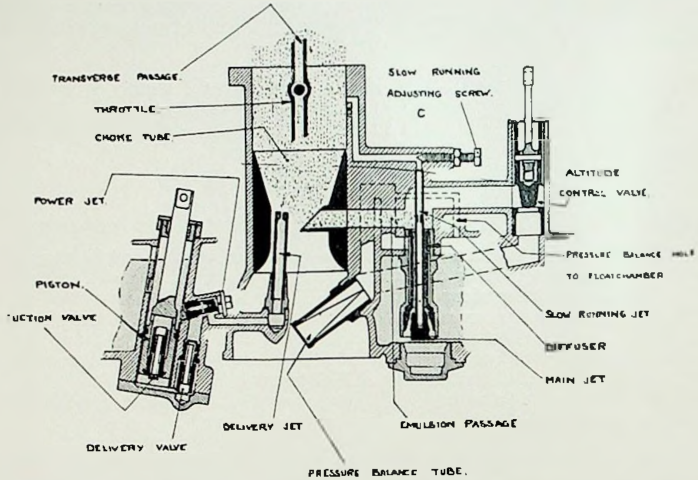
Throughout all the range of these carburetters, the jets are flow calibrated, and the numbers represent the cubic centimetres of petrol which they pass on a recognised standard measuring instrument, and it is advisable not to interfere with these in any way, but to replace with others which give the required flow.

ADJUSTMENT OF CARBURETTER.

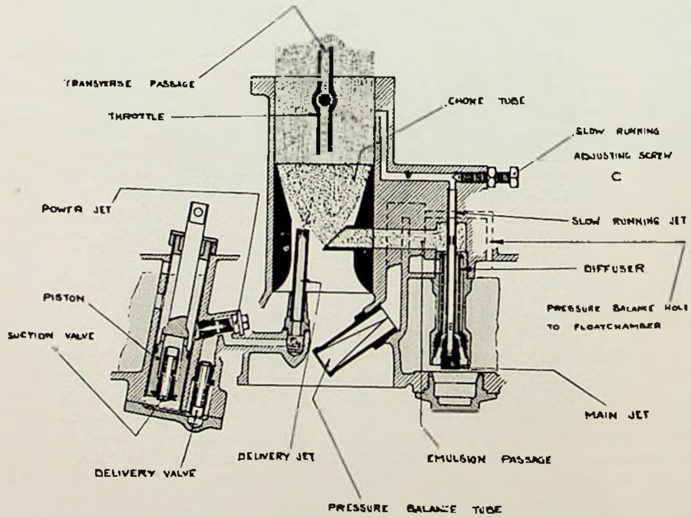
All the jet sizes are fixed before the carburetter leaves the engine works, and except under special circumstances should not be tampered with, these having been calibrated on the standard Brown & Barlow flow-meter. Should it be necessary to make any alterations or examine the jets for dirt, removal of the main jet takes place through the plug situated at the bottom of the float chamber. Care should be taken when withdrawing the jet not to lose the loose diffuser, and when re-assembling, it will be found that the diffuser will only enter the housing one way, one shoulder being larger than the other, preventing it being inserted upside down. Care should be taken to screw up the main jet tightly before doing the necessary wiring in order to ensure that the diffuser is right home.

ADJUSTMENT OF SLOW RUNNING.

Providing the correct size of slow running jet is in use in the carburetter, as found necessary on the test bench, the only other adjustment required should be made by the use of the screw situated immediately above the slow runner delivery boss. This screw should be withdrawn as far as possible in the first instance and the engine started up. The engine should then be set to run at approximately 800 r.p.m. on the propellor. The slow runner adjustment screw should then be screwed in until the engine is inclined to run weak at these particular engine revs. It should then be withdrawn very slightly so that the engine is running steadily. Under these conditions it should then be found that the slow running at about 400 r.p.m. will be quite satisfactory. Should, however, the slow running be either rich or weak, a very slight alteration to the adjustment screw should correct this.



The condition is that of full power. The slow running and transverse passage is out of action. The diffuser is in full action, and all depression holes are uncovered, and taking air to mix with the fuel. In addition, the power jet port in the pump sleeve is opposite to, and has unmasked the power jet, thus allowing petrol to go through to the spigot nozzle in the choke and as added petrol to that supplied by the main jet, in order to convert the economical cruising mixture given via the diffuser to the richer mixture necessary for maximum power.



The carburetter is still shown in full power condition, but the altitude control cock for mixture control, which in this case is of the tapered plug type, is open and allows air from the pressure balance system to enter the emulsion passage and thus directly weaken the mixture in addition to relieving the suction on the main jet.

POWER JET.

As before mentioned, this part is situated in the side of the barrel of the pump unit, and can be readily removed for cleaning purposes with a spanner. When replacing this part care should be taken not to put unnecessary strain, as the threads are in aluminium. The operating position of the power jet is controlled by a small eccentric pin situated in the pump operating lever. Care should be taken, when the suitable position of this is once found, that it is always returned to the same place. A satisfactory way of doing this is to mark the pump piston rod at the point where the port in the pump sleeve is uncovered by the piston itself. This can be found by the removal of the power jet and when the port opens, petrol will at once begin to flow through the power jet hole.

The position of the throttle under these conditions should be carefully noted before the eccentric pin is dissembled for any purpose whatsoever, as any alteration to the position of the pin would obviously delay or advance the opening position of the power jet. Under ordinary circumstances, when dissembling the carburetter for cleaning purposes, it is entirely unnecessary to remove or alter the position of the eccentric pin, and then the power jet operating position will not alter.

ACCELLERATOR PUMP.

This unit is an entirely straightforward piece of mechanism, the suction valve being situated in the piston itself, and the delivery valve placed on the side of the lower part of the pump body casting. Access to either of these parts is obtained by the removal of the cover plate at the bottom of the pump. The only likely cause of the pump failing to operate will be dirt under either of the aforementioned valves, in which case they should be removed and carefully blown out. It should not be necessary to remove the valves from the housings for this purpose.

CHOKE TUBE.

During assembly of the choke tube care should be taken to ensure that the countersinking which registers the choke position, is exactly opposite the locking screw ; otherwise the delivery from the diffuser will be reduced.

(8.)

239/31.

29th March, 32.

Gentlemen,

I am directed to acknowledge the receipt of your letter No. 15.W/Falkland Is.3535 of the 4th of February, 1932, and to express to you and through you to the Air Ministry and the Westland Aircraft Company the thanks of this Government for the evident trouble which has been taken to furnish full particulars in the matter of the suggested purchase of an aeroplane.

2. I am to state, however, that owing to the high cost both of acquisition and of maintenance involved it is not possible in present financial circumstances to proceed further in the matter.

I am,

Gentlemen,

Your obedient servant,

Colonial Secretary.

The Crown Agents for the Colonies,
4, Millbank, Westminster,
LONDON, S.W. 1.