Annual Review of Helicopter Activities

ACCLES & POLLOCK LTD

Accles & Pollock Ltd , of Oldbury, Birmingham, have made considerable advances in the production of precision tubes to meet the demands of the helicopter designer

The production of such tubes to various specifications has raised a number of difficult problems which have now been successfully overcome It is well known that the use of precision tubes affords considerable savings of both weight and machining costs

The following are a few examples of tubes now being regularly produced for the helicopter industry

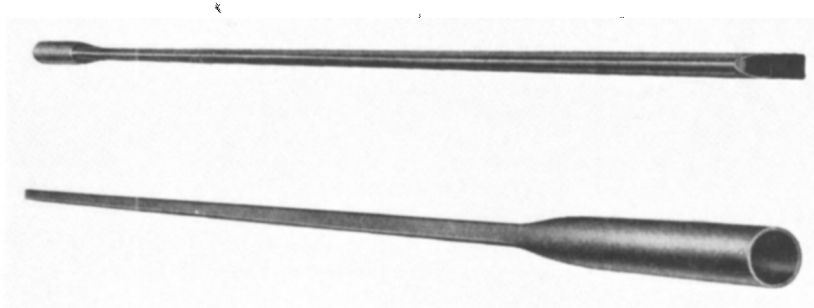
Fairey Rotodyne Air feed tubes for the tip jets , double-butted tubes for the pylon structure , undercarriage tubes

Fairey Ultra-Light Spar tubes , fuel pipes , diaphragm bracing structure tubes , landing skid tubes Accles & Pollock also make the solid section used for the leading edge balance weights and the diaphragm channel section

Saunders-Roe Main rotor spar strength member

Bristol Gearbox synchronising shafts , rear rotor transmission shaft

These few examples indicate the wide application of precision tubes in the modern helicopter and prove that the tube manufacturer can now offer the designer tubes in lengths, shapes and strengths that would not have been possible a few years ago New techniques of production have enabled Accles & Pollock to meet the designers' demands for tubes which change in section and vary in gauge along their length Double-butted tubes have been used as structural members, with considerable saving in weight Precision tubes with extremely thin walls—now also available in taper gauge—have been used to solve other design problems



This spar tube for the Fairey Ultra-Light helicopter produced by Accles & Pollock Ltd , is a further excellent example of the developments made in the precision tube field It is produced in the form of a butted tube 2 980″ diameter, with gauge variation of

10 at 315″ thickness at the root end
Tapering over 2½″ to 160″ thickness
Parallel for 8½″ at 160″
Tapering in thickness over 16′ to 050

The overall length of the tube of 13 6′ is then made up of approximately 11′ 0″ of 050 thick material

The tube is sectioned to an aerofoil shape with axis dimensions of 3 820′ o d × 1 276 o d , leaving a round portion 9″ long at the heavy gauge end, which forms the root basis for attachment to the main drive

The tube is supplied in 5CM quality material, heat treated to give T 60 specification Special techniques are used in heat treatment to maintain the required straightness limits

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These tubes can be produced in high tensile steel and new techniques of heat treatment have enabled Accles & Pollock to offer them giving strengths in the region of 75 to 80 tons per square inch without that distortion which heat treatment has almost inevitably involved in the past

The range in these speciality tubes has been extended to cover up to 12 ins in diameter

Further development is constantly taking place, including the use of stainless steels for applications where resistance to corrosion is important

AIR SERVICE TRAINING LTD

The initial Air Ministry contract, during which 65 R A F and 6 Army fixed-wing pilots were converted to helicopters, was completed in April, 1957 Unfortunately this Service contract has not been renewed to date, so that A S T 's helicopter activities during the past year have been reduced to the training of a few civil pilots on an *ad hoc* basis The majority of these civil pilots have undergone the 43-hour, 5 weeks Commercial Pilot conversion course at Hamble, and have included two Chief Test Pilots—Peter Twiss of Fairey Aviation and Tom Frost of Armstrong Siddeley Motors—and a number of other senior pilots from leading firms such as Shell, Salversen and World Wide Helicopters

By way of contrast, a recent A S T student—pictured above—qualified as a commercial helicopter pilot at the age of 19, after first completing the normal Commercial Pilot Licence training at Hamble on fixed-wing aircraft Experience with three students who had no previous flying experience has confirmed that it is possible, but uneconomical, to train a pilot *ab initio* on a helicopter, and is also an unnecessarily difficult process for instructor and student alike Lack of practical experience in engine handling and airmanship prevent the student from being able to concentrate on co-ordinating his controls, and the whole process of adequate and thorough training becomes unduly prolonged

At Hamble both helicopter and fixed-wing flying are carried out simultaneously, using opposite circuits which are varied according to wind direction The student helicopter pilot is thus made aware of the presence of other, relatively high speed air traffic from the outset of his training and becomes used to flying in accordance with continual A T C instructions Typical of the thoroughness and accuracy of the training at A S T , he is also taught to fly in and out of confined spaces using, for example, a deep gravel pit to simulate a jungle clearing, with its wind gusts and eddies

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BLACKBURN & GENERAL AIRCRAFT LIMITED

During the year Blackburn & General Aircraft Limited strengthened their interests in the helicopter field by providing the power for the new Saunders-Roe helicopter, the P 531, which made its first flight from Southampton Airport, Eastleigh, in August

The P 531 has been designed and built by Saunders-Roe as a private venture to meet the demand for a general purpose helicopter of good all-round performance, carrying capacity, versatility and ease of maintenance

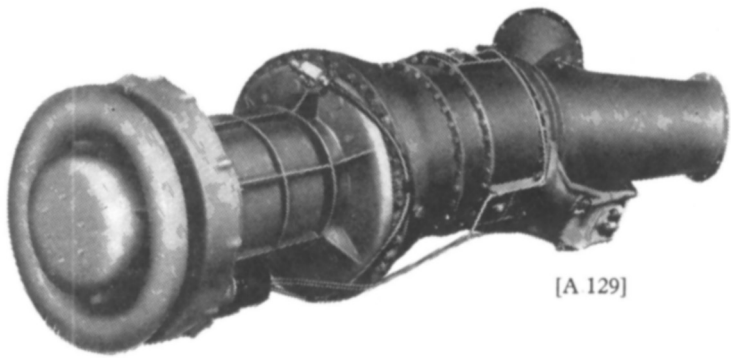
The Blackburn Turmo 603 Series, a free turbine engine, is mounted on a platform behind the cabin, and was chosen because of its ability to meet the requirements for an efficient, light weight power plant of simple design and robust construction In addition the inherent high torque characteristics of the Turmo and the absence of the need for a clutch in the aircraft transmission system are important design considerations for a helicopter of the P 531 type

A feature well known in regard to the Blackburn Turmo engine and which is particularly important to a general purpose helicopter is its ability to run on a wide range of fuels such as kerosene, light diesel and low octane petrol

TURMO (603 Series)

Performance	Maximum 425 S H P	468 lb /hr fuel
	Maximum cont 367 S H P	423 lb /hr fuel
Weight	Dry 350 lbs	
	Installed weight 400 lbs (this includes the reduction gear of 5 1)	
Dimensions (excluding inlet and exhaust ducts but with reduction gear)		
	Length 52 ins	
	Max dia 19 25 ins	

An entirely new development from the Blackburn Engine Division was announced during the year Designated the A 129, it is the first of a projected new range of engines, producing more than double the power ratings, to be made available for broadly similar fields of application, particularly helicopters, as those of the well known Blackburn-Tubomeca gas turbines



[A 129]

The A 129, which ran for the first time in July, is a free turbine, shaft-drive engine having an increased overall pressure ratio over the Turmo 600 Series of engines A two-stage axial-flow compressor is embodied in the gas generator of the engine which also incorporates the annular combustion chamber and an axial-flow, two-stage turbine A " third stage " or free turbine, which is mechanically independent of the gas generator, constitutes the power output turbine and carries a shaft by which power is transmitted to a reduction gearbox applied to the rear of the engine The two-stage turbine supplies the power for driving the compressor, and the remaining power derived from the free turbine is delivered to the reduction gearbox

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The design attains a high power/weight ratio and a reduced specific fuel consumption, and the salient features of the A 129 may be extended to other engines to give " high pressure " air bleed in addition to increased shaft power outputs

THE BLACKBURN A 129 FREE TURBINE ENGINE

Performance Maximum power, 950 S H P , S F C 66
Weight (including single stage reduction gear) 390 lbs (approx)
Overall dimensions Length (including free turbine and gearbox), 60 ins , Maximum diameter, 20 ins

Throughout the year the Fairey Ultra Light helicopter with its Blackburn Palouste gas turbine air generator has continued its demonstrations to military and civil authorities Highly successful trials from Royal Navy frigates were completed in exceptionally rough weather in the English Channel Winds of 62 knots (71 m p h) were in fact measured on the bridge, while the deck was pitching 10 to 12 feet and rolling up to 14 degrees in each direction

The precise control required for such operations stems from the system of driving the rotor by tiny pressure jets at the tips of the rotor blades These are fed with compressed air by the Blackburn Palouste gas turbine engine

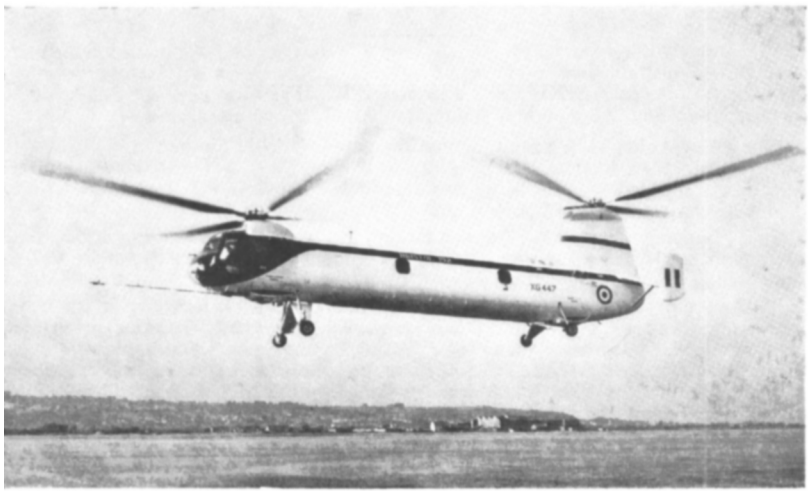
In October the Fairey Ultra Light was demonstrated very successfully to the Royal Army Medical Corps in the Air Ambulance role In these and other trials the Blackburn Palouste performed to everyone's satisfaction

BRISTOL AIRCRAFT LTD

The last twelve months at the Company's Weston Division, where all Bristol helicopter activities are concentrated, has been a period of steady progress, both with work on the Type 192 twin engine tandem rotor machine and also on production of Sycamores to meet current requirements

Following a period of intensive pre-flight testing, the Type 192 made its first flight on the morning of 5th July, piloted by the Company's Chief Helicopter Test Pilot, Mr C T D' Hosegood

Western Europe's biggest military helicopter, the Type 192, has been designed specifically to meet Service requirements in the troop and freight transport, ambulance and search and rescue roles, and is now in production for the Royal Air Force



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Powered by two Napier Gazelle "free turbine" engines each of 1,300 s h p, the aircraft has a maximum all-up-weight of 18,000 lbs and a cruising speed of 120 knots

Single-engine performance has proved to be most impressive, and visitors to Farnborough this year—where the aircraft made its public debut—witnessed a series of demonstration take-offs, fly-pasts and landings while the helicopter flew with the intakes of one engine blanked off

Production of Sycamores has continued satisfactorily and, at the time of writing, 46 of the 50 machines ordered in March, 1957, by the Federal German Government have been delivered During the course of the year, both flying and ground personnel of the German Armed Services have visited the Weston Division for instructional purposes, and members of the Helicopter Flight Test Team have been to Germany to assist the German Services in their flying training programmes The aircraft are being used on search and rescue, ambulance, communications and transport duties

The two Sycamores which make up the VIP Helicopter Flight, which now serves high-ranking German Goverment officials and Senior Officers of the Armed Services, made their first operational sortie last March, when they rescued a badly injured skier stranded in six feet of snow 5,000 ft up in the Bavarian Alps

In other parts of the world, Sycamores have logged a further year of first-class service In Malaya, aircraft of No 194 Squadron have flown more than 20,000 hours and have completed a record airlift for R A F helicopters of over 2,000 casualties during their tour of operations

Sycamores have also played an active part in Cyprus, since their arrival there in May, 1955 No 284 Squadron, which is equipped with these aircraft, has been employed on search and rescue, casualty evacuation duties, and also on Internal Security patrols and troop movements Training has included cross-country flying at night, mountain flying techniques and evacuation exercises

At home, a Sycamore has been used to help in the construction of the 52-mile Luton to Dunchurch stretch of the new London-Yorkshire Motorway During the summer months, the contractors building the road used the machine as a "flying observation platform" for their engineers working on the site In 37 flying days ending on the 16th July, the aircraft logged 155 flying hours This was, in fact, one of the few times that a helicopter has ever been used in a major civil engineering project in Great Britain

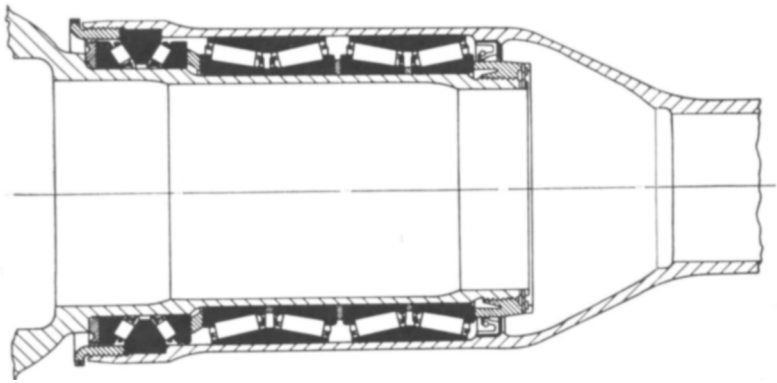
In all, over 170 Sycamores have now been built and delivered, and current operators include the Royal Air Force, the British Army, the Royal Australian Navy and Air Force, the Belgian Air Force, the German Armed Services, British European Airways and Ansett-ANA

BRITISH TIMKEN LIMITED

The past year has been a most interesting one for British Timken in the helicopter field No less than four new helicopters were displayed at Farnborough and the application of tapered roller bearings to each of these has been the subject of technical liaison between British Timken and the manufacturers

Space limitation prevents a full description of the numerous bearing applications in these helicopters, therefore the following is confined to the Fairey Rotodyne V T O airliner which represents the "new look" in V T O aircraft

Timken tapered roller bearings are mounted on the blade roots of the Rotol propellers, landing wheels, rotor feathering hinges, rotor pitch changing mechanism and rotor shaft The rotor feathering hinge arrangement is illustrated From this can be seen the thrust bearing of eight inches bore which absorbs the centrifugal force from the blade The two double row bearings which are of the Timken light section range, carry the bending moments from the blade The assembly is so arranged that none of the bending moment loads pass through the thrust bearing Preload is applied to the whole assembly by the adjusting nut The prestressing of the races minimises the deflections under load and ensures a good roll-race contact throughout the assembly



In hovering flight the total load of the aircraft is transmitted from the blades to the aircraft via the four feathering hinges and rotor shaft bearing The latter is a thrust bearing of fourteen inch bore size, but having a similar section to that of the feathering hinge thrust bearing The axis of this bearing is coincident with the rotor shaft axis and it absorbs the total weight of the aircraft in hovering flight and the bending moments from the rotor

A number of special treatments are applied to the bearings Cadmium plating is used on the bearing cages where the cage material is of low carbon steel and a large proportion of the bearings have been specially treated to reduce bearing torque

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BRITISH PETROLEUM CO LTD

"*Aiding the Search for Oil*"

The search for new oilfields must go on relentlessly World demand for oil continues to expand, and proved reserves, though large and constantly being added to, nevertheless will be exhausted at some time in the future

Aviation has come to play an increasingly important part in this search for oil Much oil prospecting takes place in areas remote from civilisation with few, if any, roads or other means of access In such places aircraft have proved invaluable for transporting in personnel, equipment and supplies, as well as for their more specialised use in aerial surveys

In particularly difficult places, landing space is restricted, however, and it is here that the helicopter comes into its own One such area is Papua, where The British Petroleum Company is searching for oil in association with American and Australian interests

In Papua the operating company, Australasian Petroleum Co Pty Ltd , was faced with exploring a territory covered by thick tropical rain forest or swampland There were no roads and only a few navigable rivers flowing down to the coast

Helicopters were first introduced into Papua by Australasian Petroleum Co Pty Ltd in 1954 to speed-up seismic work, which had been making very slow progress due to the difficulty of the terrain Bell 47D machines were used, capable of carrying two passengers, or alternatively 400 lbs of cargo from a heliport, or about 250 lbs from a jungle clearing

Although only small, these helicopters proved invaluable for their task It became possible to transport the surveyors, observers, drillers and other key personnel with their equipment to the scene of operations within a matter of hours, whereas before it took days

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In fact, these helicopters proved so successful on this survey work, that the use of larger machines for establishing and supplying drilling sites was considered Several of the sites chosen for test wells were seven or more miles from the nearest navigable river In one case where a road was built, it took 17 months to complete, even using modern machines

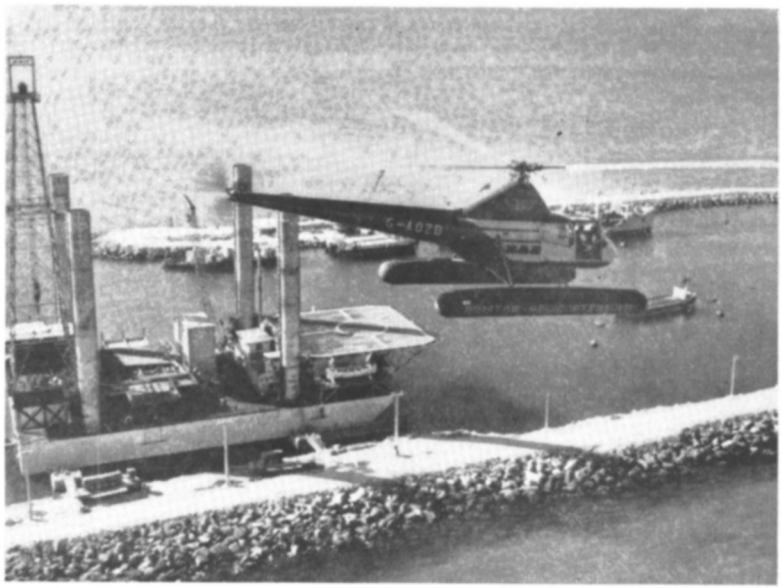
Early in 1957, three Sikorsky S 58 helicopters were shipped from America and assembled at Port Moresby These were each capable of lifting a load of about 4,000 lbs with sufficient fuel for 100 miles, and a seating capacity for 13 passengers

They were first used to carry in equipment to drilling sites at Sireru and Komewu The latter site is 80 miles from the coast and about eight and a half miles from the limit of navigation on the Aworra River In five weeks, helicopters landed at Komewu a complete drilling outfit capable of reaching 10,000 feet, earth-moving equipment, building materials, and sufficient supplies to begin drilling

In order to carry it in, the drilling outfit was designed to be broken down into loads of just under two tons Many of the loads were flown into the site and released exactly where needed without the helicopter actually touching the ground During the erection of drilling equipment on site the helicopter was even used as an aerial crane

Altogether four test wells in Papua have been drilled with outfits flown in and serviced by helicopter, including the Puri No 1 well which sprang into the news last November

Helicopters are being used in rather different conditions in the Persian Gulf by Abu Dhabi Marine Areas Ltd , in which BP has a two-thirds interest and Compagnie Francaise des Petroles, one-third



Undersea test wells are being drilled in marine areas off Abu Dhabi from a specially constructed drilling barge—Adma Enterprise Facilities on the barge include a helicopter landing deck

The barge was positioned for its first well last January about 20 miles from Das Island, where a supply and servicing base has been established, and was moved to a new well site about two miles from the first in October

Since drilling started last January, two Westland Widgeon helicopters have been in constant use, ferrying personnel, food and freight between Das Island and Adma Enterprise

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BRITISH EUROPEAN AIRWAYS

The discontinuance of scheduled services has made possible a more energetic participation in charter activities Results have been encouraging During the year ending March, 1958, over 500 hours were flown, and revenue from this work was nearly half of the Unit's total revenue The peak period for charter activities is the summer and during June, July and August this year over 130 hours were flown on crop spraying Since early August some 150 hours were flown on aerial supervision of the new Birmingham motorway Training accounts for about 100 hours a year

Development work has continued in preparation for all-weather helicopter operations Particular lines of development have been concerned with flying aids for all-weather operations and engineering improvements in the basic helicopter to increase component overhaul lives and reliability In contrast to previous years, the emphasis of the all-weather flying programme has changed from the general exploration of the problems involved to actual trials on prototype equipments, which are of a type considered necessary for such operations Flying has been carried out to determine the requirements for helicopter autopilots, instrumentation including flight director systems, and approach aids The present programme covers the use of the equipment on actual instrument flight in cloud and poor visibility by day and by night Further work has been carried out on the use of Decca as a primary navigational aid, with approach facilities in areas of good cover Other navigational aids, including V O R and A D F, are being tried to determine their possible application to helicopter operations The B E A approach lighting pattern has been developed, using higher intensity approach lights Other flying has been carried out to determine minimum site requirements and the best approach paths for operating into restricted sites

B E A have been operating a fleet of four helicopters during 1958, consisting of two Westland S 55's, one Bristol 171 Mark 3A and one Bell 47 B 3 Flying during the year amounts to approximately 900 hours

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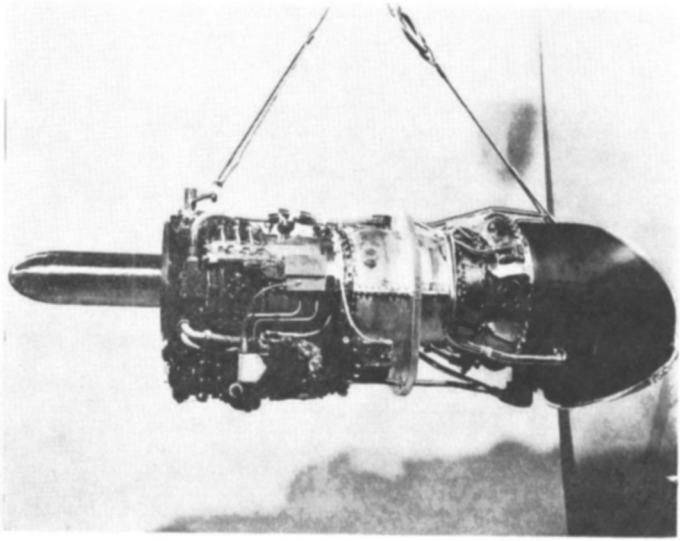
THE DE HAVILLAND ENGINE COMPANY LIMITED

The de Havilland Gnome is an ultra light-weight 1,000 S H P turboshaft unit of free turbine design, conceived from the outset as a helicopter powerplant It is derived from the General Electric T58 engine and embodies the experience gained during four years of intensive ground and flight testing of this unit in America

The Gnome employs a ten-stage axial compressor feeding air to an annular combustion system The combustion gases pass through the two-stage compressor-turbine, and thence through the single-stage power turbine, before exhausting the atmosphere through a curved exhaust duct As the speed of the power turbine is independent of that of the compressor turbine, the Gnome has the ability to give a variable power output at a selected output r p m The engine control system has therefore been designed to enable a selected rotor head r p m to be maintained constant against variations in rotor load

Development running of the T58 was initiated in April 1955 and in October 1957 it successfully completed an officially observed 150 hour military type-test Bench testing of the engine has now accumulated more than 8,500 hours of running, and an additional 1,500 hours has been performed on rotor system rig stands Also, extensive component testing, simulated high altitude testing and de-icing trials of the engine have been performed

Flight experience with the T58 has been obtained in the Vertol H-21D and the Sikorsky S-58 and S-62, to the extent of more than 400 hours in the air Other T58-powered aircraft about to fly in America are the Vertol Model 107, the Sikorsky S-61 and S-63, and the Kaman HU2K-1 Experience with the T58 in STOL aircraft will shortly be obtained when the Fairchild M224 Fledgling and the Kaman K16 make their first flights The experience gained as a result of this extensive flight testing is available in the Gnome



The De Havilland Gnome

Bench testing of the Gnome by de Havillands started in August this year and helicopter flight testing is scheduled to commence in May 1959 Manufacture of components is already underway, and complete production engines should be available during March, 1959 It is planned to undertake a Ministry of Supply 150 hour type-test in June of the same year Other variants of the Gnome are also being prepared, in particular a turboprop version suitable for VTOL, STOL, and conventional fixed wing aircraft Bench testing of this later engine will start during 1959, and single and coupled versions will enter production in 1960 The Gnome is already specified for installation in two designs of helicopter, and a further six installations are under discussion

De Havilland Gnome D Ge 1

One hour-rating	1,000 S H P
Low fuel consumption	0 65 lb /hr /S H P
Low weight	275 lb
High power weight ratio	3 64 S H P /lb
Compact dimensions	54 8 in long, 19 6 in high and 18 2 in wide

THE DECCA NAVIGATOR COMPANY LTD

The Decca Navigator System This year has seen a steady increase in the numbers of helicopters fitted with Decca Navigator

The Royal Air Force are equipping the whole of the Air/Sea Rescue Helicopter Organisation with Decca , increasing military interest in the system is also shown by the equipping of 36 H34 helicopters of the United States Army in Europe with Decca Mark 8 Receivers and Flight Logs In addition, the Royal Swedish Navy is equipping its Vertol aircraft also with Mark 8 and Flight Logs for Air/Sea Rescue duties

It was announced in January that the United States Air Modernisation Board had placed a contract for the provision of a Decca Chain in the New York area for

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evaluation with particular respect to helicopter operations New York Airways, operating scheduled helicopter services in the area, have equipped their Vertol 44B's with Decca Navigator equipment and are already carrying on with the trials

The Decca Equipment installed in the cockpit of the United States Army H 34 Helicopter

DOWTY GROUP LTD

New Dowty Shock Absorber Strut

Britain's largest rotary wing aircraft, the Westland Westminster, is fitted with a shock absorber strut (see Fig 1) for the main undercarriage designed and manufactured by Dowty Equipment Ltd

Much thought was given to this unit during the initial design stage, as in addition to ensuring that the maximum reliability and correct functioning characteristics were obtained during landing, it was essential that the damping, though adequate to

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dissipate the energy developed during vertical descent of the aircraft, was also capable of preventing the resonance effect of running the engines and rotor while the aircraft was stationary on the ground

A specially developed dashpot has been incorporated with damping characteristics calculated on the basis of preventing this, and as a result the initial predicted performances have been fully achieved in practice Extensive tests have proved that there is no tendency to ground resonance at any time

The unit illustrated in Fig 2 is a capsule type oleo-pneumatic shock absorber, attached to an extension tube The upper end is fixed to the airframe structure and the lower end is pinned to a stub axle which, in conjunction with two diagonal struts hinged to the bottom longerons, forms a swinging "A" frame

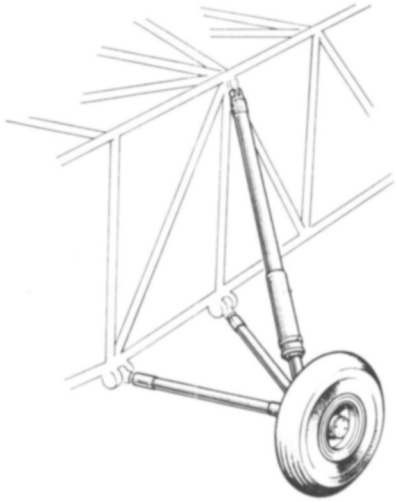

FIG 1 MAIN UNDERCARRIAGE

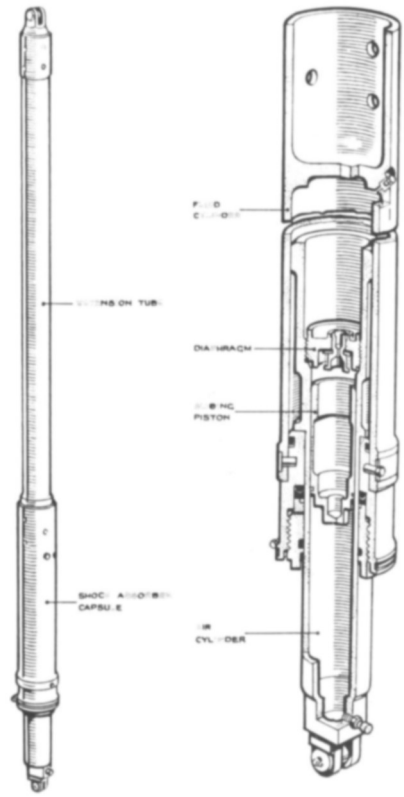

FIG 2 SHOCK ABSORBER

Resistance to dynamic loading is provided by a dashpot in which fluid is forced through orifices to dissipate energy, and the static loading conditions are met by the weight of the aircraft being supported on a column of comparatively high pressure air As such, the unit is capable of absorbing the energy representing a mass of 33,000 lbs descending at a velocity of 10 feet per second The actual travel of the strut during the dissipation of this energy is 7 15 ins which due to the geometry of the landing gear, is equivalent to an axle travel of 11 ins The weight of the unit is only 91 lbs

The capsule is constructed of two telescopic cylinders in which fluid and air

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are separated by a freely sliding piston The whole of the space above this piston is filled with fluid and the space below the piston is inflated with air On closure of the shock absorber when a landing load is applied, fluid above the piston is forced through orifices in a diaphragm to move the separator piston downwards, thereby increasing the pressure of air trapped in the lower chamber During this action, the energy of the aircraft, due to its vertical velocity, is absorbed by the air which is acting as a spring, and by the passage of fluid through the orifices The air spring energy is restored and is used to extend the strut when the load is removed During extension the main orifices in the diaphragm are blanked off by a plate valve, thus restricting the flow to a passage through the smaller recoil orifices, thereby increasing damping

The first aircraft also embodies a tail undercarriage suspension unit manufactured under licence in America by the Cleveland Pneumatic Tool Corporation which embodies a liquid spring shock absorber unit of Dowty design

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DUNLOP RUBBER CO LTD

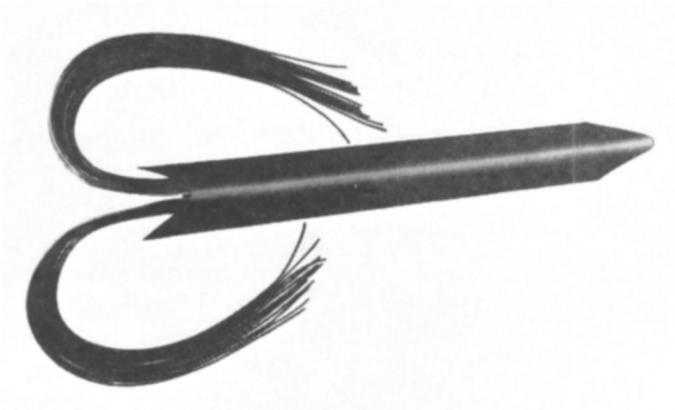
Dunlop Thermal De-icing

Dunlop manufacture thermal de-icing equipment suitable for the protection of most ice prone areas

Basically this system consists of electrically heated mats, each mat comprising an etched metal element of labyrinth form sandwiched between thin sheets of rubber The mats are used for applications such as leading edges, air intakes, etc , and can be pre-formed for bonding to the component, or can be cured directly on to it

Whichever method is used the final mat is extremely flexible , the element showing a high degree of resistance to fracture when fitted to a component subject to flexing under operating conditions It is felt that they may be particularly suitable for the protection of helicopter rotor blades, and trial installations are being prepared

Three phase or single phase systems can be used, and power can be graded along the blade to give heat intensity as required Present indications are that for rotor blades an average of 30 watts per square inch intensity at the root end are required, grading off in suitable steps according to length and speed of blade



The illustration shows a typical sample mat containing eight 3-phase star connected circuits A scheme envisaged uses six 3-phase circuits running the length of the rotor blade, with the heat distributed above and below the leading edge according to the operating conditions anticipated

Suitable cycling of the elements can be arranged to give adequate de-icing with minimum power requirement

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THE FAIREY AVIATION COMPANY LTD

A big event in the last year from the point of view of Fairey Aviation was, of course, when the Rotodyne first flew on November 6th, 1957 The initial flights have been characterised by a welcome freedom from petty unserviceability so that development has been rapid

The dominant design principle behind the Rotodyne was the need for high cruising speed The aircraft has come handsomely up to expectations in this respect and further increase is likely as development proceeds

The low speed performance is better than expectation indicating a very clean blade profile, and tests are about to begin on single engine performance

Early flights were made with a temporary fixed undercarriage since the original undercarriage had been found ground resonance prone in certain conditions Though this increased aircraft drag had imposed severe limits on vertical touch down speeds, the expedient allowed a great deal of essential flight information to be collected Meanwhile, a new retracting undercarriage free from ground resonance was designed, and is now incorporated on the aircraft

With tip jets lit, a flight condition needed only for a short period at take-off and landing, the noise, while not of an unpleasant character, is of fairly considerable volume Fairey's have therefore devoted a considerable effort towards the silencing problem Achieving a worthwhile noise reduction with minimum external drag, and long overhaul life, is a severe problem, but interim silencers have already been flight tested with very satisfactory results In the future adequate suppression of noise should be achieved for those operations where silencing is necessary

The Rotodyne has so far been a very successful prototype The qualification arises only because of the well known difficult gap between a successful prototype and a successful production aircraft This transition rather than any purely technical problem is the main task which the firm is tackling

The Ultra Light helicopter continues to perform well, and has demonstrated its ability to carry out a number of specialised roles The fact that this aircraft can

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operate safely from a ship's deck under very adverse weather conditions has already been reported It has also operated as a stretcher carrier from rough country A number of Service applications are now being explored both in the U K and overseas

LAYCOCK ENGINEERING LIMITED

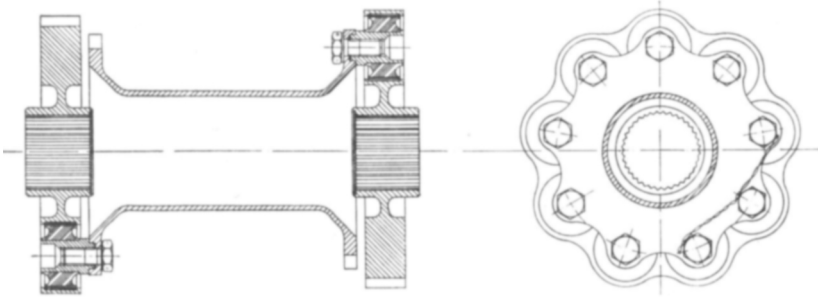
The Layrub flexible coupling continues to be standard fitment on several types of helicopter

This coupling, universal in the accepted sense, has compressed rubber trunnions as the flexible medium between the driver and driven members The specially profiled rubber elements are uniformly stressed under load and accommodate the angular deflections and axial movements experienced in flight

Steel housings, mounted on the transmission unit shaft ends, have suitably formed pockets to carry the rubber trunnions Centre sleeves bonded to the rubbers facilitate the connection to the tubular shaft assembly Since there is no metal to metal contact in the coupling lubrication is eliminated

The size and number of rubber trunnions built into the housing is varied to suit the applied torque and the flexible characteristics necessary for a particular drive

The transverse stability on the coupling is good and no centring device is necessary even at high speed , some of the smaller couplings are operating at 10,000 r p m



TYPICAL LAYRUB DRIVE SHAFT

TYPICAL LAYRUB DRIVE SHAFT

The Layrub shaft on the Skeeter intermediate primary drive has nine rubber elements in the couplings and is designated a 9/9 type On the same machine, a 10/10 coupling is interposed between the hub and the driving plate of the friction clutch The Saunders-Roe P 531 also incorporates 8/8 type couplings in the main drive

The Bristol Sycamore has 8/8 couplings on the rotor drive and larger capacity elements in a 9/9 coupling are fitted on the Bristol 192 The synchronising shaft on this particular machine has 7/7 type couplings whilst the auxiliary drive shafts make use of smaller sized 3/3 and 5/5 Layrub couplings

Several prototype projects with the latest power units are at present being equipped and further new applications are in the design stage

D NAPIER & SON LIMITED

No fewer than four of the six turbine-engined rotary-wing aircraft which took part in the flying programme of the 1958 S B A C air display, held at Farnborough, were powered by Napier They were the Westland Westminster (two Elands), the Westland Wessex (Gazelle), the Bristol 192 (two Gazelles) and the Fairey Rotodyne (two Elands)

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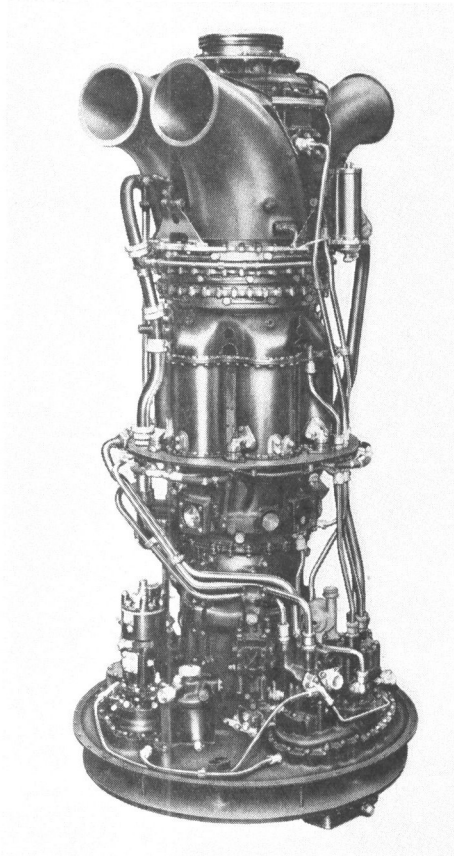
The Gazelle is a free turbine with a rating of 1260/1800 shaft horse power which can be installed at any angle between the horizontal and the vertical. In the Wessex it has an angle of 35 degrees from the horizontal, in the Bristol 192 it is almost vertical. In both instances it is supplied as an engine change unit, an assembly that resembles, in form and function, the power plant of a fixed-wing aircraft.



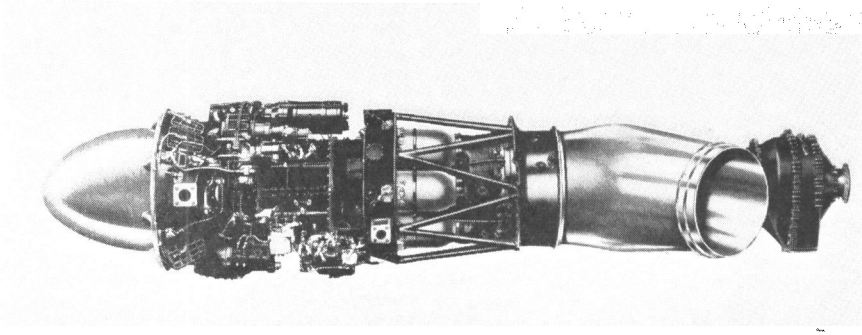
Napier "Gazelle"

Gazelles for the Bristol 192 have a power turbine with the same rotational direction as the compressor-turbine, but Gazelles for the Wessex have power-turbines that turn in the opposite direction.

Normally, each Gazelle in the 192 drives its own rotor, but the transmission and control systems are so planned that if one engine fails the other automatically increases its power to emergency rating and drives both rotors.

Power from the Westminster's two Elands is transmitted to the rotor shaft via a hydraulic clutch and a two-stage reduction gear which includes a free-wheel mechanism for each engine. Thus, the failure of one engine does not adversely affect the running of the other. The prototype Westminster had engines with a rating of 2,400 shaft horse-power at take-off, but production helicopters of this type will have a more powerful version of the Eland.

Two different forms of propulsion are used by the Rotodyne. For vertical, hovering and slow forward flight it relies upon thrust from combustion units (or pressure jets) at the rotor blade tips. These units are fed by air from auxiliary compressors driven by the Elands at engine speed via a hydraulic clutch. For cruising, the power



Napier "Eland"

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of the Elands is transferred from the auxiliary compressors to the standard aircraft propellers Many hours of development flying have proved that the transfer of engine power from compressor to propeller and from propeller to compressor is a smooth and rapid process despite the apparent complexities of the operation Devices on the engine, specially developed by Napier for the Rotodyne, control the speed of the engine as the load comes off the one and is transferred to the other

SABENA BELGIAN AIRLINES

Sabena Helicopters at the Brussels 1958 Exhibition

The world's first helicopter passenger service has now been in operation for five years None the less these rotating-wing machines are still as novel and as popular as they were in September, 1953, and they still arouse that same enthusi sm which, in those days, brought crowds of spectators to the heliport barriers in Rotterdam, Lille, Liege, Maestricht and Brussels A convincing proof of this was the brilliant success of the Sabena helicopters during the Brussels Universal and International Exhibition, 1958

Brussels is the home port of a fleet of helicopters, and the centre of the five pointed star made by the routes of the helicopter service This year's great international gathering was the Belgian capital's chance of showing again, and this time to crowds from all corners of the world, the merits of the helicopter for the carriage of passengers

Where, indeed, could this demonstration be better staged than in the Exhibition itself? For this reason, a heliport was built inside the gates of the Exhibition It was close to the main entry and to the Hall of Welcome, and on the fringe of the amusement park It had two circular take-off platforms, 25 metres in diameter and a landing platform 60 metres long and 30 metres broad In the heliport buildings was the "helistation" with the traffic services and a restaurant seating 650 people Here too were the offices of the Customs and the Security Police which gave the heliport an international status This made the Brussels Exhibition the first main international event to have its own place in the network of the world's airlines

The official and international character of this temporary heliport was emphasised by the decision of IATA (International Air Transport Association) to give it its own code lettering—BXP

Throughout the Exhibition period, the official time-table of Sabena's regular helicopter flights provided for a 3-minute stop at the Exhibition, which was thus brought into direct touch with 12 cities in France, the Netherlands, Germany and Belgium These same flights also touched down at Brussels National Airport, so that the Exhibition had its own air connections with the whole of the world air network

During the six months of the Exhibition, BXP was the landing point for 15,000 passengers in the international services It also provided a maiden helicopter flight —in many cases the first flight in any form of aircraft—for no less than 65,370 visitors

The peak day for these demonstration flights was August 17, when 93 such flights were organised and no fewer than 1,068 visitors made their first helicopter flight These flights took about 10 minutes Few who made them will forget the panorama spread below them, which they saw from higher than Atomium level Not only did this bring out the merits of Sabena's Sikorsky S-58 machines, but also those of the Vertol 44 and the Westland Widgeon, which had been put at Sabena's disposal The little Westland Widgeon, a 4-seater machine, was constantly on the job Not only did it carry many passengers, but on a number of occasions it was also chartered by the Highway Police, who, on days of peak traffic, were able to use it to regulate the intense flow of traffic converging upon Brussels

This is a story of a pleasing exchange of benefits The helicopters made it possible to get a better knowledge of the Exhibition , and the Exhibition gave the public a better knowledge of helicopters

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SAUNDERS-ROE LTD

(HELICOPTER DIVISION)

(1) Skeeter

Types Mk 12—definitive production type used for training and air observation by the British Army

Mk 50—designation of version of the Mk 12 used for training and air observation by the West German Army Principal difference is in the U H F radio installation

Mk 51—designation of version of the Mk 12 used for training and air observation by the West German Navy Different U H F radio installation

Production of Mks 12, 50 and 51 has been in full swing this year Production is now up to schedule

Early in the year the Type Test was completed in record time The time interval from the commencement of running to the issue of the document was four months

An initial C A Release was obtained for the Mk 12 during this year, and the full release will follow shortly

Development work, in conjunction with the de Havilland Engine Company, is proceeding on the installation of a turbo-supercharger to maintain performance at altitude and under tropical operating conditions

Another line of development which is well advanced are the flight trials of an autostabiliser manufactured by Louis Newmark Ltd

Metal blades for Skeeters are under development Electronic test gear is continually being developed, and has proved invaluable for stressing and vibration investigations

(2) P 531

Undoubtedly, the highlight of the year was the appearance of the P 531 five-seat, free turbine helicopter Detailed drawing work started on the 1st January, and the first flight took place on the 20th July

Two P 531's were on show at Farnborough , the first took part in the flying display every day, and the second was on display in the static park The second machine flew for the first time on the 30th September

The two prototypes are now flying with de-rated Blackburn Turmo 600 Series free turbine engines, giving 300 S H P The full Mk 1, P 531, will have a production

transmission capable of absorbing 650 S H P In its initial version the Mk 1 will have the production Turmo giving 425 S H P, but the development potential will be built-in so that the more powerful engine can be fitted later without lengthy and expensive re-design of the transmission

For this future development it is intended to use one of the 800-1,000 max S H P bracket engines—de-rated to 650 H P Outstanding tropical performance will then be guaranteed

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WESTLAND AIRCRAFT LIMITED

The design, development and construction of helicopters for production and associated equipment, continues to be Westland's sole activity Indicative of the current production scale was the combined flying demonstration each day at this year's S B A C Farnborough Show of the Widgeon, Whirlwind, Wessex and Westminster helicopters With useful load characteristics ranging from the equivalent of 4 to 12 passenger seats, the first three are in quantity production The Westminster prototype is under development as a flying crane with a designed externally carried load potential of upwards of 5 tons Both it and the Wessex are powered by Napier gas turbines

Service and commercial user interest in the 5-place Westland Widgeon has been well sustained during 1958 by deliveries to the British Navy, the Royal Jordanian Air Force, the Brazilian Navy, the Hong Kong Security Forces, and to Bristow Helicopters Limited

Throughout the year there has been continued quantity production of the Whirlwind, the alternative power unit for which is either the P and W —R 1340 or the Alvis Leonides Major piston engine of 750 B H P Used in large numbers by the Royal Navy for anti-submarine and plane guard duties, Whirlwinds have also been delivered to the British Royal Air Force, and the Army, to the French, Austrian,

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The Westland "Westminster"

Cuban, Yugoslav and Saudi-Arabian Governments for Service use, and to Fison-Airwork Limited for pest control Amongst other orders in hand is one for two Mk 7 Whirlwinds for use by the Queen's Flight

The first production built Westland Wessex all-British version of the Sikorsky S 58 powered by a Napier Gazelle free turbine gas engine of 1,450 S H P made its first flight in June, five months ahead of schedule Much credit for this achievement is attributable to the characteristics of the Napier power plant with which an appreciable background of flight experience had been accumulated at Yeovil during the preceding twelve months First of a substantial number ordered for the Royal Navy for anti-submarine duties, four of these helicopters have already been constructed and are engaged in an accelerated flight test development programme A feature of the hydraulic power operated flying control system is the provision of auto-stabilizing equipment This, whilst capable of maintaining automatic control over any predetermined flight regime, nevertheless allows the pilot authority to over-ride as circumstances dictate

Powered by two Napier Eland fixed gas turbines, each of 2,400 S H P, the Westland Westminster made its first flight in June With an initially designed all-up weight of 33,000 lbs and incorporating the proven rotor and transmission components of the Sikorsky S 56 this development prototype has its side-by-side power plants mounted above a welded steel tubular fuselage Constructed as a private venture primarily to evaluate the configuration and to gain experience with the twin turbine installation, this flying crane version can transport a load of up to 5 tons suspended from an external strong point, or as internally carried freight A second prototype is now in an advanced stage of construction, from the basic design of which will emerge civil and military transports capable of carrying 40 passengers

To meet a pressing need for convenient access to the London area, Westland has undertaken at its own expense to provide a heliport on a bank of the River Thames at Battersea Construction is well under way and this facility will become available to all helicopter operators during the early part of 1959

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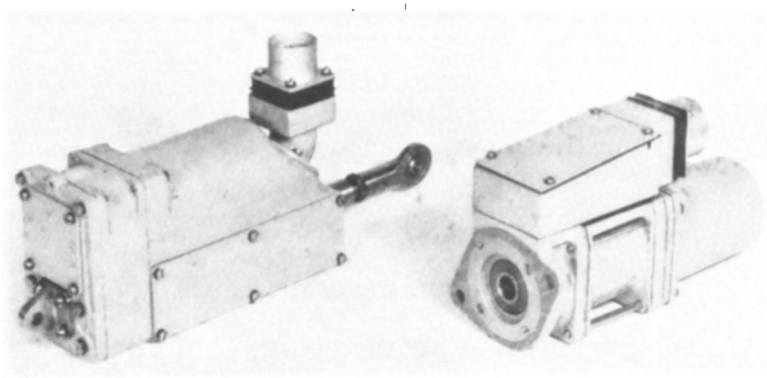
WESTERN MANUFACTURING (READING) LTD

Western design and manufacture all types of electro/mechanical, electronic, pneumatic and hydraulic components, in addition to the sub-contract manufacture of sub-assemblies ranging from Fabricated Structures to complete Aircraft Fuselages

The Company are carrying out a continuous research and development programme associated with Aircraft Accessories and Electronic Control Equipment

Among the various projects which may be of special interest for use in Helicopter aircraft applications are Universal type Rotary and Linear Electric Actuators for the remote operation of Fuel Cocks, Oil and Radiator Shutters, Trim and Clutch Control The Actuators have been designed to meet the stringent requirements of SDM (A) 215 and are available in either Rotary, Linear, or "Offset" Linear form to give high performance and reliability with a low weight factor

High temperature relays have been developed to operate continuously at 250°C and development is progressively proceeding for these Relays to operate at higher temperatures



Western "Automation Inspection" equipment covering a wide variety of applications has been developed for production, field service and special purpose Test Rigs These Test Rigs can be manufactured to functionally test electrical, hydraulic or pneumatic components Such equipment provides the answer to many problems associated with production and experimental work

Western's research, development and manufacturing facilities are extensive and comprehensive The Test House is completely equipped for all M o S approval tests, including High and Low Temperatures, Vibration, Humidity, Tropicalisation, Cycling and Fungus Tests, Flame and Explosion Proofing and High Altitudes, etc There are separate Engineering Laboratories for Metallurgical Chemical Analysis and Radiography Inspection

The Company manufactures on a sub-contract basis, aircraft structures such as Flaps and Ailerons, Fuselage Sections, Mechanical components, Undercarriage Control Gear, Hinged Wing Components, Aircraft Seats, Flare Chute Release Gear

Western maintain a high precision standard and specialise in aviation accessories, numbering the Ministry of Supply, the Services and the leading Aircraft Manufacturers among their various clients During the last five years, Western have also been building up Overseas contracts, and are producing a variety of equipment manufactured under licence, in conjunction with American associate companies

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BRITISH MESSIER LTD

Over the past twelve months, in the helicopter field British Messier activities have been concentrated on the production of the undercarriage for the Bristol Sycamore and the Bristol Type 192 On the latter aircraft production is now in full swing not only on the shock absorbers and roll dampers but on all the associated undercarriage structure

The undercarriages for the Type 192 are designed on the principle that the energy during a landing is absorbed by the four shock absorbers, and the rolling motion is damped out by the separate mechanical dampers

British Messier are now engaged on the design and manufacture of the undercarriages for the new Bristol Type 203 Helicopter, the prototype of which is targetted to fly during the summer of 1959

Some years ago, British Messier set up a special department to investigate the theoretical problems associated with ground resonance In this theoretical approach the elasticity of the undercarriage, the three dimensional stiffness of the tyres and the rotor parameters have all been taken into account The resulting equations are necessarily complex but using a digital computer the equations can be solved and the behaviour of the helicopter predicted

In addition, they have extended the use of simulators to undercarriage performance predicti ns with a definite reduction in numerical analysis work, and in some cases reducing the amount of drop testing required

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BOOK REVIEW

"HELICOPTERS AND AUTOGYROS OF THE WORLD"

by P Lambermont with A Pirie

(Cassell, London, 1958, 30/-)

This book sets out to provide a catalogue of the world's helicopters and autogyros giving leading particulars and a brief description of the layout , it is, in fact, a book of reference from what one might call the historical point of view Within these terms of reference the book is extremely satisfactory Apart from the most recent products, nothing appears to have been omitted and it is quite fascinating to read of some of the early developments

On the important point of accuracy, it is difficult to comment without undertaking exhaustive cross checks Some of the Russian data, for example, differs from that obtainable from other sources, but this merely reflects the difficulty of obtaining reliable information As far as possible the data seem to have been collected with considerable care

There is an adequate list of contents so that it is quite easy to look up any matter of interest without exhaustive search, and the book is also generously illustrated The information is given simply and without critical editorial comment , one can imagine a veteran reader supplying his own in some cases

The Index of Personalities is intriguing with a certain preponderance of "Central European" names Yet another example of the original contributions to human endeavour that have derived from this part of the world

D M D

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