# newsletter

102
RNB

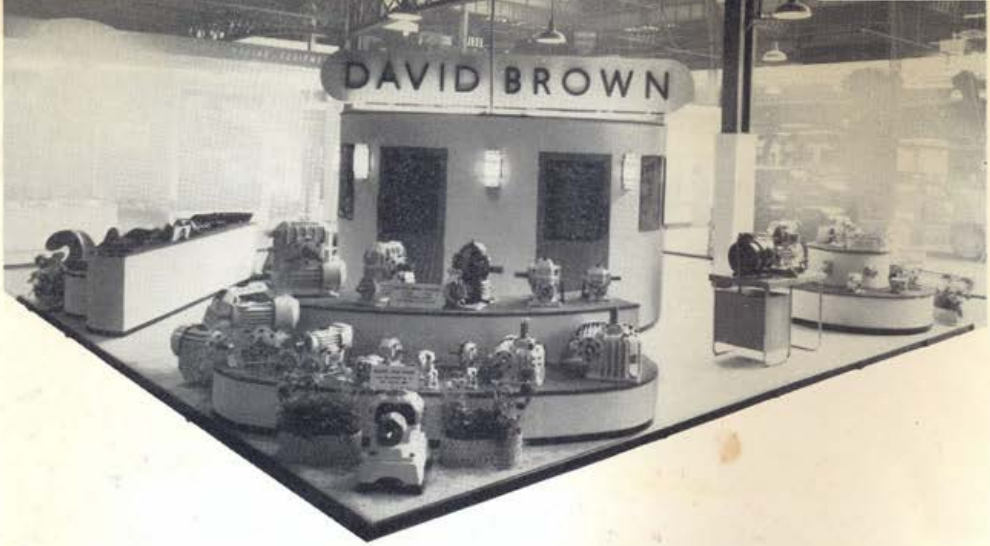
*incorporating* ***CONTACT*** *quarterly*

A DAVID BROWN PUBLICATION

JULY, 1954 VOL. 6 NO. 7

CIRCULATION 12,750

A FOUNDRY CRAFTSMAN




*Products of David Brown Gear and Foundry Groups were included in an attractive display at the 1954 Mechanical Handling Exhibition, held at Olympia. In this view, "Radicons" are in prominence, the larger units built by David Brown and Sons (Huddersfield) Ltd., and the small range from David Brown Gears (London) Ltd. Coloured photographs showing the application of products were mounted around the circular office block in the centre of the stand. (A detailed report of the show appears in "Incidentally").*

# For Mechanical Handling

*Geared motors from The Coventry Gear Company, floating reamers, hobs and cutters from The David Brown Tool Company, and stock gears from The Keighley Gear Company, were set out as a corner feature.*


*These castings—parts for excavators, track plates, and a lifting hook for oilfield equipment—are products of The David Brown Foundries Company, Penistone.*

# newsletter

JULY, 1954 — A David Brown Publication — Vol. 6 No. 7


DAVID BROWN AND SONS (HUDDERSFIELD) LTD.
THE DAVID BROWN FOUNDRIES COMPANY
THE DAVID BROWN TOOL COMPANY
THE KEIGHLEY GEAR COMPANY
THE COVENTRY GEAR COMPANY
DAVID BROWN-JACKSON LTD.
DAVID BROWN GEARS (LONDON) LTD.
DAVID BROWN MACHINE TOOLS LTD.
DAVID BROWN TRACTORS (ENGINEERING) LTD.
ASTON MARTIN LTD.
LAGONDA LTD.

## SALES ORGANISATION

THE DAVID BROWN CORPORATION (SALES) LTD.,
INCORPORATING:
ASTON MARTIN DIVISION
AUTOMOBILE GEARBOX DIVISION
COVENTRY GEAR DIVISION
FOUNDRIES DIVISION
GEAR WORKS DIVISION
JACKSON DIVISION
KEIGHLEY GEAR DIVISION
LAGONDA DIVISION
LONDON GEAR DIVISION
MACHINE TOOLS DIVISION
TOOL DIVISION
TRACTOR DIVISION
TRACTOR DIVISION, SCOTTISH BRANCH

## OVERSEAS COMPANIES

ASSOCIATED COMPANIES IN AUSTRALIA, CANADA, EIRE AND SOUTH AFRICA

## NEXT ISSUE

*The next issue of NEWSLETTER will be distributed on August 6th. Closing date for contributions will be July 19th. Copy received after that date cannot be guaranteed inclusion.*

### *This month's cover*

*At work in the foundry pattern shop of David Brown-Jackson Ltd. is Roy Booth, 6 ft. 2½ in. at the age of twenty, who has been awarded a medal and a cash prize as winner of the 1954 essay competition for apprentices organised by the Lancashire Branch of the Institute of British Foundrymen. Roy's essay is printed in the CONTACT supplement to this issue.*


*A Bristol type 173 Mark 2 sixteen-seater helicopter in service with British European Airways.*

# The Age of the Helicopter

**The need for an aircraft that can fly with perfect control without dependence upon high forward speed, that can rise and descend vertically, making runways unnecessary, and that can hover if need be, has now been solved in a thoroughly practical manner.**

THAT is the foreword to a brochure published recently by one of the British companies which has pioneered the development of the helicopter, a machine which has hit the headlines almost daily in recent weeks. To pioneer any piece of equipment which is obviously destined to become an important servant of man always brings a real sense of pride, and when the history of the helicopter comes to be written The David Brown Foundries Company will be counted as one of the suppliers of components in the very early days. In the post-war era, our Penistone company has devoted an increasing proportion of existing plant—and has added new facilities—to producing castings for aeroplanes and helicopters. The announcements of the past weeks are therefore more than likely to be of consequence.

In a statement in the House of Commons in mid-May, Mr. Duncan Sandys (Minister of Supply) said that the sums paid by the Ministry to industry for research and development work on helicopters had risen from £115,000 in 1946-7 to an estimated £1,256,000 in 1953-4. He added that in 1954-5 expenditure was likely to increase to more than £2,500,000.

The Minister mentioned that The Bristol Aeroplane Company, to whom The David Brown Foundries Company have supplied castings for various models, had two prototypes of the Bristol 173 helicopter, which has twin piston engines, undergoing development trials. Further prototypes were in course of construction. Mr. Sandys announced that a production order had been placed for about a hundred of the military version of this aircraft. The Bristol Aeroplane Company, he added, was also planning a larger type with gas turbine engines, capable of carrying up to 27 passengers.

The Bristol Type 173, the latest version of which has been named the Rotocoach, is designed to carry 14-16 passengers over a range of 340 miles at a cruising speed of 138 m.p.h. When it first flew in January 1952, the manufacturers claimed that it was the first twin-engined helicopter in the world to offer safe flight with one engine shut down. An order for three Rotocoach helicopters has now been given by the Ministry of Supply and these are intended for civil operation on British internal services. It can easily be converted to freight transport.

In November, 1953, a Mark 1 prototype of the Bristol 173 completed a series of trials aboard the Royal Navy's largest aircraft carrier, H.M.S. Eagle.

At Yeovil, Somerset, Westland Aircraft Ltd. are also going ahead with a busy programme of development in addition to meeting an increasing production requirement. Again, The David Brown Foundries Company is contributing castings to the Westland-Sikorsky S.51 and S.55 helicopters, four and twelve-seat capacity machines respectively which are fulfilling civil, military and naval roles. These two types together now have over three-quarters of a million flying hours to their credit.

It may come as something of a surprise to know that Igor Sikorsky was building helicopters as long ago as 1908—his first did not fly, but he was undeterred. Throughout the years of his rise to fame there was always a helicopter project under development in some corner of the drawing office. The success of his machines in war years, and later in Malaya and Korea, which were by this time being built in Britain under licence by the Westland company, was highlighted by such events as an S.51 making the first London to Paris (city centre to city centre) passenger flight and the relief of the storm-bound Wolf Rock lighthouse in February 1948.

By 1949, Westland had in fact become the largest helicopter factory in Europe, and the machines really became front-page news during the disastrous floods in Britain and Holland in February 1953.

Westland were again in the news last month, when Mr. John Profumo (Parliamentary Secretary, Ministry of Transport and Civil Aviation) told a questioner in the House of Commons: "We propose to authorise B.E.A. to purchase immediately two S.55 machines. The intention is to start an experimental scheduled passenger service between London Airport and the centre of London". Mr. Profumo added that arrangements had been made for a landing site on the South Bank, and this was in fact used for the first time the following day.

What of the future? To the manufacturers, to suppliers such as The David Brown Foundries Company, that question presents a problem and a challenge. Certainly there is every reason to expect a rapid increase in the volume of freight and passenger traffic undertaken by helicopter. Marshal of the Royal Air Force Lord Douglas of Kirtleside, chairman of British European Airways, had this to say in the House of Lords a few weeks ago: "Helicopter development should be pressed by all means and with all speed. I believe that within the next ten years all the shorter routes, up to 200 miles, in this country and on the Continent will be flown by multi-engined helicopters coming into the middle of cities".

*This Royal Navy Westland-Sikorsky S.51, a four-seater machine, is of the type which played a prominent part in flood rescue work on the East Coast of England and in Holland.*

# *Incidentally . . .*

**NEWS AND GOSSIP FROM NEAR AND FAR**

## For Handling Materials

The Mechanical Handling Exhibition, organised biennially by the Iliffe Press journal of that name, is a specialised show which commands the attention of those associated with handling materials in industry. This year's show at Olympia, opened by the Duke of Edinburgh, was no exception and despite the high degree of efficiency which has been reached in industry there were still numerous innovations.

Wholly devoted to products applicable to mechanical handling, the David Brown stand was representative of both Gear and Foundry Groups. "Radicon" worm reducers were not only prominently featured in the David Brown display, but were to be seen in various applications on the stands of other exhibitors. A transparent plastic "Radicon" was run periodically on our stand to demonstrate the positive method of lubrication, prompting many questions from visitors. A four-speed industrial gear unit was also among the Park Works exhibits.

The new 2¼ "Radicon" was among the exhibits on behalf of David Brown Gears (London) Ltd., with standard units mounted in positions demonstrating their versatility in operation. The Coventry Gear Company also introduced a new product in the size 1⅝ "Coventry" geared motor, shown along with other geared motors and co-axial units from the standard range. Stock spur gears were exhibited by The Keighley Gear Company, while The David Brown Tool Company was represented by a set of floating reamers, hobs and cutters.

From the wide range of castings which The David Brown Foundries Company produces for mechanical handling equipment, the exhibits shown included parts for excavator buckets, excavator picks, track pads for excavators and mobile cranes, ripper blades, and a lifting hook for oil well equipment.

## Another Drama Win

To conclude a memorable season, the David Brown Tractors Dramatic Society have been declared winners of the Huddersfield and District Drama League's 1953-54 festival. Their entry, "The Hasty Heart", was given at Meltham Mills last November, for in this festival the adjudicating panel visits a performance by each entrant, and the result is declared at the end of the season.

As winners, the D.B.T. Society will hold the "Huddersfield Examiner" trophy, presented by B.B.C. producer Philip Robinson when the results were announced on Friday evening, June 18th, and also receive a Certificate of Merit.


*At Exhibition House, Johannesburg, David Brown Precision Equipment (Pty.) Ltd. have a permanent stand showing products of the Benoni works. "Radicon" worm reducers and components were prominently featured at the time this photograph was taken, though in due course a half girth ring was to be mounted on the two pedestals in the foreground. In the picture (left to right) are Mr. E. Wright and Mr. A. Brindle (of David Brown Precision Equipment (Pty.) Ltd.) and Mr. W. C. Hawkes (of David Brown & Sons S.A. (Pty.) Ltd.).*

*At the invitation of David Brown Tractors (Engineering) Ltd., Dr. A. Reinikainen (centre) head of the Finnish Agricultural and Forestry Equipment Testing Station at Helsinki, paid a two day visit to Britain on June 15th and 16th.*
*During the course of his stay, Dr. Reinikainen discussed with David Brown technicians common problems of tractor and implement design, with particular reference to farming conditions in Finland. He also illustrated other aspects of the Helsinki testing station's work by means of a film on timber handling and snow clearing.*
*Among the array of British-made equipment at a comprehensive demonstration, Dr. Reinikainen was particularly interested to see a rotary harrow, of Finnish design and manufacture, which the David Brown company is currently testing in this country.*

## D.B.M.T. Visitors

Two technical assistants of the Malayan Railway, who have just completed two years' training with British Railways, recently spent a couple of days at the Manchester works of David Brown Machine Tools Ltd.

On Tuesday, May 25th, eighteen overseas students visited the works by arrangement with Bolton Training College.

## Firemen in Competition

The Industrial Works Fire Brigades have entered upon another competitive season and the team from David Brown and Sons (Huddersfield) Ltd. has had moderate success in two competitions.

At Huddersfield on May 29th, Park Works won the Bentley and Shaw Cup for the light trailer pump event, and at Barnsley on June 19th they won the Championship Cup for the heavy trailer event. In the latter competition the opposing teams included many well known works fire brigades from Yorkshire, with as many as 25 teams competing in some sections.

The Park Works team comprised J. Knox, D. Gibson, H. Eastwood, G. Horsfield and J. Rushworth.

## In Memoriam

An extension of the Naval Memorial on Plymouth Hoe was dedicated on Thursday, May 20th, by H.R.H. Princess Margaret, to officers and men of the Naval Forces of the Commonwealth who lost their lives in the 1939-1945 war.

Mrs. Alice Sedgwick left behind her work in the Tackle Shop of The David Brown Foundries Company, Penistone, to join the relatives of other Naval personnel attending the ceremony. Her husband, A.B. Edwin Sedgwick, was aboard H.M.S. *Inglefield* when the vessel was split in two by a bomb and sunk off Anzio beachhead; of 44 men who lost their lives, his was the only body which was not recovered.

After paying tribute to "officers and men of the Naval Forces of the Commonwealth who laid down their lives in two wars and have no grave but the sea", Princess Maragret unveiled the screen wall of the extension, on which the 1939-1945 names are recorded.

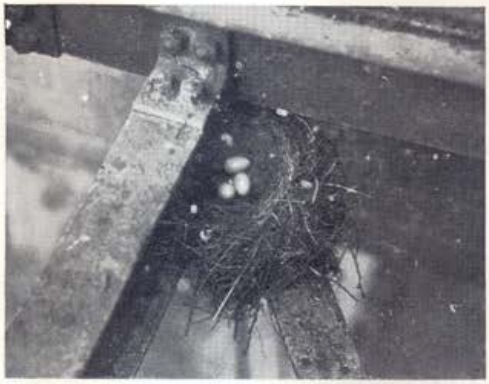
Mrs. Sedgwick's son, Roy, is apprenticed as a coremaker at the Penistone Works.

*Among the snapshots which Mrs. Sedgwick took at the ceremony was this view of the central obelisk, completed in 1924 and standing a hundred yards from the lighthouse on the cliff edge.*

## For Our Benefit?

Our apologetic note for having missed the opportunity to photograph a thrush's nest high up on the fire escape of a four-storey building at D.B.T. Meltham was unnecessary after all. A few days after publication, a little bird (using a telephone) suggested that it might be interesting to take another peep at the nest.

A photographer went along—without delay—and returned with this picture. By this time anotner



family will be ready to go out into the wide world.

Ornithologists tell us that it is unusual for a thrush to use the same nest for more than one brood, which has brought us to the conclusion that the bird returned for one of two reasons. Either it came back for the benefit of *NEWS-LETTER*, or, and this seems more probable, it has taken a liking to the canteen tea and biscuits which were provided for its first family.

## Ideas that Work

Awards made by the Tractor Group Suggestions Scheme since the publication of the last report are as follows:

| *Sugg'n. No.* | £ | s. | d. | *Sugg'n. No.* | £ | s. | d. |
|---|---|---|---|---|---|---|---|
| AD.41 | 1 | 0 | 0 | 1815 | 2 | 10 | 0 |
| 1659 | 2 | 10 | 0 | 1817 | 1 | 0 | 0 |
| 1680 | 1 | 0 | 0 | 1818 | 1 | 0 | 0 |
| 1739 | 1 | 0 | 0 | 1820 | 2 | 10 | 0 |
| 1779 | 2 | 10 | 0 | 1824 | 1 | 0 | 0 |
| 1783 | 1 | 0 | 0 | 1827 | 2 | 10 | 0 |
| 1799 | 2 | 10 | 0 | 1828 | 1 | 0 | 0 |
| 1808 | 2 | 10 | 0 | 1834 | 2 | 10 | 0 |
| 1806 | | 10 | 0 | 1835 | 2 | 10 | 0 |
| 1807 | 1 | 0 | 0 | 1837 | 1 | 0 | 0 |
| 1811 | 1 | 0 | 0 | S119 | 1 | 0 | 0 |
| 1813 | 1 | 0 | 0 | S132 | | 10 | 0 |
| 1814 | 1 | 0 | 0 | S103 | 5 | 0 | 0 |
| | | | | S118 | 2 | 0 | 0 |

The following are still under consideration:-

1604 1638 1639 1697 1744 1772
1784 1812 1826 1829 1830 1832
1833 1836 1839 1841 1843 to 1849 inclusive.

## Commission for Metallurgist

Among the cadets commissioned at a passing-out parade at Eaton Hall, Chester, on May 28th was Mr. A. B. Woodhead, a former metallurgist at The David Brown Foundries Company who is at present on National Service. H.R.H. Princess Margaret took the salute after attending a church service which preceded the parade, and afterwards she had lunch at Eaton Hall.

To obtain a commission during National Service is a fine achievement on which Brian is to be congratulated. His wife, Mrs. Mary Woodhead, who is also employed in our Penistone laboratories, attended the ceremony to see her husband receive his commission.

## Young Gardener's Success

Fifteen-year-old John Eastwood, an apprentice gardener at D.B.T. Meltham, has been informed that he has passed the Royal Horticultural Society's general examination for juniors. John took the examination in March after a winter course at Huddersfield Technical College.

## Beside the Sea

Old associations were renewed when members of the technical staff and management of David Brown-Jackson Ltd. visited Messrs. J. Robertson & Sons Ltd., Fleetwood, on Saturday, June 19th. Commander Weston Smith and Mr. I. Selby were among the visiting party which was joined by the Fleetwood company's Managing Director, Mr. John R. Robertson.

A friendly game of bowls was played in the afternoon, after which the hosts provided an enjoyable tea. In the early evening the visitors went into the Fleetwood workshops and saw David Brown-Jackson products being assembled in trawler winches for various fishing companies.

Later, challenge games of snooker and darts were played in the company's clubrooms and it was time to leave for home much too soon for the liking of the visitors though quite late according to the clock. The very enjoyable outing had the effect of further improving the friendly relationships between the management and personnel concerned, and David Brown-Jackson Ltd. look forward to acting as hosts when their Fleetwood friends call in return.

*The Salford party en route for Fleetwood.*

## Implements for New Zealand

An agreement is shortly to be concluded between David Brown Tractors (Engineering) Ltd. and Messrs. Booth, MacDonald and Co. Ltd. of Christchurch, whereby David Brown agricultural implements will be progressively manufactured in New Zealand.

Under the terms of the agreement, David Brown Tractors (Engineering) Ltd. will collaborate with Booth, MacDonald and Co. in supplying full technical and production data, which will enable the New Zealand company to manufacture an increasing number of implement components from materials obtained from local and other sources.

Several considerations have prompted the formation of this agreement, which has been drawn up with the support of Messrs. Todd Bros., the David Brown tractor distributors in the Dominion.

One of the factors prompting the agreement is the recent reintroduction of New Zealand's pre-war policy of supporting local industry by prohibiting the importation of implements that can be made by New Zealand companies.

Nevertheless, there will exist a very considerable demand for the specialised implements which are generally provided with modern tractors and as the result of this agreement a David Brown tractor owner in New Zealand will still have available the implements specifically designed for his use. At the same time, the operator will have the added benefit of using quality equipment made on the spot by a company which is fully conversant with local farming conditions.

## Your Next NEWSLETTER

At the time the August issue of *NEWSLETTER* is published, some works will be closed for the annual holidays.

Employees at these works will receive copies at the first opportunity after the holidays. Readers to whom *NEWSLETTER* is sent by post direct from Group Publicity Services will receive their copies approximately a fortnight later than usual.

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# *Personal*

### BIRTHS

To Mr. A. F. Wright (*Light Machining, Park Works*) and Mrs. Wright—a daughter, Anne.

To Mr. R. Curry (*Milling and Drilling, Park Works*) and Mrs. Curry—a son, Graham Russell.

To Mr. R. Chambers (*Heavy Fitting, Park Works*) and Mrs. Chambers—a daughter, Pamela Hazel.

To Mr. G. H. Gledhill (*Gearbox Drawing Office, Park Works*) and Mrs. Gledhill—a son, Keith Anthony.

To Mr. W. Moore (*Gear Cutter, The Coventry Gear Company*) and Mrs. Moore—a son, William David.

To Mr. W. Forster (*Foreman, Machine Shops, David Brown-Jackson Ltd.*) and Mrs. Forster—a daughter, Barbara Lilian.

To Mr. E. Broad (*Welder, Penistone*) and Mrs. Broad—a son.

To Mr. G. Hughes (*Welder, Penistone*) and Mrs. Hughes—a daughter.

### MARRIAGES

Miss I. Hoyer (*Production Progress, Park Works*) to Mr. D. Garner (*formerly of Turning Dept., Park Works*).

Miss S. J. Gibbons (*Estimating Dept., Park Works*) to Mr. J. Booth

Miss Ann Boothroyd (*Canteen, Park Works*) to Mr. B. Kaye.

Mr. S. Ownsworth (*Aircraft Foundry Inspection, Penistone*) to Miss E. Croft, of Gilroyd.

Miss A. Starkings (*Shorthand Typist, Penistone*) to Mr. E. Lockwood, of Penistone.

Miss J. Beedham (*Wages Department, Penistone*) to Mr. E. Dransfield, of Penistone.

### RETIREMENTS

Mr. W. Whiteley, an employee of Maintenance Department, Park Works, for 27½ years.

Mr. J. E. Hepworth, an employee of Reamer Section, The David Brown Tool Company, for 17½ years.

### DEATHS

Mr. T. Fawcett, an employee of Light Machining, Park Works. for 17½ years

Mr. L. Greenwood, an employee of Gearbox Machining, Park Works, for 11½ years.

Mr. S. Schofield, an employee of Millwrights Dept., Park Works, for 5 years.

Mr. Arthur Phipps, aged 68, who had been employed as a beltman in the Mantenance Depment of David Brown-Jackson Ltd. for 44 years.

Mr. C. Thorpe, tacklesmith at The David Brown Foundries Company for seven years.

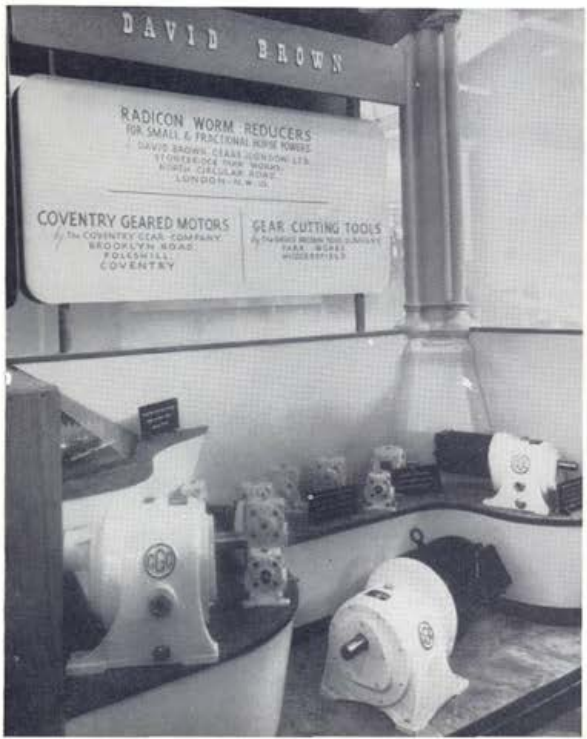
Mr. C. H. Hutchinson, general labourer at The David Brown Foundries Company for 14 years.

# PICTURE PAGE

**A MONTH-BY-MONTH PICTORIAL RECORD OF DAVID BROWN PRODUCTS AND PEOPLE**


*Taking advantage of new regulations, Tyburn Road Tank Services Ltd., of Beaconsfield, Buckinghamshire, are now operating a 4,000 gallon tanker for direct delivery of aircraft fuel to Royal Air Force and United States Air Force airfields in this country. This is the largest tanker made in this country at the present time, with an increase of 400 gallons compared with the capacity which has hitherto been legally permissible.*

*Built on an eight-wheeler chassis supplied from the Walton-le-Dale, Preston, works of Atkinson Lorries Ltd., the tanker is powered by a six-cylinder Diesel engine developing 112 h.p. at the governed speed of 1,700 r.p.m. A David Brown model 557 gearbox supplied by the Automobile Gearbox Division of David Brown and Sons (Huddersfield) Ltd. drives both rear axles, to give five speeds ranging from 3.68 to 29.1 m.p.h. at the governed maximum. Fully laden, the tanker weighs 21 tons 18 cwt. (Photo: "Motor Transport").*




*A permanent exhibition, to be known as the Birmingham Exchange and Engineering Centre, was recently opened to the public by Lord Bennett of Edgbaston. Housed in premises at Stephenson Place, Birmingham, the Centre is conveniently situated and is intended as a place of reference for the would-be buyer as well as a display of general interest. Permanent staff will be on duty to answer queries and supply literature.*

*Two hundred exhibitors are represented at the Centre, each having a stand of set design 6 ft. by 3 ft. in area.*

*Insofar as the David Brown organisation is concerned, a stand is being utilised to display "Coventry" geared motors from The Coventry Gear Company, tools and cutters on behalf of The David Brown Tool Company, and small "Radicon" worm reducers from the range built by David Brown Gears (London) Ltd.*

*A "Daily Sketch" cameraman secured this excellent picture as the Queen and the Duke of Edinburgh took the salute at a review aboard the aircraft carrier H.M.S. "Eagle", lying off Malta at the time the Royal party was returning from the Commonwealth tour.*

*For a Naval photographer, the David Brown 30IC industrial tractor on the left provided a vantage point from which to record the ceremony. The tractor is one of the two named after Prince Charles and Princess Anne following the Royal children's visit to the carrier with tractor rides on the flight deck as the highlight.*

*David Brown Tractors (Eire) Ltd. had a new stand at the 1954 Dublin Spring Show, exhibiting a representative and seasonal selection from the range of David Brown tractors and implements. Features of the David Brown 25 model were illustrated by sectional sub-assemblies set out on a small display unit under the main canopy, which attracted a good deal of attention from the Eire farmers who are ordering Meltham-built tractors in larger numbers than ever before.*

# Tributes to the 'Back-room Boys'

MEMBERS of four sections of David Brown Tractors Sports and Social Club, each of which has won one or more awards during the 1953-54 winter season, were presented with plaques provided by the management through the club's president (Mr. J. Whitehead) at a dinner and social evening held at Meltham Hall on Thursday, May 26th. Over 100 were present at the event to cheer their colleagues as Mrs. Whitehead handed out the plaques, appropriately inscribed to record the section's achievement.

There were special bursts of applause for various outstanding performances but the loudest acclaim of the evening came when the awards were presented to long-serving officials—"back-room boys" as they were described.

Two of the sections were winners in their first season of competition—the Dramatic Society claiming the "Amateur Theatre" trophy as runners-up in the Craven Drama Festival, the Certificate of Merit awarded to the runners-up in the Buxton Drama Festival for full-length plays, and the "Huddersfield Examiner" trophy as winners of the Huddersfield and District Drama League, while the Chess Section carried off the championship of the Huddersfield League on returning to competitive play after a lapse of several years. The Darts Section retained the championship of the Holmfirth League. In the Football Section, the Huddersfield Works League team were champions for the third year in succession and added the Subsidiary Cup to their list of trophies; the District League team finished the season in the position of runners-up.

*Mrs. Whitehead hands a plaque to Dramatic Society member Mr. G. Scholes.*

Referring to the "back-room boys of the Meltham club", Mr. J. A. Longley remarked that the players won the trophies but the work of the committees made the successes possible. Mr. Longley went on: "The longest serving member of the football committee resigned at the beginning of this season. I refer to Alec Robertson, who has marked out the field, packed and carried the bag week after week; in fact, he has been one of the best servants the club has ever had. The plaque which we present to Mr. Robertson tonight is in appreciation of his services and is inscribed with the list of honours which the Football Section has won while he has been a committee member. We find also two committee members who have completed ten years' service—Mr. Herbert Bastow and Mr. Arthur Ambler—and the plaques which they receive are similarly inscribed". A plaque was presented by the Club to the President, Mr. Longley remarking that although Mr. Whitehead had not quite ten years' service he had done everything he could do to help and encourage all Sections. Appropriately, this plaque was presented by Chris Yewlett, who has the longest period as a playing member of the Football Section. Members of the football teams took the opportunity to present a tea service to Alwyn Smith, who has recently married.

*Mr. Robertson*

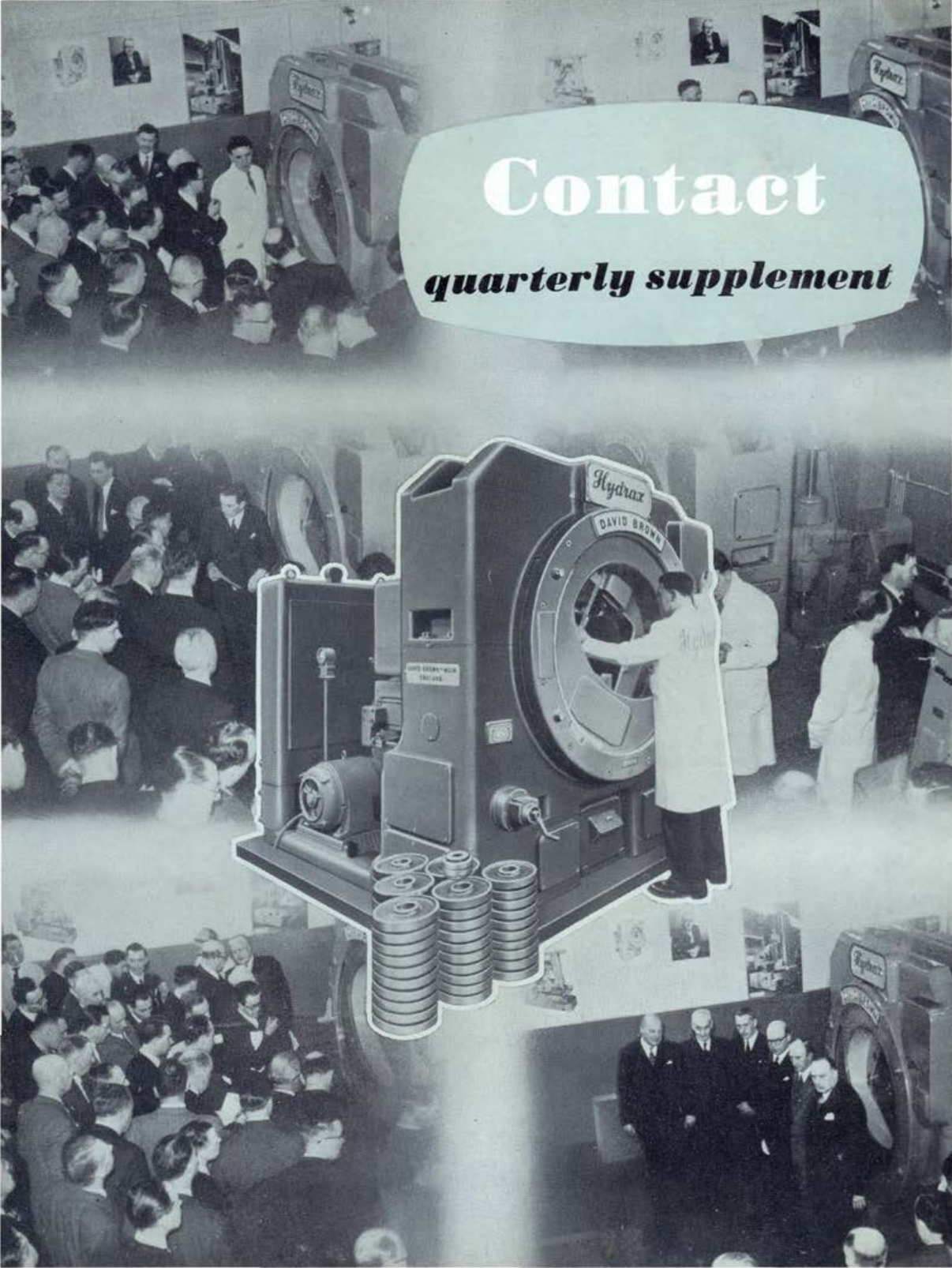
"Finally", said Mr. Longley, "a word of thanks to the ladies. We don't hear much of them, but we owe them a lot, for they are often put to inconvenience on our behalf." It was not possible to make a presentation to every one, but the bouquet which Mrs. Ambler was asked to receive was meant to be a token of the club's appreciation of the help the ladies gave all the year round.

In proposing a vote of thanks to the management, Mr. Herbert Bastow suggested that Mrs. Whitehead should have a plaque as "the most consistent supporter" (loud applause). Mr. Bastow went on to thank the President for the support which each Section received, and for the plaques distributed that evening. Seconding Mr. Bastow's remarks, Mr. T. R. Sheppard commented that it gave all Sections great pleasure to bring trophies to the club and thereby to further the prestige of the company.

"I can assure you that we get as much fun out of club functions as you do", said Mr. Whitehead in reply, "but nevertheless we thank you for your presents and kind remarks".

# Contact

## *quarterly supplement*



# News of the New

**In their unceasing efforts to meet the needs of customers and product users in almost every branch of the engineering industry, David Brown technicians are constantly working on new projects. Rarely a month goes by without the introduction of a new product by some David Brown company, and without claiming to include every new piece of equipment CONTACT gives details in the following pages of recent developments which, after testing and proving, have been added to the list of David Brown standard products.**

THE David Brown HYDRAX Production Gear Hobbing Machine, which was recently shown to the public for the first time at our Manchester works, is claimed to have a production rate equivalent to that of a multi-spindle machine and is believed to be the fastest in the world. It is designed for the rapid generation of spur and helical gears by "climb" or conventional hobbing.

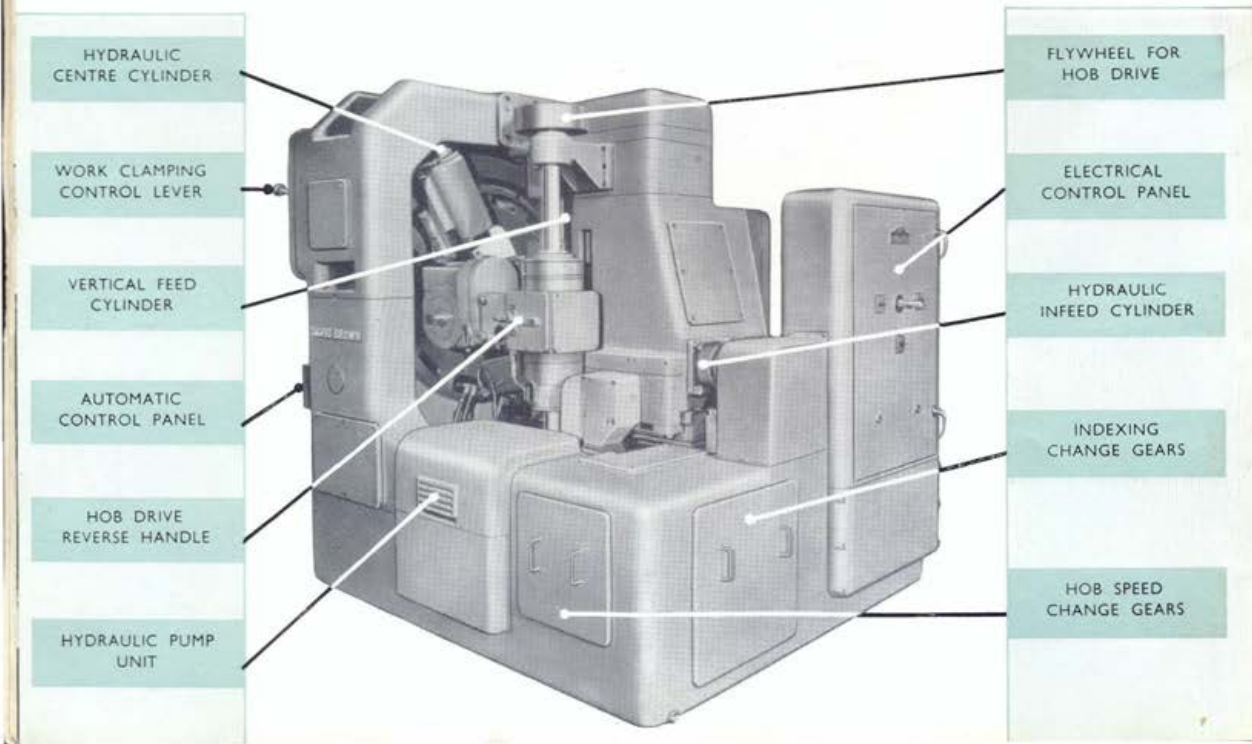
Although the Hydrax machine is built on exceptionally massive lines, weighing 9½ tons, the floor space occupied is only 78 in. by 84 in. The machine is expected to attract world-wide interest, particularly in the automobile and similar industries where quantity production methods are used.

*The photographs grouped as the cover of CONTACT were taken at the time the "Hydrax" was first shown to the public, and give a fair indication of the interest the machine aroused*

The outcome of several years' intensive research by David Brown engineers, the Hydrax machine has several revolutionary features, many of which have been patented. It has a fully automatic cutting cycle operated by a single push button; feeds are hydraulically controlled and steplessly variable; and rates up to ⅛ in. per revolution of the work can be obtained without exceeding the limits of accuracy required for subsequent shaving operations. Its high cutting speeds are achieved by means of a cutting principle which permits a shorter hob travel than is possible in conventional machines.

Contrary to normal practice, the work axis is inclined to the direction of hob feed at the helix angle of the gear and the hob slide is set to the worm angle of the hob. When cutting, the hob is traversed in a vertical direction along the helical tooth and the Hydrax method involves a considerably shorter hob travel than is necessary in more conventional cutting action. The minimum

*Main features of the HYDRAX are seen in views from the near and off-side respectively.*



hob traverse is given by plunge-feeding the hob to depth.

Among other features of the Hydrax cutting action is an apparent displacement which may be described as "relative hob shift". When cutting helical gears, the point of first contact on the hob is some distance from the point where contact ceases. This shift, which varies according to the helix angle and facewidth of the gear, takes place automatically and is due to the contact moving along the hob as the hob feeds through the work. A hand-operated hob-shifting mechanism is incorporated so that hob wear can be uniformly distributed when gears of small helix angles are cut.

Maximum hob speeds are well in excess of normal requirements for single and multi-start high speed steel hobs, and are sufficiently high to permit the use of tungsten-carbide cutters. A quick-acting clamping device fitted in the work spindle simplifies loading and unloading and both operations are controlled by a single lever. Since the hob slide is nearly always horizontal, removal of the hob is also easily performed.

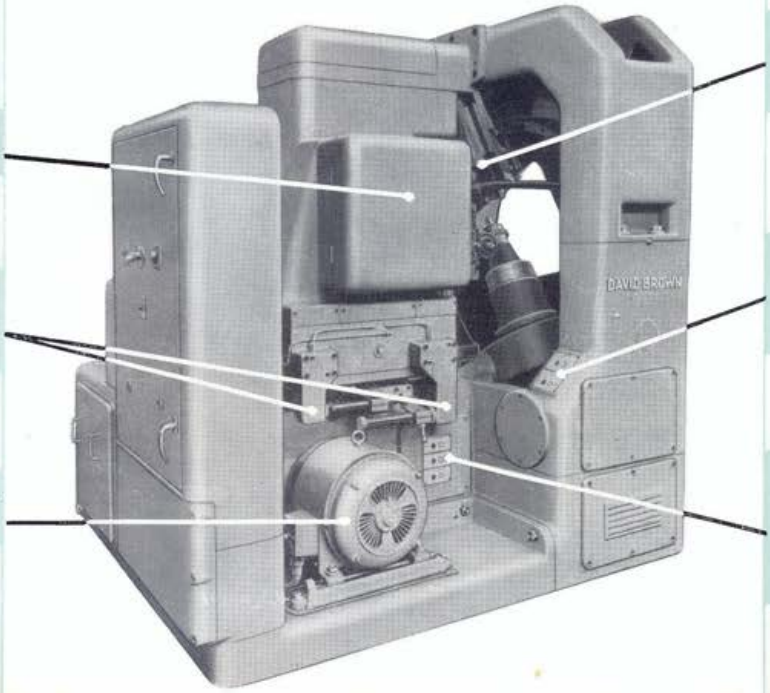
Lead cams or differentials are not required for spiralling, and the use of simple hob and table drives employing a minimum of gears prevents the multiplication of small errors. To ensure that the hob and work are maintained in the same relative positions during cutting, the column is clamped to the bed and the over-arm support by hydraulic pressure.

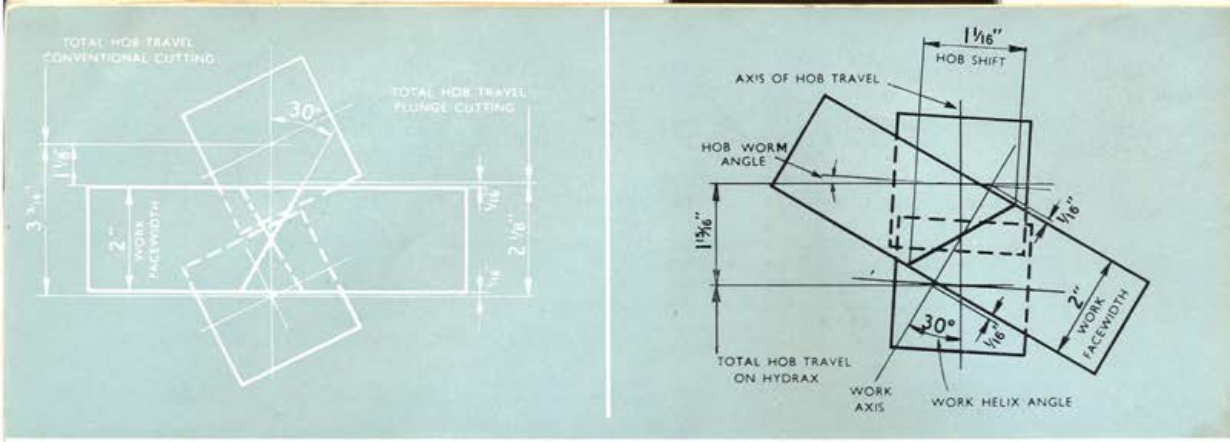
Hobs up to 7 in. diameter and 7 in. width can be used and the hob spindle runs at speeds ranging from 84 to 600 r.p.m. Worm gears are used for the final drive to the spindle and angular adjustments can be made to eliminate excessive backlash. Since the same change gears are used for both hob speeds and indexing, the range of hob speeds is extensive.

Inclination of the hob slide is equivalent to the worm angle of the hob; since this is small, setting can be done rapidly. The angle of the hob slide is indicated on a vernier scale.

Initiated by the pressing of a single push button, the sequence of automatic cutting operations begins with the setting in motion of the main and coolant pump motors. At the same time the revolving centre is fed into the work arbor under hydraulic pressure, which is uniformly maintained during cutting. Next the column plunge-feeds the hob to depth and is then clamped in the cutting position. After the hob has been fed in a vertical direction through the work, the column is again unclamped and traverses away from the work. Finally, the motors stop, the centre withdraws from the work arbor and the hob slide returns to its initial position.

All the various machine motions can be controlled independently by hand for setting purposes, and the hand-operated mechanisms are disconnected once the automatic cycle is introduced. Adjustable stops govern the column infeed and hob slide traverse. The final setting of the work spindle is performed by hand through gearing which causes angular movement of the cradle equivalent to one minute for each revolution of the dial. A power drive can be brought into action when any appreciable change of angle is required.






*These diagrams indicate the reduction in hob slide traverse on the HYDRAX compared with conventional hobbing for a gear 7 in. diameter, 2 in. facewidth and 10 D.P. The hob is 2¾ in. diameter and 2¾ in. facewidth.*

Should the main motor become overloaded during cutting, the feed is discontinued and the hob returns to the start position.

To eliminate undue backlash in the final drive to the work spindle, the worm wheel, like the corresponding wheel in the hob-spindle drive, is split at right angles to its axis. This allows an angular adjustment of one half relative to the other. The dividing worm wheel is made larger in diameter than the largest blank for which the machine is designed and in this way pitch errors in the gears to be cut are minimised.

Gear blanks are clamped in position by a strong helical spring capable of providing a maximum load of 15 tons. It is housed in a spindle and is compressed by hydraulic pressure to release the work. The hydraulic system also controls the movement of the hob slide and the rotating centre. Electrical interlocks prevent the machine operating with the work unclamped. Power is provided by four electric motors arranged so that only rotation of the work spindle can take place before the pump motor is started.

The Hydrax machine is capable of cutting spur gears up to 10 in. facewidth and 14 in. diameter with a 3 in. diameter hob, and gears up to 10 in. diameter with a 7 in. diameter hob. Thirty degree helical gears with a maximum facewidth of 3 in. and up to 14 in. diameter can be cut with a 3 in. diameter hob, and up to 10 in. diameter and 9 in. facewidth with a 7 in. hob. The machine takes hobs from 2½ in. to 7 in. diameter and the maximum pitch is 3 D.P. Plunge and vertical feeds from 1/16 in. to 5 in. can be obtained.

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FROM the same works comes an announcement that a 216 in. turbine gear hobbing machine, the largest of this type so far built by the David Brown organisation, has been despatched to the Ansaldo Shipbuilding Works, Genoa, where it is to be installed in a new temperature-controlled machine shop.

Built to B.S.I. specification No. 1498/1948, Grade "A", the 216 in. machine weighs about 105 tons and is designed to produce turbine wheels from 90 in. to 216 in. diameter with a maximum pitch of 1½ D.P. It has a vertical hob slide traverse of 106 in. at speeds ranging from 0.010 in. to 0.106 in. per revolution of the table. Maximum centre distance from hob to table is 115 in., the table being 174 in. diameter with a 42 in. bore. Hob speeds from 15 to 60 r.p.m. are available and the power infeed is 0.036 in. per revolution of the table.

Two independent dividing worm wheels are incorporated in the table drive; one is a fine pitch master wheel, which is used to apply the finishing cut and the other is a coarse pitch wheel, used principally for roughing. The latter wheel is also used for setting up and can be coupled to an independent motor when it is required to rotate the table at a relatively fast rate.

It is impossible to engage both wheels simultaneously, since electric interlocks prevent the starting of the independent table motor when the fine pitch master worm wheel is engaged.

The master worm wheel has 950 fine pitch teeth of special proportions giving the maximum number of teeth in continuous engagement with the mating worm to ensure accuracy of division and surface finish of the finished gear. This master wheel is split at right angles to its axis and through the

centre of the teeth. One half of the wheel is rotated relative to the other between semi-finishing cuts and, by a process of measuring and further cutting, greater adjacent and accumulative accuracy of pitch is achieved. Vertical travel of the hob is effected by a large lead screw, mounted centrally between guideways which are relatively narrow to give increased precision. This lead screw was finished on the makers' master screw-cutting lathe to limits of accuracy demanded by the B.S.I. specification and certified by the National Physical Laboratory.

Adjustment of this screw is by means of two nuts, one of which is fixed and the other adjustable. A large seating on the hob saddle locates the hob slide, which can be swivelled through 180 degrees to accommodate right or left hand helical teeth. This swivelling motion is power-operated.

The hob driving spindle, on which is mounted the flywheel, is located in the final driving gear by multiple splines. A conical bearing at the front end of the spindle, designed to facilitate the accurate alignment of hob and spindle, has axial adjustment, by which any errors due to excessive clearance can be quickly rectified. When centralising the hob, axial adjustment is made by means of a rack and pinion in the bracket which carries the conical bearing.

Movement of the upright along the bed of the machine is normally power-controlled, but hand-operation is also possible by means of a large screw and reduction gearing. Recesses are provided in the upright guideways into which oil can be pumped under pressure to relieve the load, thereby permitting free and precise traverse of the upright by hand.

Because of the wide range of gears within its cutting capacity the 216 in. machine is designed so that part of the load on the table is counter-balanced by hydraulic pressure. The pressure can be adjusted to suit individual gears and enables a constant bearing pressure to be maintained irrespective of the gear weight.

A main gearbox, incorporating the change gears for the feed, spiralling, indexing, and prime mechanisms, is situated at one side of the machine, whilst hob speed change gears are housed separately at the opposite side.

Oil is supplied to the table unit by two 1 h.p. gear pump motors mounted in tandem. One pump supplies oil to the table load relief, whilst the other feeds lubricating oil to the two sets of dividing gears and the main gearbox. The gears and bearings in the hob slide are automatically and continuously lubricated. A third gear pump is used to circulate cutting oil.

Eight motors are used to provide power for the main drive, hob slide traverse, upright traverse, rapid traverse of the table, lubricating and coolant pumps. The two latter drives are duplicated, the standby motors being brought into action automatically in case of failure of the primary motors.

As an additional precaution the 10/20 h.p. variable speed main motor and 1 h.p. lubricant and coolant pump motors are arranged for D.C. supply so that, in case of a power failure, the drive can be switched to a secondary source, such as a battery set, to ensure uninterrupted cutting. The hob slide and upright traverse motors are arranged for A.C. supply and are fitted with limit switches to prevent overrun.


*The 216 in. hobbing machine being tested at the works of David Brown Machine Tools Ltd.*


AN addition to the range of "Coventry" geared motors has recently been made by The Coventry Gear Company. Known as the $1\frac{5}{8}$ model, the new unit, which is available in either double or triple reduction form, has an exceptionally wide range of application. Typical uses are drives for conveyors, small compressors, pumps, hoists, dryers, agitators, strainers, fans, textile machinery, and numerous other industrial purposes where individual drives are advantageous.

Coventry stock motors of the protected and totally enclosed type operate at a fully loaded speed of approximately 1425 r.p.m., but other makes and types of motors can be fitted in most cases if specially requested by the customer. A choice of 17 output speeds, ranging from 25 to 345 r.p.m., is available, with an equivalent variation of input powers from 0.16 h.p. to 0.75 h.p

Extremely versatile in application, the motors can be mounted in any of six operating positions. Moreover, lubrication, oil level inspection, draining and refilling can be carried out without difficulty in any of these positions.

As the gear units and motors are integral, the units are as simple to install as electric motors. Also, since their total height is very little greater than that of motors alone, they are particularly suitable for installation in confined spaces. Weight (excluding motor) of the double reduction unit is 21 lb., and the triple reduction version 23 lb.

The gear units are also available without motors. In such cases, the motor adaptors are replaced by modified covers, and the input and output shafts are co-axial.

All reduction gears in the unit are precision cut in high tensile steel. The first reduction gears are of the single helical type, while second and third reductions are spur gears.

The case is a one-piece iron casting, faced at each end to receive the end cover, motor adaptor and gear assembly, and incorporates a combined filling and ventilating plug, drain plug and oil level indicators. The end cover and adaptor have oil-tight and dust-proof joints, and an oil seal is provided in the output shaft cover.

The gears are splash-lubricated and the internal arrangement ensures an adequate flow of oil to each bearing. When vertical mounting of the unit is specified a screw pump is incorporated to provide a positive oil feed to the top bearing and gears.

Other units in the "Coventry" geared motor range are the Size 2 (0.5 to 2.00 h.p.) and the Size 3 (0.75 to 5 h.p.).

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IN introducing the new $2\frac{1}{4}$ "Radicon" worm reducer, David Brown Gears (London) Ltd. have added to the existing range a unit capable of transmitting from 0.20 to 3.55 h.p. With the well known features of the $1\frac{1}{8}$ and $1\frac{5}{8}$ sizes, the new unit is the largest in the range.

An important feature is its versatility; having detachable feet, it will operate in any one of 24 mounting positions. An extensive choice of ratios is offered, ranging from 5.25:1 to 60:1.

Typical examples of the application of these units include small pumps, laundry equipment, electrical controllers, shutter operation, small machine tools, conveyors, food-preparing machinery, stirrers, agitators, etc.

# Aspects of Industrial Gear Drives

by F. J. EVEREST, M.Sc., A.C.G.I., D.I.C., M.I.Mech.E., A.M.I.E.E. M.I.Prod.E., A.I.Mar.E.

**When asked by the Institution of Mechanical Engineers, to give a lecture on the occasion of their visit to Park Works several months ago, I decided that, since most of the aspects of gearing design and manufacture have been fully covered in recent years, I would tread a less hackneyed path and deal with some of the problems involved in the operation of gearing in service.**

**In choosing the title "Aspects of Industrial Gear Drives" it was intended to cover marine, road and rail transport, as well as applications in general industry.**

**Prepared from a recording of the actual lecture, this written account has been somewhat abbreviated to meet CONTACT'S requirements and only one-third of the original illustrations are reproduced.**

IT cannot be stressed too strongly that, if gears are to function satisfactorily, the skill and craftsmanship embodied in their design and manufacture must be matched by equal care and attention to the fundamentals of correct installation and maintenance. The purpose of this lecture is to outline some of the essential conditions to be met, and some of the pitfalls which must be avoided.

Most gears are today manufactured to very fine limits of accuracy as regards tooth shape and dimensions, concentricity, etc., and permissible errors are quoted in ten-thousandths-of-an-inch in the highest quality gearing. It is sometimes overlooked, however, particularly by the ultimate user, that such accuracy is of no avail unless the alignment between mating gears is equally accurate and maintained so throughout the life of the gears. Hence, the mounting arrangements must be sufficiently rigid to prevent undue deflection under load, and the wear of bearings, which would result in malalignment, must be avoided.

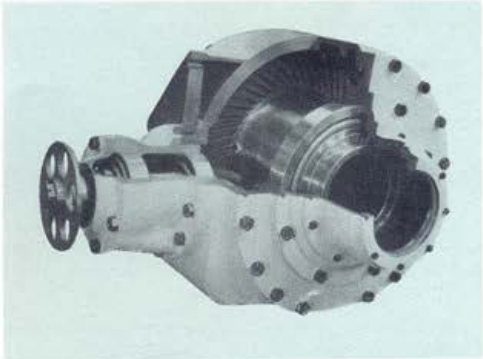
Many examples could be quoted to illustrate how the neglect of this simple truth has resulted in failure. For instance, it has been a practice for many years in electric tramcar and railcar drives for the motor to be slung parallel to the axle, and for a spur pinion on the motor shaft to mesh with a spur gear wheel on the driving axle. Often these shafts were mounted in plain bearings, and bearing wear, amounting to a sixteenth-of-an-inch, and more, has been permitted in operation. This state of affairs has resulted in misalignment and consequently in faulty meshing of the gears.

As an instance, on a traction gear wheel which had failed by tooth fracture owing to this cause, it was noted that the contact area extended over little more than one-third of the gear facewidth. The gear manufacturer has sometimes been able to offset this effect by angling off the heavily loaded portion of the gear teeth, but this is a poor compromise, and the real answer is to use ball and roller bearings.

The growing appreciation of the importance of rigidity and proper bearing arrangements has been one of the reasons leading to the adoption, for this application, of the totally-enclosed hypoid axle unit shown in Fig. 1.

This unit is one of over four hundred recently built at Park Works for the new Toronto Subway, opened at the end of March, and it will be observed that the gears are encased in a rigid fabricated steel case with taper roller bearings.

*Fig. 1 One of over four hundred hypoid axle units built at Park Works for the new Toronto subway.*



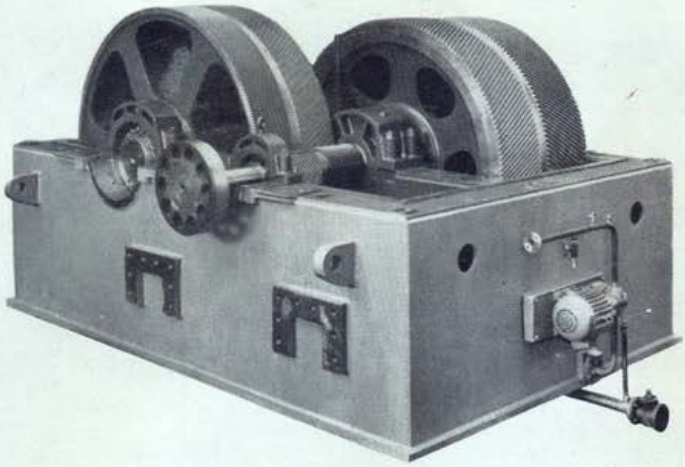


*Fig. 2*
*The construction of this gear unit, intended for a cement mill drive, gives maximum rigidity with reasonable weight.*

## Minimum Deflection

The deflection on the gears as measured in the laboratory was only one-fifth of that normally to be expected from an automobile axle unit, thus demonstrating the extreme rigidity in this modern application of rail traction, and the wisdom of entrusting to the gear manufacturer the responsibility for mounting and encasing the gears.

Another application where similar remarks apply is in drives for cement mills, which are probably one of the most arduous industrial drives that a gear designer has to face. The duty is very heavy and continuous, and a life of 15 to 20 years is required, while at the same time it is expected that cost, size, and weight be kept to reasonable proportions.

Fig. 2 shows one of several alternative modern designs for this heavy duty. The fabricated steel case is of double-wall, box-section construction, giving maximum rigidity consistent with reasonable weight. The bearings are of self-aligning, double row, roller type, which, together with the rigid case, maintain correct meshing in the precision-cut gears.

The gear case has a fabricated sheet steel cover which can be readily removed for maintenance purposes without interfering in any way with the alignment of the gears.

The trend in naval gearing is towards considerably smaller and lighter main propulsion units, and a prototype unit was recently developed and manufactured at Park Works for a new class of warship.

The specifications called for a very considerable decrease in weight and size as compared with the best past practice, and for a corresponding increase in gear loadings and stress on the gearcase. This represented a very difficult problem, but, by skilful design, a fabricated case was developed, giving maximum rigidity with minimum weight. All metal was cut away where this was not contributing to the general stiffness.

The rigidity of the case would be impossible to calculate, so a small-scale plastic model was made for test purposes, as shown in Fig. 3, and this also served a useful purpose in guiding the Welding Shop in fabricating the cases.

The substantial increase in gear loading demanded by the Admiralty made it imperative that, under load, the whole of the gear tooth flanks should be in proper mesh. The gearcase had, therefore, not only to be bored so accurately that the shafts were perfectly aligned, but had to be sufficiently stiff in itself to be unaffected by the twisting of the ship's hull structure in a rough sea.

## The Key to Lubrication

The next problem, of equal importance to satisfactory gear operation, is correct lubrication. The correct grade of lubricant will depend on the type of gear and the peripheral speed of the gear teeth. Generally speaking, a straight mineral oil is best for industrial gears, the viscosity being fairly heavy for slow-running gears, and successively lighter for higher speeds.

There are a few applications, such as hypoid rear axle gears, where an Extreme Pressure lubricant is necessary, owing to the heavy tooth loading and high relative sliding. E.P. oils are

also sometimes useful for the running-in of helical gears, where there is a tendency to initial scuffing.

The key to successful lubrication lies in ensuring that the correct lubricant gets to the right places in the right way, and in a totally-enclosed unit this will involve both the gears and the bearings. The well-known "Radicon" worm reduction unit follows the best practice in engineering design by providing the simplest solution to the lubrication problem, the method being as illustrated in Fig. 4 by means of a unit built with a transparent plastic case.

In this unit the sump is filled with oil to a level just below the centre line of the wormshaft, and thus, when the worm begins to revolve, it carries oil around with it and up into the meshing point with the wheel. The wheel in turn carries oil around until it is scraped from the side surfaces of the wormwheel by special sheet metal scrapers. These direct the oil into troughs cast inside the case wall in which it flows to the wheelshaft bearings. Hence a continuous circulation of oil is obtained without any additional moving parts other than the two gears and shafts.

As the speed increases some of the oil is flung off the wheel and flows down the case walls, where cooling automatically takes place, and this is generally assisted by the fitting of a fan on the wormshaft. The higher the speed, the greater is the heat generated, the amount of oil being circulated, and the overall cooling effect.

The same principles generally apply in rear axle, spiral bevel, hypoid, and worm gear units. In industrial drives, where higher powers and speeds are reached, excessive churning of the oil has to be avoided, and the gears do not dip but are lubricated by means of a small oil pump.

In the case of high-speed turbine gear units, the same principles apply, and oil is pumped through pipes and spray nozzles, which direct a fine fan-shaped spray directly onto the point of mesh. Oil is similarly fed to the plain bearings, and, in units of modern design, as much as possible of the pipework is contained inside the gear unit.

## External Effects on Gears

Having dealt with conditions inside the gear unit, attention should now be called to certain factors external to the unit which can have a serious effect on the operation of the gears. Only too often overloads, not visualised at the design stage, are imposed on the gears in the form of shock loading or cyclic torsional oscillations.

In most industrial drives the gears may be protected from shock loads by fitting couplings, such as the Cone Ring type, which provide the necessary resilience and damping. In some applications, however, accidental stalling of the equipment occurs occasionally, and this necessitates the use of hydraulic couplings or other protective devices.

The installation shown in Fig. 5 is a 300 h.p.

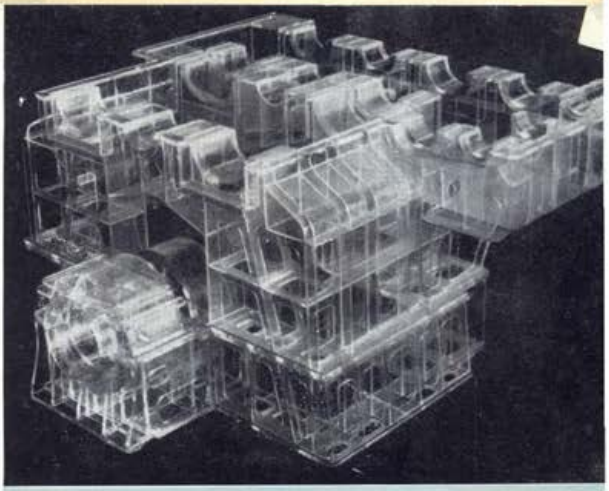


*Fig. 3 This plastic model of a marine main propulsion unit of the latest design was built to assess the rigidity of the gear case.*

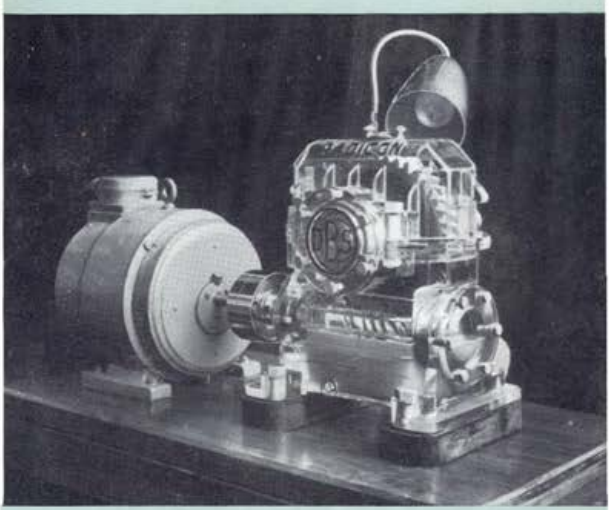
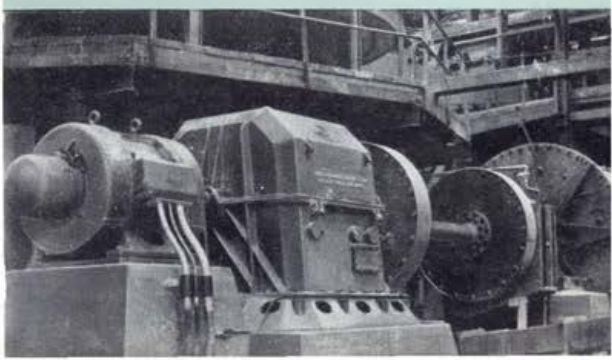
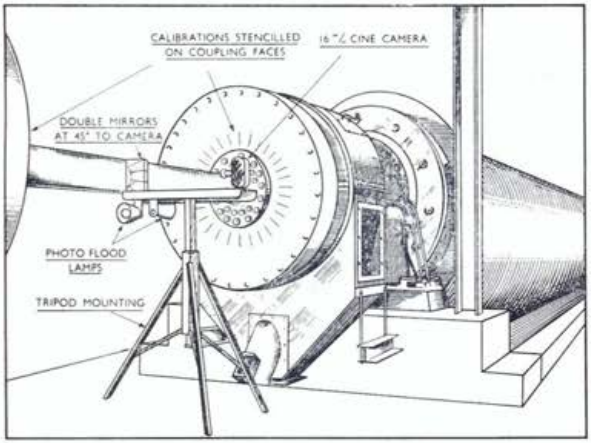


*Fig. 4 RADICON lubrication—the oil level can be seen just below the wormshaft centre line.*

*Fig. 5 A torsion shaft and diaphragm couplings in a cement mill drive protect the gear unit against shock loading.*





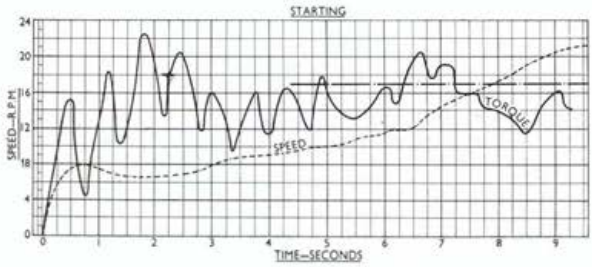




*Fig. 6 Arrangement of equipment for torque tests in an 800 h.p. ball mill drive; Fig. 7 The results recorded by the apparatus.*

drive to a cement ball mill, in which the gear unit is protected against shock loading by means of a ten-foot torsion shaft. This has a diaphragm coupling fitted at each end, and these permit slight misalignment between the gear unit and the mill, which might arise from unequal settling of the concrete foundations.

Whenever flexibility is introduced into a drive, however, there is always a danger of the natural critical frequency of oscillation of the driven end of the equipment relative to the driver coinciding with some exciting frequency in the drive. Should this occur, dangerous cyclic torque variations can arise.

Cement mill drives are particularly arduous and have been the subject of careful investigation in recent years. In Fig. 6 is illustrated an experimental set-up used for analysing the variations of torque in an 800 h.p. ball mill drive. Two sets of marks were made on the inner faces of the diaphragm couplings and midway between these a pair of mirrors and a cine camera were mounted on a tripod.

With the driving torque at zero, the reflections of the two sets of marks were set exactly opposite each other, and when under load they became displaced due to the twist in the torsion shaft. By examination of films taken during acceleration and retardation, as well as at top speed, the variation of torque with time was readily plotted (Fig. 7).

The curves of acceleration and retardation clearly showed a tendency for the installation to oscillate at a frequency of 96 cycles per minute, which was in fact the calculated natural frequency. At top speed, torque fluctuations were erratic, and, as was expected, showed no tendency to build up sustained torsional oscillations, as the nearest possible exciting frequency was 118 cycles per minute, being the revolutions per minute of the gear unit intermediate shaft.

## Critical Oscillations

In driving long kilns for firing cement or other chemicals, it is customary to mount a girth gear wheel about half way along the kiln shell, the drive to the girth pinion being similar to that for the ball mill. There is a real danger in these plants of critical torsional oscillations occurring, as the coarse pitch girth gears can provide an exciting frequency of the same order as the natural frequency of the system.

This, in fact, did occur in one installation and the cement company welded a tube around the torsion shaft to reduce its flexibility, but the resultant shock loads nearly wrecked the drive. Slots were then cut in the tubes to restore the necessary degree of resilence, and finally the tubes were removed. As the exciting and natural frequencies coincide at about three-quarters of full speed, it is not safe to run the kilns at or near this speed and operators are warned accordingly.

Another interesting experience with a kiln drive occurred during the war, when an alumina kiln in Northern Ireland, after a few years' successful running, developed alarming vibrations and could not be run much above half speed. The loss of output was very serious, and lengthy tests and investigations by the manufacturers of the kiln and the electrical equipment failed to locate the cause. The problem was particularly baffiing since the frequency of the vibrations at 120 per minute did not coincide with the calculated critical frequency of 200 per minute.

The gear manufacturer was called in, and a preliminary examination showed the girth gears to be seriously worn and hammered, and the frequency of vibration coincided with the frequency of tooth contact of the girth gears.

In order to examine the motion of the kiln in more detail, a strip of linoleum was fixed at the side of the girth ring, and a small electric motor

mounted alongside, so that a revolving scriber fixed to the motor shaft made scratches in the linoleum at equal intervals of time. By measuring the distances between the scratches, it was possible to plot speed/time curves as shown in Fig. 8. At all speeds below 50 r.p.m., audible vibrations did not occur, but the motion of the kiln alternated between short periods of rapid acceleration followed by longer periods, when the kiln, having overrun the drive, coasted with the girth gears out of engagement until the drive was again taken up. Hence, instead of a uniform load being transmitted by the gearing, the drive took the form of short hammer blows during which the instantaneous load on the gearing was five times the normal.

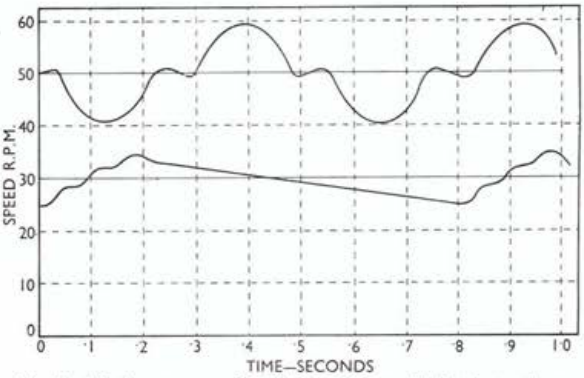



*Fig. 8 Motion curves of a girth gear on which the teeth were seriously worn.*

At 50 r.p.m. the whole character of the motion changed, and violent lashing of the girth gears occurred, accompanied by a terrifying hammering noise. The motion curve shows that the normal sinusoidal curve to be expected when torsional oscillations occur was, in fact, broken up into half cycles separated by intervals where the girth gears were coasting between the driving and reverse flanks.

The half cycles corresponded to the calculated critical frequency of 300 cycles per minute, but the effect of the excessive backlash in the girth gears, and clearance in the pinionshaft bearings, both due to wear, had reduced the effective natural frequency to 120 cycles per minute, which coincided with the girth gear tooth contact frequency at 50 r.p.m.

After correcting the worn tooth profiles, taking up backlash in the girth gears and clearance in the bearings, and providing better lubrication for the open gears, satisfactory running conditions were restored at all speeds.

One application in which torsional oscillations can be very serious is in marine main propulsion. The inertia of the propeller at the end of a long flexible propeller shaft provides a system very easily excited to torsional oscillations. Excitation may arise from the propeller blades passing the stern post, reciprocating bilge pumps connected to the main drive, and Diesel or other reciprocating prime mover.

Cases have been experienced where all of these factors have resulted in critical oscillations within the normal speed range. In one recent installation, five criticals were met, and the gear unit was wrenched from its bearers.

In all such installations the problem can be solved by the introduction of hydraulic or magnetic couplings in the drive.

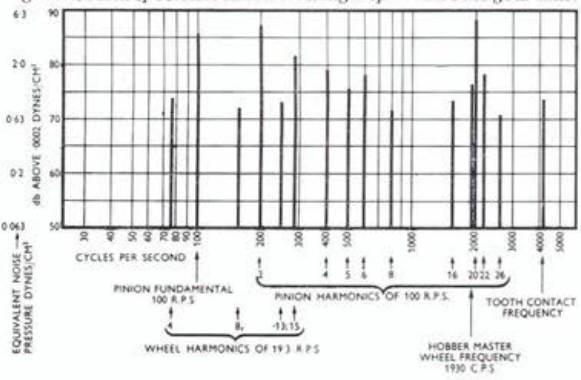
## Scientific Analysis of Sound

Another problem which occasionally arises is that of noise. Noise, however, is relative, and an acceptable level in one application might be totally unacceptable in another. Generally speaking, a high degree of quietness is expected from gear units for automobile and railcar drives, passenger lifts, high-speed marine and turbine drives, and similar applications.

Where trouble is experienced with noise, the cause is not always immediately obvious, and it is sometimes necessary to resort to scientific methods of noise analysis. From the spectrum of sound frequencies, it is usually a simple matter to identify the major components, and trace their origin.

Fig. 9 illustrates a typical sound spectrum taken some years ago on an offending turbine reduction unit. It will be observed that the main components in order of importance are the frequency associated with the hobbing machine master wheel, the pinion speed fundamental and harmonics, the gear tooth contact frequency, and harmonics of the wheel speed.

*Fig. 9 Sound spectrum taken on a high-speed turbine gear unit.*



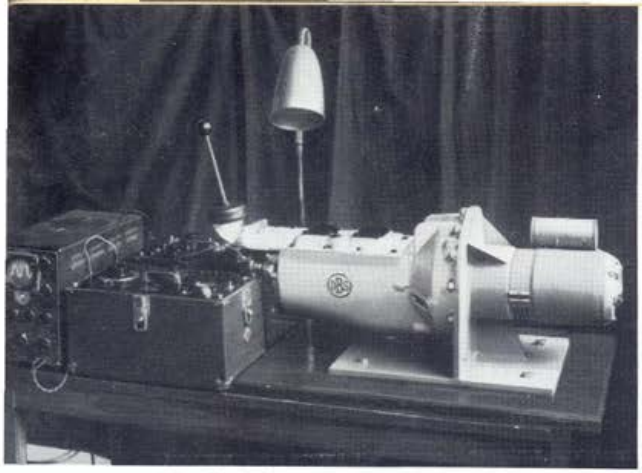


*Fig. 10 The equipment constructed in the laboratory at Park Works to illustrate the the principle of sound analysis.*

Tests of this kind have shown the way to the attainment of very considerably quieter gears. Hobbing machines are now available with fine pitch and extremely accurate master wheels; the accuracy of gear tooth profile and pitch has been much improved in recent years, while the concentricity and balance of the gears now receive adequate attention.

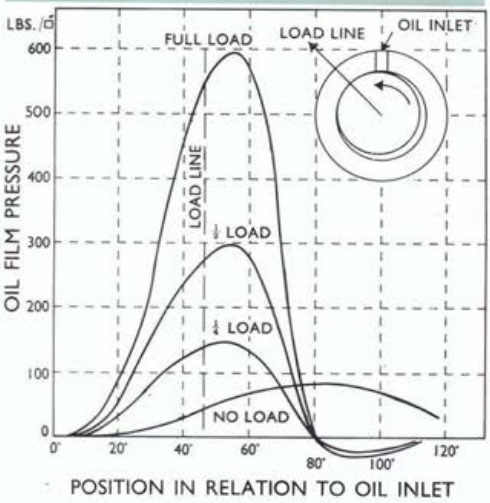
In Fig. 10 is shown equipment used to illustrate the principle of sound analysis. A constant mesh automobile gearbox is run close to a microphone and sound analyser, to which is connected a cathode ray oscilloscope. By manipulation of the tuning controls, it is easy to demonstrate how individual frequencies may be isolated from the jumble of sounds emitted from gears, bearings, and case.

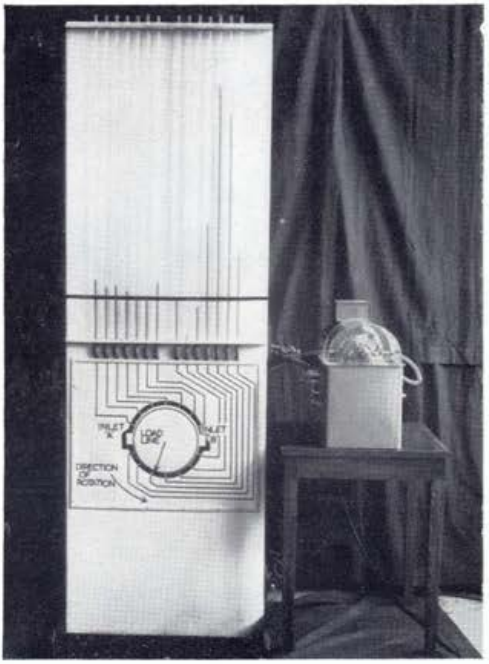
Reverting to the sound spectrum for the turbine gear unit shown in Fig. 9, it will be noted that prominent peaks correspond to the pinion revolutions per second, and the corresponding second harmonic. This might result from eccentricity or lack of balance, but it could also derive from bearing instability, and this is a problem which has received much attention recently in connection with high-speed plain bearings.

The diagram in Fig. 11 illustrates a journal lying in its normal working position in a plain bearing. The oil inlet lies slightly ahead of the load line at a point where the annular space is converging. The revolving shaft drags the oil into this wedge-shaped space, and, although the oil pressure at the inlet is normally about 12 lb./sq. in., the hydrodynamic pressure at the load line may be well over 500 lb./sq. in. Typical curves of oil distribution are also shown in the same figure.

It is interesting to observe that, after passing the load line, the annular space diverges, resulting in a rapid fall in pressure until a zone of partial

*Fig. 11 (below) A diagram showing oil pressures at various points around a plain bearing.*
*Fig. 12 (right) The previous diagram demonstrated by practical equipment.*



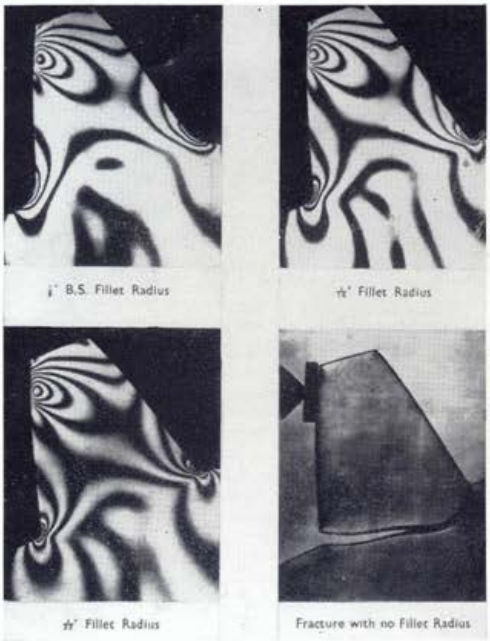



*Fig. 13 Effect of fillet radius on stress concentration.*

vacuum is reached. This absence of oil around the unloaded half of the bearing is undesirable, and sometimes a condition of instability arises, with the shaft oscillating rapidly between the loaded and unloaded halves of the bearing, resulting in noise and damage to the unloaded half of the bearing.

A solution to this problem has been found in providing a second oil inlet diametrically opposite the first, whereby oil is fed into the unloaded half to provide a cushion of oil at substantially atmospheric pressure.

The equipment shown in Fig. 12 was constructed to demonstrate this process, and comprises a shaft revolving in a plastic bearing. Around the periphery of the bearing shell have been drilled a number of holes connected to a row of manometer tubes. By supplying oil initially to the main inlet, and then to the auxiliary inlet, the build up of hydrodynamic pressure around the bearing is easily demonstrated.

Another experimental technique which gives an insight into the stresses and strains in gear teeth involves the use of polarised light in conjunction with plastic transparent gears, to give a visual photo-elastic picture.

Typical stress pictures are shown in Fig. 13, where the effect of varying the fillet radius and the advantage of the full British Standard fillet are demonstrated. These diagrams may be likened to the familiar meteorological charts, in which close grouping of lines indicates areas of severe tress.

This photo-elastic technique can be applied to the study of gears in motion, by means of the equipment illustrated in Fig. 14. By observation of the projected image on the screen, the pattern of ever-changing stress can be followed, and of particular interest is the sudden change in stress distribution which arises from the reversal of direction of sliding when the point of contact passes from the arc of approach to the arc of recess at the pitch line.

Such are the stresses and strains in the simplest of gear drives, but how much worse are these if undue malalignment, shock loading, torsional oscillations, or other adverse factors, are permitted!

Gear drives can be, and usually are, at least as reliable as any other mechanical equipment, but they sometimes suffer from, and receive the blame for, faulty conditions of operation. It is important therefore that care is taken to see that adverse conditions, not specified or allowed for in the design stage, should not be permitted to arise in practice.

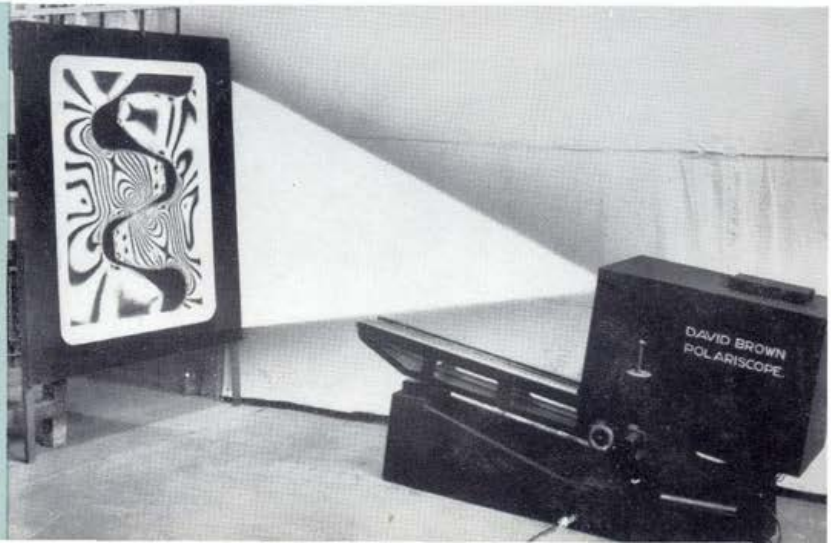



*Fig. 14*
*The closely grouped lines projected by the David Brown Polariscope indicate area of dynamic stress in gears in motion.*


# The Art of the Foundryman

PETER ROTHWELL JACKSON was a pioneer foundryman, and the firm of P. R. Jackson Ltd., which he founded at Hampson Street, Salford in 1840, soon became known through men of initiative who used new techniques and introduced methods which were later to become accepted as general foundry practice. With the foundry facilities was soon allied machinery for cutting large gears, and by the latter years of the nineteenth century the firm had become established as suppliers of heavy gears in either iron or steel, of their own manufacture entirely.

In 1930, P. R. Jackson Ltd. became associated with David Brown and Sons (Huddersfield) Ltd., the Salford firm becoming David Brown-Jackson Ltd. The ties became even closer with the linking in 1951 of The David Brown Foundries Company and David Brown-Jackson Ltd. to form The David Brown Foundries Group. Manufacturer and client benefit by this alliance for research facilities and results are available to be applied throughout the group.

In 1954, a foundry still depends largely on its technicians and the skill of the true craftsman at every stage, and as David Brown-Jackson Ltd. can claim to have such men in their ranks today the reputation for quality is maintained. Only a few months ago, the company received an order for a particularly large pair of gears for the Shotton (Chester) rolling mills of John Summers & Sons Ltd. The wheel, and the mating forged pinion which David Brown-Jackson Ltd. were also asked to manufacture, were required as the reduction gearing between a 5000 h.p. slab mill and the pinion stand of a 45 inch slabbing mill. This primary mill rolls ingots up to 12 tons weight to slabs between four and five inches thick, and these slabs in turn form the raw material for a 60 inch hot-strip mill. As a breakdown had occurred, quick delivery was essential.

The casting of 37 tons represented the largest ever made at Salford works and necessitated running the two open hearth furnaces in parallel, bringing both to the pouring position at the same time in order to give the correct carbon content.

Employees who had any part in the making of this gear were naturally proud of their association, none more so than 20-year-old apprentice patternmaker Roy Booth, who was one of those who put in extra hours to help speed delivery. The job left the works as an announcement was posted on the notice board inviting entries from apprentices for an essay competition run by the Institute of British Foundrymen and open to any young foundry workers in the county of Lancashire. The subject had to be some aspect of foundry work, and with the details of the large double helical gear still in his mind Roy decided to set down his knowledge of this particular job.

As *NEWSLETTER* has already recorded, that essay won for Roy the "John Wilkinson" medal and a monetary award, having been adjudged the best entry from the county.

John Wilkinson lived at the beginning of the nineteenth century and was one of the first ironfounders in Great Britain. He had interests in a number of industrial undertakings in the North-west, including those at Lindale-in-Furness (Lancs.) and his own iron works at Bersham (near (Chester). Authorities have attributed to John Wilkinson the invention of the cupola. He was connected with the building of an iron bridge across the Severn, and supplied castings to Boulton and Watt, the pioneer makers of steam engines.

Among his most notable inventions was a mill for accurately boring the inside walls of cylinders.

Mr. J. S. G. Primrose (a staunch member of the Lancashire Branch of the Institute of British Foundrymen) was responsible for the instigation of the "John Wilkinson" medal some thirty years ago. Commemorating the work of a true pioneer, the medal is a replica of one of the tokens which John Wilkinson and many other employers issued to their workmen in those days instead of paying them in ordinary currency.

At the time he received the medal from Mr. F. A. Harper (President of the Lancashire Branch of the Institute of British Foundrymen) at a meeting held at the Engineers' Club, Albert Square, Manchester, Roy was asked to read his paper to the 70 members present.

Since he joined David Brown-Jackson Ltd. on leaving school five-and-a-half years ago, the foundry has been Roy Booth's work and hobby. Technical College studies have occupied one day

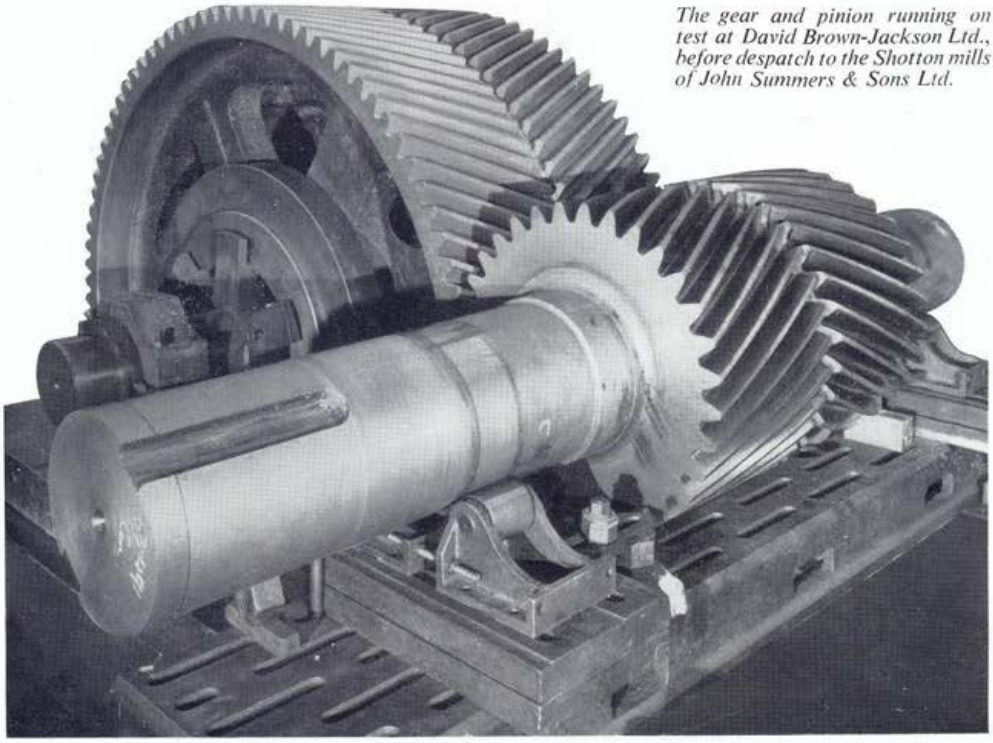
a week and as many as three or four evenings, and Roy now holds City and Guilds final certificates in both patternmaking and foundry work.

## The Casting Stage by Stage

Setting out to cover the progress of the job up to machining—for the full facilities of the works were also called upon to cut the double helical teeth of the cast wheel and the forged mating pinion—Roy wrote his description in the following terms: "The cast weight of the gear (including heads) was 725 cwt. and the estimated weight of the casting alone was 475 cwt. Metal used was David Brown carbon steel (40-45% carbon, 65.5% yield). The biggest problem was the melting of this large amount of metal, with only two furnaces of the gas-burning type of open hearth available to give a total capacity of 41 tons.

"With an outside diameter of 9 ft. and a face-width of 4 ft., this casting has a centre bore of 26 inches diameter, keywayed in two places. Thickness of metal varies between 11 inches and 4¼ inches. Owing to the great difference in these thicknesses, the bottom of the boss and rim was chilled, for a clear sound casting was required at the rim owing to the double helical teeth having to be machined afterwards. Machining allowances determined by the Methods and Pattern Shop were ⅞ in. on the rim and on the bottom of the boss, and 1½ in. on the topside of the boss. Before starting, a great deal of planning was needed as to methods of running and feeding, equipment required in the way of boxes, and tackle for the making of the mould. Coreboxes and pattern tackle were supplied by the firm's own pattern shop, which specialises in this type of work. Consultations with the moulders and coremakers were advisable owing to the size and design of the casting, and it was decided that the job should be made in a 10 ft. 6 in. box so that it could be made on a cylindrical moulding machine.

"Before starting the mould, the 10 ft. 6 in. box had to be fitted with lugs for holding down girders to secure the head boxes in position on the top part. After this had been done, the box was excavated to the correct depth and centred on a cylindrical moulding machine, then the mould was commenced by striking a level bed with a strickle from a spindle centre. The depth of the bed from the joint on top of the drag was set by an arm fastened to the strickle. In making the bed, a horngate runner was put in, setting the silica



*The gear and pinion running on test at David Brown-Jackson Ltd., before despatch to the Shotton mills of John Summers & Sons Ltd.*

firebrick pots underneath the bed in three places, two ingates coming into the boss and the other coming into the mould on the rim.

"The next thing to do was to ram up the face diameter by using a segment block pattern on a cylindrical moulding machine.

"Removal of the core from the box was quite quickly achieved by unbolting the back of the box and drawing the back and sides in opposite directions. Thus the core was left free, standing on the bottom flange. Filleting, finishing and removing of loose pieces (flanges, ribs, key-bosses, etc.) was carried out, and the finishing core was painted with a Zircon wash before removal to the drying stove. Six of these arm cores were made as well as three boss-splitting cores, a centre core and six covering cores. Apart from the centre core which was made in tubes, all were made in boxes constructed in the patttern shop.

## Closing and Preparing for Casting

"Before commencing coring, the mould was placed in a pit three feet deep in order that the height of the finished closed mould would allow sufficient headroom for pouring the ladle from the crane. Coring began by setting six arm cores with the aid of two pieces the thickness of the rim. The diameter of the boss at the nose of the arm cores was checked to ensure correct metal thickness, and in the course of setting, every alternate core had a boss-splitting core set in the nose by means of a print. Next to be set was the centre core, resting in a print on the bed, centred with calipers, and held with the aid of studs from the noses of the arm cores.

"There then remained only the covering core to be set. These rested on the pieces of the arm cores which formed the flange panel holes, the back end of these cores on top of the sand forming the outside diameter. Metal thickness underneath these cores were set with calipers on the sides and down the heads. With the covering cores set the top of the mould, was complete apart from a boss head ring and six rim heads through the covering cores. The depth of the heads was increased with a 4 ft. diameter ring rammed up to the diameter of the centre ring head, and also with six 2 ft. diameter rings lined with two inches of sand to form 20 in. diameter heads.

"Then came the extension of the runners, two at 3 ft. 1 in. centres for the use of a double nozzle ladle, and the other, a lander, having to be extended approximately 10 ft. past the outside of the box to allow room for the two ladles and cranes (both on the same track).

"During this stage of forming the outside diameter, the runner pots are continued with a right-angle joint at the back of the mould face up to the top of the box. The mould was finished by trowel and filleting of the recesses before painting with a Zircon wash. Drying was effected by removing the mould from the machine into a large stove working on the same principle as the small Longdon pit driers, i.e., the back of the stove contains a coke fire, and the hot air is circulated from behind by a fan.

## Core Making

"Having prepared paper templates of the core boxes for core grids, work began on the actual making of arm cores. In each arm core there were two grids, one in the bottom flange panel carrying three staples for lifting, the other in the main body of the core holding mild steel prods. A layer of core sand was first put in the bottom of the box, then the first grid was placed in position on studs. Two or three bricks were set on top of this grid and the second grid was position on top of these. The grids were then wired together, forming a strong foundation around which to make the core, also for the lifting of the cores. The core was then continued, ramming sand two or three inches thick, following the outside shape and leaving a space in the middle to be filled with cinders. This procedure was continued to a few inches from the top of the box and the rest was then completely rammed up with core sand.

"When the furnaces were tapped the two ladles used were of 30 tons and 20 tons capacity respectively. From the largest of the two furnaces 27 tons were put in the large ladle, and the other was filled to 13 tons from the small furnace. Cranes lifted and positioned the ladles over the runner pots, the large double-nozzled ladle feeding two of the runners at the same time; the runner pots set in the mould were placed at 3 ft. 1 in. centres to correspond with the nozzles. The other ladle, a single nozzle, was run at the same time on the other side of the mould by means of a lander. The metal filled the mould and rose up the heads to a height of two or three inches from the top of the head boxes. Exothermic powder was spread on top of the metal in the heads, thus keeping the metal as hot as possible by stopping the cold atmosphere from chilling the heads which had to feed a big volume of metal. After the casting had solidified it was withdrawn from the mould, taken to the roughing shop and fettled.

"The foundry work on the job was then finished, but the gear had to be machined before being despatched from the works".

Cutting of the 102 teeth of 1 D.P. on the double helical wheel took three weeks, and whereas in the past end milling was the method of cutting large gears, this was hobbed on a machine of five metres capacity. The change of cutting method has in fact been evolved in comparatively recent years, resulting in greater accuracy and consequently smoother running. After the pinion had been cut, the pair were tested in running and were despatched exactly twelve weeks after the time of receiving the order.

*D.B.T. apprentice joiner Malcolm O'Grady and the water wheel designed and built to provide electricity for Wood Cottage Youth Hostel.*

# A Stream in Harness

YOUNG people from all parts of Britain know Wood Cottage Youth Hostel as an overnight refuge on Pennine walks. Three miles from Holmfirth on the main Wakefield-Manchester road, the hostel is in a difficult position so far as water and electricity supplies are concerned. The water problem was solved between 60 and 70 years ago by the installation of a hydraulic-ram pump from a small stream in the valley which slopes steeply behind the hostel. Some twenty years ago a new pump was installed, and the ingenious way in which the stream is made to provide power to pump a supply of water 100 yards up the hillside to storage tanks has always been admired by visitors.

How to provide electricity has been left to the present generation to decide, and 18-year-old Malcolm O'Grady, an apprentice joiner at the Meltham factory of David Brown Tractors (Engineering) Ltd., pondered the problem from the time his parents took over as wardens some four years ago. It occurred to him that the best way to harness the power available—the stream—and at the same time make the best use of his own trade knowledge was to construct a water wheel to drive a dynamo.

Timber presented no difficulty, and in August 1953 a large sycamore tree growing near the house was cut down and despatched for cutting by machinery to specifications which Malcolm had drawn up. Fellow-members of the Y.H.A. were intrigued with the plan and Malcolm soon found a band of willing helpers ready to give their time and energy to the scheme.

Having selected a point for the wheel, the first step was to build a dam some 50 yards up-stream. Stone from the hillside nearby was reinforced with clay to form a stout bank and a trench was dug to give a controlled flow of water to the wheel.

Two 14 ft. beams from a local farm which was being demolished were used to span the stream, thus providing the main platform and also forming the base for the wheel shaft bearings. Then, for over two months, Malcolm spent his spare time making the wheel, 6 ft. 6 in. in diameter and with 16 buckets of approximately 1½ gallons capacity, Getting the wheel into position was a feat in itself, but eventually it was mounted in the bearings and given its first trial run. Belt drive was arranged to the dynamo, wiring was run to the hostel, and during Christmas, 1953, Wood Cottage had electricity for the first time.

However, the belt drive was not as efficient as had been hoped for, and having put so much work into the project Malcolm and his friends decided to re-design the driving mechanism. Since that time, careful thought has been given to the lay-out of chain and sprocket drive which will step up the running speed in three stages from 25 r.p.m. at the wheel to some 2,500 r.p.m. at the dynamo. Moreover, the dynamo will not provide a direct supply but will be used to charge accumulators at the hostel.

The aim is to provide Wood Cottage with an electricity supply before winter comes, but already this private enterprise hydro-electric scheme has become a talking point in the nieghbourhood and among Y.H.A. members everywhere.

# Launching the HYDRAX

TECHNICIANS and laymen who attended the first public demonstrations of the HYDRAX gear hobbing machine, at the Manchester works of David Brown Machine Tools Ltd., on May 26th, were agreed that they had been privileged to see what will undoubtedly prove one of the most revolutionary gear cutting machines ever to be built in this country. Operating on similar work alongside a hobbing machine of conventional design, the David Brown HYDRAX machine achieved a six-fold increase in output during a test run. Moreover, the gears which it cut had such a high standard of finish that shaving would not be necessary for many automobile and commercial vehicle applications.

It is for these industries that the HYDRAX is particularly intended, though it will undoubtedly claim the interest of such industries as those concerned with the manufacture of tractors, aircraft and textile machinery.

Introducing the new machine to the guests, Mr. A. Avison said:—

"This is a very proud day in the history of this old and well established company, and we have invited you here to see publicly for the first time a machine which is revolutionary both here and on the other side of the Atlantic for cutting automobile and other similar gears.

"It has been said that necessity is the mother of invention and it is very true to say that the HYDRAX was born of necessity. Some two years ago we learned that there was a high-speed hobbing machine in production in America; we went to see the machine and were somewhat impressed. Moreover, we knew that if we could not produce something as good as, or better than, that machine, we should not be able to compete in the automobile industry. We set to work and here you see the result.

"The HYDRAX may look somewhat unusual; in fact, the accidental twisting of a photograph on the wall of his office suggested to Mr. K. L. Oliver a principal which resulted in the idea for this machine. I must pay tribute to the team responsible for designing and building this machine—Mr. Oliver himself; Mr. Eric Drury (the designer), assisted by Mr. Frank North and Mr. Percy Garner; and Mr. Harold Lee, who had the support of his colleagues on the shop floor in the actual production.

"We hope that this machine will have a big market and we are confident that at least we shall save dollars, for there will be no need to buy from the United States. In fact, we hope to make dollars by selling these machines.

"I think I can anticipate two questions which you would like to ask. Firstly, what quantitites are we going to make? If we knew we would tell you, but we are confident that the machine will sell in large quantities. Secondly, at what price will the HYDRAX sell? Again, we don't know, for it will depend on the demand which follows the launching. Even so, we are confident that we shall be able to sell three of these for the price of two of the American machines. The David Brown machine is more massive in proportion and impressive in operation; it will, in effect, produce more. Operation of the HYDRAX is quite remarkable and in comparison with a hobbing machine of hitherto conventional design its production is in the ratio of five or six to one".

The widespread interest in the machine was soon obvious, and since the introduction there has been a flow of visitors to the Manchester works. France, Holland and Belgium are among the countries which have been represented.

*Mr. Avison introduces the new David Brown HYDRAX hobbing machine to representatives of the engineering, industrial, National and technical Press, and David Brown executives.*

# Aintree off to a Wet Start

NEWCOMER to the David Brown equipage and to European car racing, Carroll Shelby, from Texas, drove his Aston Martin DB3S in the first motor race to be held at Aintree, scene of Liverpool's famous "Grand National".

In teeming rain, and on a rather narrow track, the Le Mans type start of the sports car race was a terrifying spectacle. Shelby, however, with his DB3S in American colours, got off the mark more smartly than most and fought a string of larger capacity cars. In the end he defeated all but one. Among the first to congratulate him after the race was Prince Bira, and all agreed that Shelby drove in a determined but polished manner.

Sponsored by "The Daily Telegraph", the racing was organised by the British Automobile Racing Club (of Goodwood fame) for the Aintree Automobile Racing Company which, with courageous enterprise, had built the complete new track. From the spectator's point of view the sight of the whole three-mile circuit is breathtaking and in this respect Aintree has few rivals in Europe.

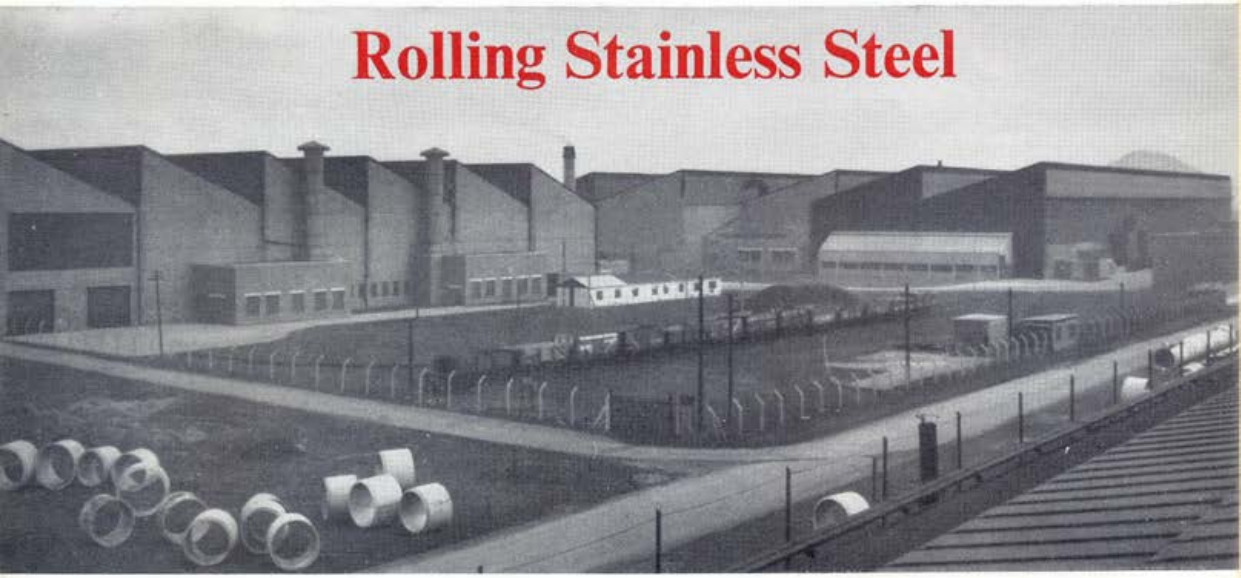
The circuit was formally opened by Earl Howe (Chairman of the Royal Automobile Club Competitions Committee) who broke a tape with his Aston Martin DB2-4.

*Earl Howe declares the circuit open before driving his Aston Martin on a historic lap of honour. Mrs. Mirabelle Topham (principal of the Aintree Automobile Racing Company) is on the left, and third from the left is Mr. G. P. Simon (General Manager of "The Daily Telegraph").*

*The spectator panorama from the pit grandstands. Note the "Grand National" jumps in the distance behind the pits.*


*With the cars lined up for the start in front of the enormous permanent grandstand, Carroll Shelby checks the controls with his mechanic. (Cars point to the left as the track was used anti-clockwise.)*

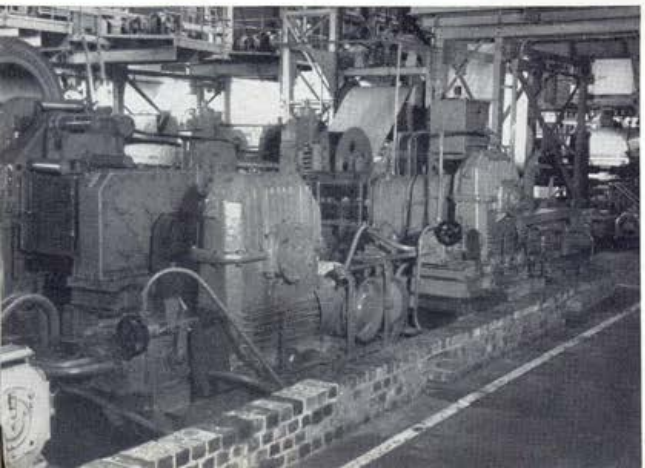
# Rolling Stainless Steel



*The Shepcote Lane Rolling Mills of Firth-Vickers Stainless Steels Ltd.*

IN the post-war changeover of industrial production to cater for domestic rather than military requirements, there emerged a big demand for stainless steel, particularly in sheet form. No company was more affected by this outstanding demand than Firth-Vickers Stainless Steels Ltd., the Sheffield firm whose name has for years been known to the housewife as representing the very best in cutlery, though equally synonymous with the stainless steel products which find their way into almost every industry and profession.

*The last pinch roll at the end of the cold line employs a 17 in. RHU "Radicon", and the upcoiler on the left is driven by a 14 in. unit. Note the strip passing to the final coiler and the actual coil top left.*



To meet the demand it was decided to install new plant, and an agreement was reached with Samuel Fox & Co. Ltd., of Stocksbridge—who were contemplating similar developments—that a new factory should be built as a joint undertaking. At Shepcote Lane, only a short distance from the main Staybrite Works of Firth-Vickers, was purchased a 70-acre site which had the vital services and facilities available. Little more than a quarter of the total area was needed for a production unit large enough to meet the requirements, and the surrounding area is in a position for further development in the years to come.

Seventeen acres are now covered by a modern factory which has reached efficient production by modern methods in a very short time, and has absorbed the current demand to a large degree.

David Brown representatives who were recently privileged to make a tour of the Shepcote Lane Rolling Mills had high praise for the layout and organisation; moreover, the number of David Brown gear units in service in the plant gave them a feeling of being "at home"!

Messrs. Vickers-Armstrongs Ltd. were prominently associated with the installation of plant at the new works, plant which includes massive mills capable of reducing 4½ in. thick slabs to a finished thickness of about 0.150 in. in one heat.

The David Brown "Radicon" worm reducers, which were supplied through Messrs. Vickers-

Armstrongs by David Brown and Sons (Huddersfield) Ltd. are employed in the Coil Build-up line and on the Softening and Descaling lines for both hot and cold rolled strip.

Having gone through a further butt-welding operation, the sheet passes through pinch rolls to a looper and then by further pinch rolls (in this instance driven by a 14 in. "Radicon" of the RHUD type) to a softening stove. It is drawn from the stove by a 12 in. RHUD unit and served to a descaling tank before going into the final looper. After shearing, the strip is passed out by a combined flattener and coiler. Between each of these processes the strip is handled by pinch rolls driven by RHU and RHUD "Radicons" ranging from 12 in. to 20 in. in size.

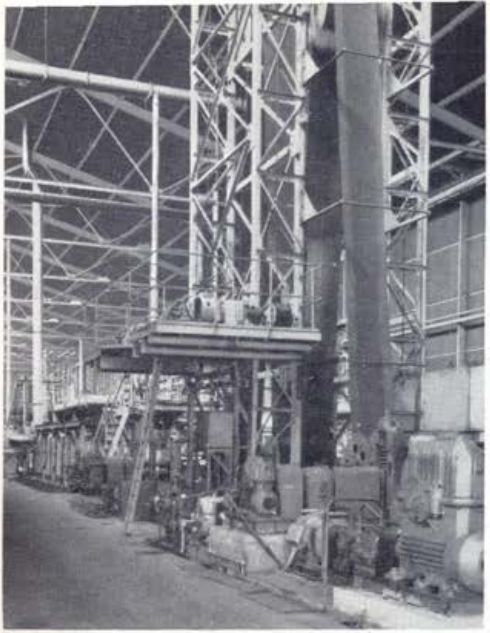
A further softening and descaling line operates on a similar pattern to that already described, with no less than seven RHU "Radicon" worm reducers driving the roller-leveller from the pay-off reel, the pinch rolls into and from both loopers, and the final up-coiler.

After coming off the hot mills, individual coils are butt-welded together to form a heavier coil—weighing up to about five tons. On the build-up line the coils first pass through a leveller driven by a 17 in. "Radicon" which reduces the speed from 636 to 28.6 r.p.m. This is followed by an edge trimmer embodying a 20 in. "Radicon", with input and output speeds of 695 and 15.8 r.p.m. respectively. After butt-welding, the strips are passed through a re-coiler incorporating another 17 in. "Radicon" with running speeds of 687/32.7 r.p.m. All these units are of the RHU type and transmit a drive of 40 h.p.

At the commencement of the line for softening and descaling the hot-rolled strip, the sheet is first passed through an uncoiler-flattener, driven by a 20 in. RHU unit at 573/19.1 r.p.m.

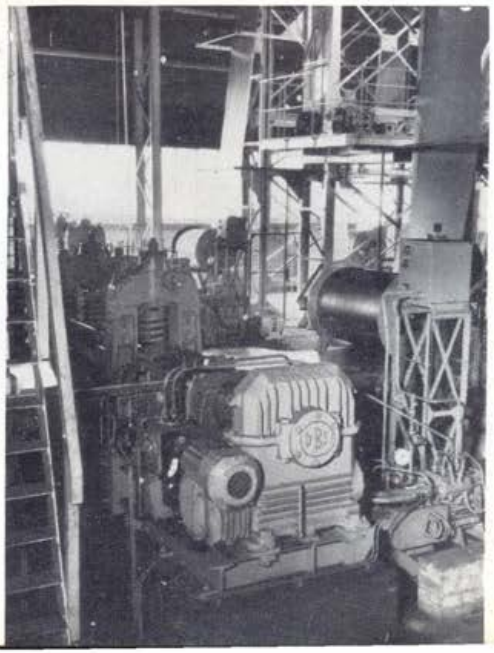
Resistance Welders Ltd. supplied an A.I. welding plant which is used for butt-welding on the coil build-up line. This welder has a positioner driven by a 17 in. RHUD unit supplied by our Huddersfield works, transmitting 13 h.p. at 730/3.04 r.p.m.

As can be said of all equipment in steel mills, the duty is exceptionally arduous. For reasons of economy and by virtue of the demand for the product, the lines are kept running as near continuously as possible. In the majority of cases the "Radicon" units are driven by variable speed hydraulic motors—of powers ranging from 10 to 40 h.p.—and have given satisfactory service in a production programme which has undoubtedly averted what could have become a national shortage.



*Three David Brown "Radicon" worm reducers which are located in the cold softening and descaling line are clearly seen in their respective applications —namely the roller-leveller and pinch rolls to and from the looper.*

*No. 3 pinch roll on the hot line is driven by this 12 in. RHUD "Radicon", which transmits a drive of 7½ h.p. at speeds of 690/4.58 r.p.m.*




## HUDDERSFIELD

### Official Celebration

The David Brown Athletic Reserves football team will long remember the dinner held at the Pack Horse Hotel, Huddersfield, on Friday, June 18th, to celebrate winning Division IV of the Huddersfield & District Football League. An excellent meal was followed by a speech of welcome and congratulations from Mr. Jack Pullan, Chairman of the Park Works club, and Mr. F. J. Everest (in the absence of Mr. A. Avison) formally presented the trophies.

Entertainment was provided by Mr. Charles Withers (vocalist), and Mr. Charles Swithenbank (accompanist). During a break in the programme Albert Maugham (captain) presented a plaque and a pipe on behalf of the players to Mr. George Dobson (trainer) and Mr. Irving Lockwood (team manager) respectively in appreciation of their work during the season. After replies from some of the recipients the evening's entertainment really got under way.

Mr. Avison, Mr. J. T. Riley and Mr. A. Maugham sent messages of apology for being unable to attend.

### Cricket: 26 Works Entries

At the invitation of David Brown Tractors, the Park Works first team played a friendly match at Meltham on Sunday, June 20th. Unfortunately we could muster only ten men, but even so Tractors played better than us. Although there was a slight collapse after their second wicket fell, they rallied to score 218. The score may have flattered them a little, but it was too much for our boys who finally reached 104. From our point of view the features of the match were an innings of 40 by Brian Glendinning and a wonderful caught and bowled by Alan Airey. Alan flung himself forward full length on the ground and reached forward to take the ball with one hand.

Thank you, Tractors, for a very pleasant day.

Since the last report, our first eleven has won a match, lost one, drawn one and had two washed out. In the cricket we have seen, Reis Davies has been consistent with the bat and Stanley Fletcher has bowled well. Our cup hopes were dashed for another year by Penistone "A", playing at Moor End on Saturday, June 12th. Penistone batted first on a soft wicket, and with four wickets down for 21 runs their chances did not look good. Later batsmen played their parts well and eventually the total reached 128. Our reply amounted to 97. We wish Penistone further success in the competition.

The second team seems to have gone to pieces, not having won a match. They have been bowled out for remarkably low scores, but the tide will surely turn.

The Departmental Knock-out Competition was started on Sunday, June 20th, and with twenty-six

*Mr. Everest presents an award to Park Works footballer Bob Earnshaw. On the left is Mr. L. Broadbent.*

teams entered there is sure to be fun before the final stage. An innovation this year is that all League players are barred from taking part.

### Chess Club Formed

With a membership of twenty-six, a Chess Club has recently been formed at Park Works. Mr. W. T. Chesters is chairman of the committee, with Mr. A. Kaye as secretary, and anyone interested in joining the club should get in touch with either of the two.

Two tournaments are at present being run to determine the club's playing strength. A return match was recently played with D.B.T. Meltham (we lost the first 3½-2½), and lost 4-2. As D.B.T. are the holders of the Watkinson Trophy we think the results are satisfactory.

L. Broadbent, Hon. Sec.

## PENISTONE

### National Champion

Miss Gloria Goldsborough of The David Brown Foundries Company Sports Club, became British Women's 440 yards champion by winning at the White City on June 19th in a time of 57.1 seconds. The record time for this distance was set twenty-one years ago at 56.8 seconds. Miss Goldsborough was six and nine yards ahead of the second and third finishers.

Since the last occasion on which her successes were recorded in *NEWSLETTER*, Gloria has retained her titled in the Northern Counties 440 yards open (held at Leeds), and at Barnsley she won for the second time in succession over the same distance in the Yorkshire Women's event.

That Gloria has not been picked for the British team to compete in the British Empire Games at Vancouver is explained by the fact that there is no 440 yards event scheduled.

### Works Cricket

Matches played in the Inter-Departmental Cricket Competition at The David Brown Foundries Company have resulted as follows:—

Aircraft Foundry 47 for 9, Technical Staff 48 for 0.

Pattern Shop 96 for 5, Machine Shop 61.

Bronze Foundry 111 for 5, Fettlers 42.

## CANADA

### Dealer Sponsors Polo Team

In some parts of Canada, ice hockey commands the enthusiasm that football does in this country, and a David Brown agent near Lindsay in Eastern Ontario hit upon the idea of sponsoring the Dunsford team in return for sales aid. It seems that the idea works, for the dealer (Mr. C. C. Bingleman, better known to his colleagues as "Bing") has the highest sales among dealers in Ontario.

Coach for the team is Mr. Tom Stares (left), Service Manager with the company. While with the previous dealer, who handed over to Mr. Bingleman two years ago, Tom sold the first David Brown tractor in the area.

The team has recently had a very successful season, winning 35 out of 40 games (teams in a league play each other as often as 4 or 6 times in a season). Next year Dunsford will be in a higher league and will play on the new Bobcaygon Ice Rink. When forwarding the picture, David Brown (Canada) Ltd. took care to explain that this is not promotion—a team selects a league, and the league decides whether or not to accept the team!


*Ambassadors on ice. The Dunsford team which is sponsored by an enterprising David Brown dealer in Ontario, Mr. C. C. Bingleman.*

# HECKMONDWIKE

## Cricket: Two Competition Wins

D.B.T. Heckmondwike's cricket section started the season on May 16th with a match in the Gomersal Knock-out Competition against S. Laws & Sons. Having won the toss we batted first and in the allotted twenty overs reached a total of 125 for 9 wickets. Highest scorers were J. Hobson (26) and E. Crowther (21), both of whom were caught. Our opponents were bowled out for 59, C. Ibberson taking three wickets for no runs and the rest being shared among the other bowlers.

In a Sunday friendly match against Sheards of Birstall the opposition elected to bat, knocked our bowlers all over and out of the field, and declared at 219 for 3. These wickets were taken by L. Butler, E. Sykes and J. Jackson. Apart from E. Sykes (25) and D. Beaumont (24) our batsmen fared little better than the bowlers, and were all out for 120.

On June 16th we played Ravensthorpe Parish Church in the Mirfield Parish Knock-out Competition. Although we lost the toss we quickly bowled out our opponents for a total of 56, C. Jackson taking 2 for 1 and C. Ibberson 2 for 4. A. Graves (20 not out) and J. Harrison (17) helped us to a quick win.

We practice on the field at Hollins every Wednesday evening and are always pleased to see new and old faces.

Alan Marwood, Hon. Sec.

# SCHOLES

## Keen Bowling Competition

Making good use of the newly opened bowling green, the Lee Mills works of David Brown Tractors (Engineering) Ltd. recently played a match in competition with The Keighley Gear Company. After keenly contested matches, the home team won with a score of 274 against 258.

Boisterous applause and remarks from the supporters continued throughout, reaching a climax in the last game of the evening, which a Keighley Gear Company apprentice, B. Curry, was unfortunate not to win.

Both teams are keen to stage a return fixture at the first opportunity.

# SALFORD

## On the Green

At the invitation of Tractor Group friends, members of the Bowling Section of David Brown-Jackson Ltd. visited Meltham Hall on Sunday, June 13th, for a game of bowls. It was a friendly game in the truest sense of the word, and Salford players enjoyed playing on the green, although they were defeated. Salford recorded three winners in G. Bustard (21-20), G. Seymour (21-19) and H. Martin (21-19).

Tea was provided at Meltham Hall, and the visitors enjoyed the programme of entertainment later in the evening. The Salford Bowling Section looks forward to another visit to Meltham Hall in the near future.

Salford league and competition bowling results, with outstanding performances, are given below:—

First Team:

D.B.-J. 208 (W. Smith 21-13, G. Seymour 21-13, G. Davies 21-14), Erskine Heap 220.

First Round Knock-out: D.B.-J. 212 (W. Smith 21-9, G. Toft 21-7, A. Beresteyn 21-5, J. Sidebotham 21-5), Groves & Whittnalls 186.

D.B.-J. 207 (W. Smith 21-4, G. Seymour 21-7, St. George Engineers 187.

D.B.-J. 234 (A. Poole 21-9, H. Martin 21-9), Barlow & Chidlaw 202.

D.B.-J. 199 (J. Taylor 21-7), Greengates 217.

Second Team:

D.B.-J. 204 (S. Worrall 21-6, W. Forster 21-8, J. Hardman 21-8), Erskine Heap 187.

First Round Knock-out: D.B.-J. 197 (S. Worrall 21-8), Erskine Heap 228.

D.B.-J. 190, Salford Electrical Instruments 235.

D.B.-J. 174, Irwell "A" 236.

D.B.-J. 146, E. G. Hughes 230.

# MELTHAM


Cricket

DAVID BROWN'S DO WELL

When the Yorkshire Council broke

It has always been the aim of David Brown management to provide its workpeople with something more than just a place of employment. Production and welfare are closely allied, and the increasing number of reports of social and sporting events which appear in the pages of *NEWS-LETTER* month by month reflect the amount of pleasure which employees derive from getting together in their leisure time.

In this issue we have the honour of recording that in the realm of sport a member of the Fenistone staff has become a national track champion, and the heading to this section is from no less an eminence than the "Manchester Guardian".

The heading to a half column cricket feature which stated quite simply "David Brown's Do

Well" was an accurate reflection of the achievements of the two D.B.T. teams representing the Meltham factory in the Yorkshire Cricket Council —the only club among 94 members to field two first teams weekly.

The Free-Lance XI are at the head of the Council with a percentage of 93.18 (unbeaten in the ten games played), and the Bradford Section team holds tenth place with 66.66%.

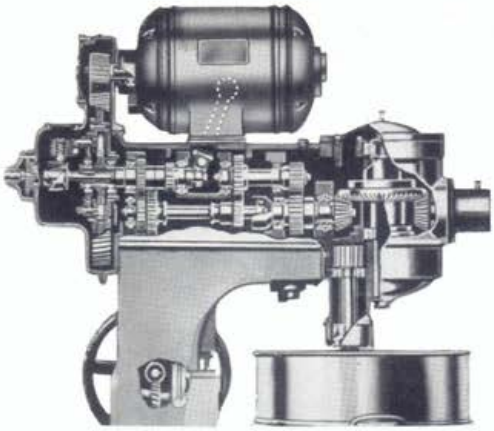
The first of the Free-Lance team's six fixtures in the past month was at Rotherham. The opposition totalled only 102, due to fine bowling by D. Smith, Dennis and Stopford, who returned 2 for 41, 3 for 33 and 4 for 24 respectively. Tractors made 103 for 4 in reply, A. Smith scoring 30 and D. Smith 28. When Glasshoughton were dismissed for 61, Stanley Speight claimed six wickets for 15 runs, and Donald Smith took the other four for 45. D.B.T. went on to win by six wickets. Playing at Knaresborough in persistent light rain, the home team were dismissed for 103 (Jack Stopford taking 6 for 48 in 16 overs). Rain threatened to end the match, but openers Ken Brook and Douglas Booth gave the Knaresborough bowling a terrific battering. At the end of 40 minutes' batting the match was over; Tractors had won by ten wickets, with Brook not out 59 and Booth not out 43.

Scunthorpe were at Meltham on Whit Tuesday, and Stopford's 6 for 40, assisted by Dennis's 3 for 31 put them back in the pavilion for 112. Again Ken. Brook hammered the attack and the runs were made in 59 minutes. Brook was unbeaten with 78, and Bill Dennis made 27. The return match with Rotherham at Meltham saw D.B.T. make 140 for 9 (R. Pownall 29 not out, A. Smith 26, R. Myers 24), thirty runs too many for Rotherham who were bowled out by Stopford (5 for 38) and Dennis (3 for 39) for 110. Having travelled to Hull Y.P.I., the Free-Lance team won by eight wickets. Hull reached 131 for 6, but K. Brook (44) and A. Smith (42) gave us a good start which Bill Dennis (29 not out) and Donald Smith (13 not out) carried on to finish the match.

Though somewhat overshadowed by the Free-Lance team's achievements, the Bradford Section XI have nevertheless put up very good performances. They pulled off a good victory at Tong Park, Harry Marshall contributing 23 not out to a total of 101. The D.B.T. side's fielding was first class, with four men run out, L. V. Gallagher taking 4 for 4, and the final reply amounting to 80. Visitors from Thackley were dismissed for 66 (L. V. Gallagher 5 for 8, Savage 3 for 19), and Tractors lost five wickets in rubbing off the runs. At Illingworth, a "sticky dog" was encountered and of a total of 84 S. Speight claimed 30. Illingworth were made to fight for the runs, but eventually won by seven wickets. Our first encounter with Steel, Peech and Tozer will not soon be forgotten. Jim Savage played havoc among their batsmen and his 7 for 19 in 12 overs resulted in the whole side being out for 45. The D.B.T. score reached 45 for 6 wickets, but panic almost set in as three wickets fell without the addition of the vital run. It was left to C. Giles to hit the one run required for a one-wicket victory. Entertaining English Electric the D.B.T. team made the season's highest total in the Yorkshire Council—263 for 8 (D. Booth 90, L. V. Gallagher 42 not out, and J. Savage 33 not out). Savage and Speight again showed their bowling powers to return 6 for 45 and 4 for 43 respectively in a comfortable win.

If you have a weak heart, the cricket ground at Meltham Mills is no place for you when a Victory Cup match is in progress. All three matches so far have been very exciting but Tractors have won them all and will now play in the semi-final at Meltham Mills on a date to be fixed. Against Mirfield in the first round, the visitors scored 90 in the 18 overs allowed. Douglas Booth (41 not out) and Jack Stopford (36 not out) hit off the runs in 13 overs. In the second round Tractors showed brilliant fielding, running out four men in a Staincliffe side which scored 96. Eight wickets were down and there was only one over left when Stopford (36 not out) and Arthur Sykes (13 not out) made the last runs. The third round encounter with Ossett was probably the most exciting match ever played at Meltham. In spite of early shocks the visitors scored 115, Donald Smith bowling well to take 5 for 46 in nine overs. The light was beginning to fade when Tractors went in to bat, and at the end of six overs there were only 25 runs on the board for the loss of five wickets. Alwyn Smith joined D. J. Smith and the total reached 40 for 6, Pownall and A. Smith made it 65 for 7, and Bill Dennis helped it to 95 for 8 with four overs left. Sykes and Smith were at the wicket and nine runs were made off the fifteenth over. Five runs came from the sixteenth, but it was doubtful whether the batsmen could see the ball. In the seventeenth over the pair turned on the heat and hit fifteen runs. With eight balls to come, five runs were needed. There was no score from the first, but with brilliant understanding the next five were placed for singles. A win with two balls to spare, in which Alwyn Smith's 49 not out was a superb effort for which he was warmly applauded.

The Evening League Team have recently run into form. After an uncertain start, including a defeat in the first round of the Emmerson Cup by Cliffe & Co., they have won three games in succession. Against Park Works they scored 94 for 7 (P. Clegg 32) in reply to a total of 90.



# Quality Gears for 'Super' Mixer

LEFT: *A sectional view shows the gearing arrangement of the Hobart "Super" mixer; a substantial proportion of the precision cut gears are supplied by two David Brown companies.*

BELOW:
*The "Super" mixer, smooth in appearance and in operation, is but one of the numerous labour-saving machines in the Hobart range.*

FOR more than half a century the Hobart Manufacturing Company Ltd., New Southgate, London, has pioneered the manufacture of food-preparing equipment, devoting extensive research to devising worth-while mechanical aids in saving time and hard work in catering establishments and in the home. Moreover, many machines originally intended for food production now find wide application in the industrial field.

Up-to-date engineering practice is adopted in the design and manufacture of Hobart machines, of which the new "Super" mixer is an excellent example. This mixer is for heavy duty commercial use, available with 80-quart and 40-quart capacity bowls, and is one of the popular models for bakeries, large canteens and industrial applications in this and other countries.

Smooth operating is one of the outstanding features of this mixer, and the precision-cut gears supplied from David Brown works at Huddersfield and Coventry play a large part in this performance. From The Keighley Gear Company's Prospect Works are supplied the internal gear and beater shaft pinion, together with the helical bevel pinions and wheel driving the planetary and attachments. Adjustment of the bowl level is controlled through a worm and wheel to spur gears acting on a steel lifting rack, all of which are supplied by The Coventry Gear Company. The accurate cutting, heat treatment and hardening of these geats are contributory factors to the long life and trouble-free running which the manufacturers claim for all Hobart machines.

The range of Hobart products also includes slicers, potato peelers, mincers, choppers, coffee grinders, dishwashers, etc., together with attachments for kitchen operations such as chipping, shredding and grating. Several of these machines also employ transmission gears cut by David Brown companies.

# Re-opening the Green

*When this photograph was taken some three years ago there was little sign of the crown bowling green which lay hidden under tall grass and willow herb.*

WHAT appeared to be an overgrown patch of garden in front of the offices when the David Brown organisation took over Lee Mills nearly three years ago emerged in its true light on Saturday, May 29th, as a crown bowling green. Local residents first supplied the information that a green had at one time been laid and research in the wilderness soon proved the truth of the statement. The work of reclamation was begun, and after a David Brown tractor and rotavator from the Meltham works had produced a fine tilth it was decided to seed the green rather than lay new turf.

Executives and representatives from Tractor, Gear and Foundry Group companies were present at Lee Mills on the occasion of the official re-opening of the green, along with the Chairman (Councillor S. P. Owens, J.P.), the Clerk (Mr. S. G. Dilnot) and members of Holmfirth Urban District Council.

Mr. H. Cockhill (Chairman of the newly-formed Bowling Section) thanked the management for the latest addition to the company's sports facilities, expressing the hope that members would look after the green "as if it was their very own".

The President of the Section, Mr. L. S. Blackburn, officiated as opener, stating that the ceremony marked the completion of two years of hard work. "If you had seen what we had to start with you would not have known that it was a bowling green" said Mr. Blackburn. "The piece of land was about four feet deep in red willow herb, but on digging we found that we had a properly laid crown green. Equipment was loaned from Meltham, the patch was turned over, and new seed was sown."

Mr. Blackburn remarked that Lee Mills sporting amenities would benefit by the addition of the green, and employees had the choice of bowls, table tennis, football and cricket (on pitches of indifferent quality, but serving their purpose nevertheless), and a natural swimming pool supplied with spring water.

"When Lee Mills opened as a David Brown company in September 1951, a section of twenty men came here from Park Works", Mr. Blackburn recalled. "Now we have 170 employees" he announced, adding: "We hope to increase that number to 200 before the holidays".

Mr. Joe Smith, a labourer at the Lee Mills works, has been responsible for the general preparation of the green, with help during lunch-hour breaks from bowling enthusiasts.

To mark the official opening, Mr. Blackburn bowled the first wood in competition with Mr. G. L. Hancock, President of the Bowling Section of The David Brown Foundries Company, whose team afterwards beat Lee Mills in a friendly match by 214-159. Individual games resulted as follows: (Lee Mills names first): F. Senior (captain) 8, A. Riley (captain) 21; G. H. Deal, 21, M. Butcher 17; J. W. Heywood 7, V. Beaumont 21; F. Stead 21, H. Armitage 14; K. Taylor 18, D. Champion 21; W. H. Thomas 21, C. R. Storey 15; J. L. Earnshaw 9, J. Bottomley 21; K. Dickinson 14, J. Turner 21; R. Marshall 17, G. Crossland 21; H. Cockhill 10, W. Barden 21; J. Pearson 13, A. Hoyland 21.

*Mr. Blackburn bowls the first wood to mark the official opening of the reclaimed green.*

# Royal Lagonda

THE David Brown organisation has recently had the honour of supplying to H.R.H. The Duke of Edinburgh this 3-litre Tickford Lagonda drophead coupe. Finished in dark "Edinburgh" green, with grey hood and seats, it is a standard car apart from the radio-telephone, hydraulically-operated hood, dashboard—which is covered by dark green leather instead of the normal polished burr walnut—and a number of other small details.

*The telephone on the floor between the two front seats has a cable which extends for the instrument to be used by rear seat passengers.*

*Neatly concealed in the luggage boot is the outwardly-looking simple mechanism for the radio-telephone system.*

*Printed in England by Edward Mortimer Limited at Pellon Lane, Halifax*