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Official publication of the British & International Golf Greenkeepers Association
FEBRUARY 1992



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GREENKEEPER International

EDITOR
David White

Tel: 0323 891291 • Fax: 0323 895593

DESIGN/PRODUCTION EDITOR
Tim Moat
Tel: 0904 610611 • Fax: 0904 643074

SALES AND MARKETING MANAGER
Bill Lynch
Tel/Fax: 091 413 7218

ADVERTISING SALES EXECUTIVE
Carol Dutton
Tel/Fax: 0207 570117

PRINTING
Hi-Tec Print, Unit 7, Universal Crescent,
Houghton Road, North Anston Trading
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Tel: 0909 568533 • Fax: 0909 568206

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GREENKEEPER International

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Take a closer look...



...at what Greenkeeper International can do to promote YOUR business.

Here's what one of our advertisers has to say about the industry's most effective magazine:

'Our decision to use Greenkeeper International during 1991 has certainly been justified and we will be using BIGGA's magazine even more extensively during 1992.'

— ROGER MOSSOP, Marketing Manager, ICI Professional Products

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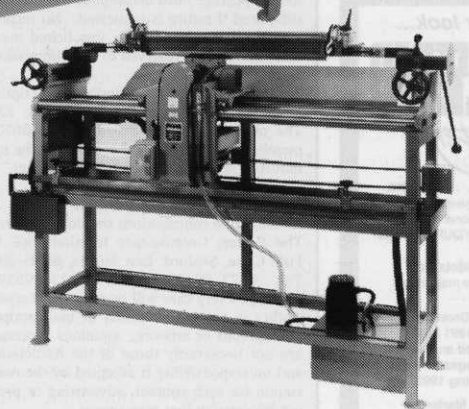
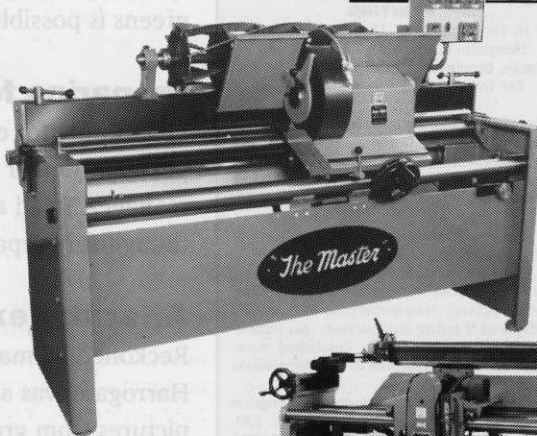
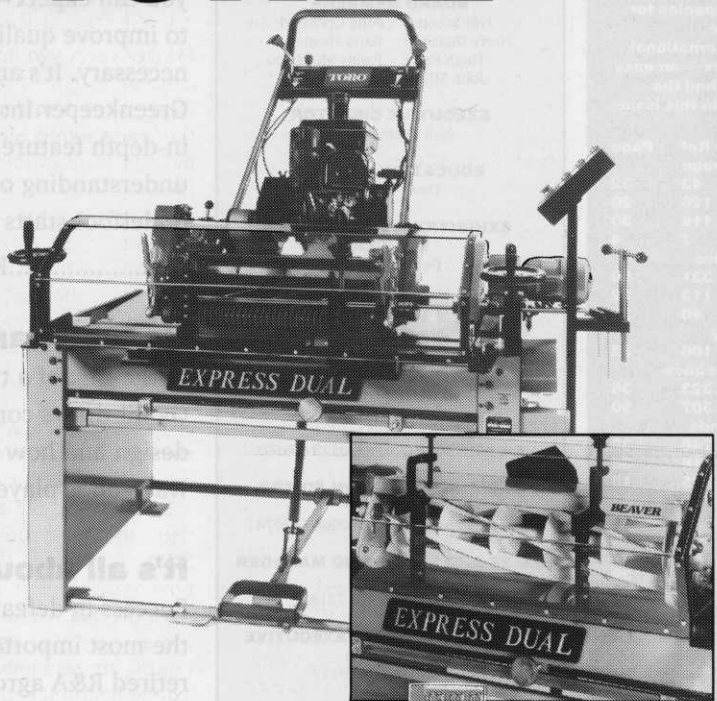
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■ This page is about faces *and* places, in particular a special place in Holland busily preparing for an invasion. I refer to Barenbrug's plant breeding centre at Oosterhout and the Nunspeet Golf Club, site for the Barenbrug Golf Trophy which takes place on May 18th.

From May 17th-19th a lucky handful of British greenkeepers will join fellow European amenity turf specialists in a truly international golf event and a Dutch tour which includes a visit to Barenbrug's centre. But to win you must be in – so if Holland takes your fancy, look again at the recent Barenbrug "See, Buy and Fly" missive, or 'phone Michel Mulder on 0359 70766.



Remaining with Barenbrug, but moving from 'places' to 'faces', it is good to see that John Bradley has joined their British subsidiary, Barenbrug UK Ltd, as technical sales rep for amenity grass seed. Readers will recall that John was previously with British Seed

Houses in the amenity market. He will now cover the south and west regions and support Barenbrug's special accounts.

■ The British Institute of Golf Course Architects, concerned that golf course development is generally misunderstood and is receiving bad publicity, will hold a one-day seminar on Wed. March 11th at the Institute of Civil Engineers, London, entitled "The Positive Face of Golf Development". The seminar aims to present some hard facts about such development and undo some of the myths which fuel debates; whilst restoring confidence in the values, aims and techniques involved in creating and integrating golf courses. Reservations through the Administration Secretary, Tel: 0883 712072.



■ Karen Smith, a familiar figure much respected as Ransomes 'always-on-the-ball' PR executive, has rejoined the company as PR and Marketing Manager, Ransomes Sims and Jefferies Ltd., following a short period away from Ransomes whilst working as PR executive at Quietwaters. Her new brief will encompass marketing analysis, public relations, exhibitions, promotions and marketing communications, working alongside John Wilson, General Manager, Sales & Marketing. Greenkeeper International is delighted to say 'welcome back, Karen'.

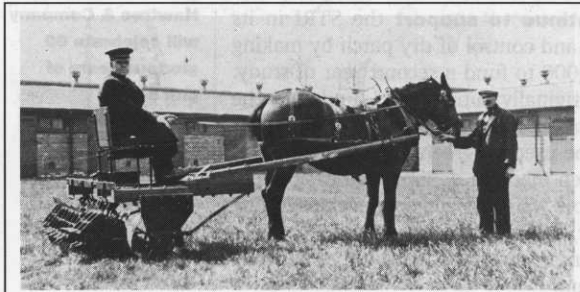


■ Hayter Beaver have announced the appointment of Robin Boyes as territory manager in the south-west of England. In this he will work closely with dealers to promote and sell the company's range of professional grasscutting equipment and add support to the after-sales service which Hayter Beaver provide for end users. Robin is no newcomer to the company, having joined Hayters 13 years ago and spending the last four years as demonstrations co-ordinator.

■ At the recent AGM of the Surrey section of BIGGA, a Southern Soils representative presented section chairman Clive Osgood with a three figure cheque, freely given and promised as a committed annual donation toward providing extra training for younger members of the section. Southern Soils feel this will offer good long term benefits for both members and the Association. Good for them!



■ Robert Hawthorne, perhaps better known to us as the head greenkeeper at Portadown Golf Club in County Armagh, has now joined John Lindsay Professional Sportsturf as their technical sales representative, specifically to develop sales in Southern Ireland and further strengthen the company's position in Northern Ireland. Robert is an ex-Greenmount College student.



■ Sixty years ago on February 11th, William Hargreaves, a steam engineer whose business was a victim of the Depression, founded W Hargreaves & Co. Ltd., – using the trade name SISIS. William thought that increased interest in physical recreation might offer a steady and growing market for well engineered equipment and, in the beginning, the company produced tennis and netball posts and other playing field equipment.

The then novel concept of machinery to aerate turf resulted in meetings between William Hargreaves and R B Dawson, Director of the Board of Greenkeeping Research, (now the STRI), at Bingley, and regular contact has been continued ever since.

From the first humble premises in an old converted chapel, the Company moved in 1962 to a custom-built factory in Macclesfield and ten years later expanded and built a larger factory – their current home.

By 1965 the SISIS name had been increasingly identified with the product and the company was renamed SISIS Equipment (Macclesfield) Ltd. The company are now represented in more than 30 countries world-wide.

To the man whose main vocation was to ease the job of the greenkeeper; and to the company that is now celebrating its Diamond Jubilee, Greenkeeper International extend heartfelt congratulations.

• Pictured: a 1937 SISIS horse drawn aerator.



■ David Heads, head greenkeeper at Frilford Heath GC, is the winner of the all-expenses paid trip to New Orleans in the 'Blazon Better Way to Spray' national campaign. At BTME, BIGGA Chairman George Malcolm offered David his congratulations.

Get set for Westurf

■ At the start of 1992 I busied myself transferring important dates and regular events that I aim to cover from one ICI wall-planner to the next. Mercifully few fall under the category of tedium; whilst others, like the delightfully parochial Westurf Trade Show at Long Ashton, Bristol, are undoubtedly a real pleasure. Westurf particularly has come a long way in a short time and although I describe it as parochial, ie. provincial, it now stands proud as the biggest and best outdoor trade exhibition in the South West. From humble beginnings it has grown in both size and importance and is now unquestionably ranked with the 'big-uns' and is certainly the place to be on April 29th. For all its growth it still retains a friendly relaxed atmosphere that is difficult to pinpoint, but is the better for all that. Quite apart from good communications – Long Ashton is little more than a wedge away from the M5/M4 corridor – it offers free entry, free parking and the opportunity to view in some comfort the best of trade exhibits from around the country. The trade see it in an enlightened way too, supporting it with increased attendance and often using it as a launching pad for new and innovative products and services. BIGGA members and their green chairmen are seen in abundance, travelling from afar as Wales, London, the Midlands and the West Country. Make a date – April 29th – see you there? Trade details and available space? Ask Gordon Childs by 'phoning 0803 844056.

Dry patch studies continue

■ **The R&A is to continue to support** the STRI in its research on the biology and control of dry patch by making a research grant of £25,000 to fund a second year of study. The dry patch project, originally initiated and funded by the R&A, aims to find the cause of dry patch and develop control methods that may be used by greenkeepers. Significant progress has already been made in defining the basic problem of dry patch and how water repellency develops in fine turf. Over the next year, studies will concentrate on identifying the causal factors responsible and on preventing occurrence of the problem.

■ **Recent scandals** about corruption in the stock market in Japan has brought to light similar problems in the Japanese golf industry (source: Japan Golf Report December 1991). There have been several well publicised cases of course developers bribing politicians in the hope of getting their particular projects approved, and of one huge scandal in particular concerning former transport minister Shintaro Ishihari and fellow politician Kiyoshi Mizuno. Both accepted large financial 'donations' from real estate agent Ken Mizuno, the latter Mizuno being investigated by police after selling no less than 52,000 memberships of Ibariki Country Club, although he had advertised only 2,830 for sale! Several of his companies have since gone bankrupt, the memberships are now worthless, and numerous claims have been filed from investors. Mizuno, who also acquired several golf courses in the USA, has been under investigation by Nevada police since 1972 for excessive gambling activities and suspected gangster connections. (nb. None of these

Hawtree & Company will celebrate 80 glorious years of golf course architecture in 1992, my spy informant suggesting that Fred Hawtree will pen an anthology entitled: 'Hawtree on Golf 1912-1992'. This writer will look forward to its publication with great interest; and to an additional study also scheduled "which will actually destroy a theory once advanced which provided a Scottish alternative route to owning the patent". Which theory and which patent? We shall just have to wait and see!

Mizunos have any connection with Mizuno Corporation, the sporting goods manufacturer.)



Nicklaus: Peace



Trevino: AIDS cure

■ **What do you give** to the man who has everything? The legendary four-some, Nicklaus, Palmer, Rodriguez and Trevino, competing in the 1992 Senior Skins Game in Hawaii in January were asked to reveal their ideal gift – and their New Year's Resolutions. **Jack Nicklaus:** 'My ideal gift would be lasting peace among all the people of the world, my resolution to work harder at being fit so that I can give myself a chance at winning a major in '92'. **Arnold Palmer:** 'My ideal gift would be a Cessna Citation VII airplane (he already owns a Citation IV), my resolution is to win some tournaments'. **Chi Chi Rodriguez:** 'I would like all the kids in my **Chi Chi Rodriguez** Youth Foundation and kids around the world to be successful in life. My resolution is to be No.1 in golf, but I would also like to see the people of the world put negative things of the past behind them and concentrate on making the future positive. **Lee Trevino:** 'Personally, I have everything I could possibly want, but if I had one wish, it would be that we find a cure for AIDS and Cancer. My resolution is to take time between tournaments in 1992 and spend more time at home!'

NOTICE TO MEMBERS

The BIGGA Annual General Meeting will be held on **Wednesday 8 April 1992 at 2.30pm** in The Royal York Hotel, York (immediately adjacent to the Railway Station)

–NEIL THOMAS Executive Director



BIGGA ANNUAL GENERAL MEETING

Copies of the audited accounts will be available from Section Secretaries during the four weeks prior to the Meeting.

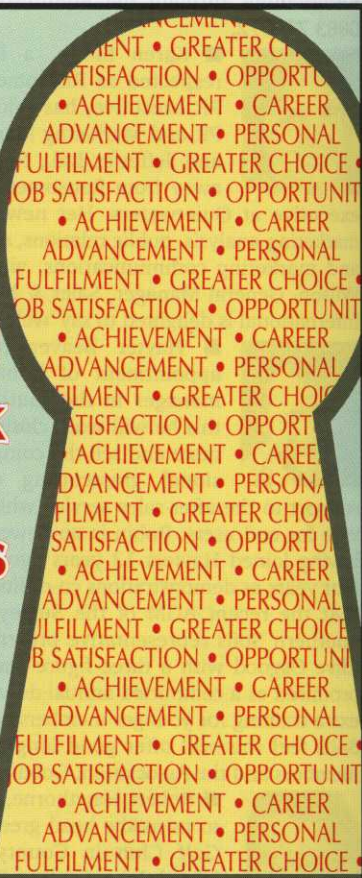
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An exciting new era for the Association

Whilst it is indisputably true that money makes the world go around, it is equally true in the vocation of greenkeeping that education is the key to professionalism – and the two are inextricably linked!

No – please don't flick to the next page, for I am not about to launch into a 'party political' on Clubs that fail to recognise and follow recommended BIGGA pay scales, or of well documented examples where educated greenkeepers have risen to lofty heights and larger salaries. Like the forthcoming general election and the continuous haranguing that is bound to come, you'll be getting quite enough of that in the future.

Yes, it's true, we certainly intend to continue 'banging the drum' about increased knowledge bringing increased rewards, and of the role your Association will play in this revolution. It's true also that in the five years since its formation, BIGGA has purposefully set its cap toward the path of improving and enhancing the recognition of the greenkeeper as a professional and in advancing management and maintenance techniques to ever higher standards.

If there are some who still doubt, they need look no further than the establishment of numerous new college-based courses and the introduction of "in-house" training at Aldwark Manor. Look and marvel, for though all this educational activity costs money – lots and lots of it – your Board of Management has not sat around waiting for others to trail-blaze, rather they have hit upon a clever and provocative scheme whereby those within the game of golf and working in associated fine turf industries will be able to both contribute and offer suggestions on further advancements to the education and development of golf's best raw material, that unsung hero, the greenkeeper.

Titled the Greenkeeper Education and Development Fund, this exciting new promotional venture was launched at BTME by Viscount Whitelaw and acclaimed by everyone as a real breakthrough in fund raising and management.

In recognising that educational needs are legion, financial contributions are sought from both individuals and companies or groups, such to be channelled into one centrally founded Fund, to which some £56,000 is already committed for 1992 and which is confidently expected to grow substantially with an increased input from the Joint Golf Course Committee.

With the JGCC seeking to persuade every golfer in the land to contribute the price of a golf ball into their central fund (which will quite rightly include substantial provision for greenkeeper training) so also are BIGGA seeking contributions – but in a different manner.

Formed as either 'Golden Key Circle' or 'Silver Key Circle' memberships, companies or groups making donations to the Fund in excess of £3000 annually (Golden Key) will be recognised and profiled within the pages of Greenkeeper International and will become Company members of BIGGA. They will also have priority stand space at the BIGGA Open Championship marquee and be instantly identified by a specially designed plaque and 'Golden Key Circle' tie. Individuals who donate over £150 annually will share many similar benefits, including Associate membership, and earn a 15% discount on all BIGGA educational programmes. For Silver Key Circle donors representing groups or companies and contributing sums of from £1000-£3000, there will also be Company membership; together with the wearing of a 'Silver Key Circle' tie and the display of a distinctive plaque. As individuals, (donating from £75-£150) Silver Key Circle donors become Associate members and earn a 7.5% educational programme discount.

This then is the 'bones' of membership to the Greenkeeper



Education and Development Fund, a no-nonsense idea that is bound to catch on, presenting as it does an opportunity to put in to get out. We are in no doubt that improved professionalism benefits *everyone*.

Already there are many good friends in the trade who have indicated their support for the Greenkeeper Education and Development Fund in 1992 – in most cases tried and true supporters of our past endeavours – and I am delighted to single them out and acknowledge their contribution here: Iseki UK Ltd (for support of the Iseki Regional Golf Tournament), ICI Professional Products (for support of the Premier Greenkeeper of the Year Award), Toro Irrigation, Lely UK Ltd, and the PGA European Tour (for support of the Student Greenkeeper of the Year Award), Rufford Top Dress Supplies Ltd (for continued support of the Association), Kubota UK Ltd (for support of the BIGGA Management Course Programme); and Lindum Seeded Turf (for support of the National Education Conference).

Also at the launch ceremony at BTME were three worthy recipients of somewhat special awards and these men must not escape without plaudit. In 1987, when the former greenkeeping associations amalgamated to form BIGGA, the British Golf Greenkeepers Association placed its funds in trust for the very purpose of promoting greenkeeper training. Now those trustees, Alan Gamble, Alan Kite and Ivor Scoones, have begun to wind-up the trust and will transfer monies held to the new Education and Development Fund. It was for their selfless service as trustees that Viscount Whitelaw made the awards, giving credit where credit was most certainly due!

Where will the money go? Obviously there are many items on the educational agenda that cry out for funding, some perhaps more important than others but all deserving of wider exposure. The Association will look increasingly toward the funding of scholarship awards, the development of management courses; of training aids and text books and the provision of an Association library. The National Education Conference is vitally important, as are regional and sectional seminars and the adding of training resources at BIGGA headquarters and the promotion of the Master Greenkeeper Certification programme. We seek to provide technical training films and to promote greenkeeping as a career on videotape, to get deeply involved in research projects and look closer still at the wonders of computer programmes specifically designed for the greenkeeping industry.

It all adds up to an exciting new era for the Association and those who support our aims and ideals. To coin a phrase, it's a chance for the industry; and for those who benefit from the game in some phase or other either as players or officials, to put their money where their mouth is! So let's hear it for fund-raising BIGGA style. There has never been a more deserving case.

DAVID WHITE

Well *someone* must have designed it like that; in the first of a new series of articles, golf course architect JONATHAN GAUNT traces the early days of design philosophy and examines the 'penal school' and the 'strategic hole'

I have been playing golf for over twenty years, though only recently have I realised the true value of golf lessons. I've undergone a radical swing change and now stand on the tee looking at the course in a completely different way. I feel more confident about where the ball will go – which has a direct effect upon my playing strategy – and I can plan the way I want to play the course in direct relation to the way the course design influences my game. Because of this, I am increasingly aware of the design philosophy which I believe British golf course architects of the early part of this century possessed.

A well designed course is multi-functional (which it has to be in order to attract golfers of all ages and standards), but that stated, there are fine courses that cater for only a small group of golfers, such as Pine Valley, East Sussex National and Kiawah Island. These are long, difficult layouts which are enjoyable and eminently playable if you are a low handicap amateur or golf pro., but are of a design style that is penal or heroic, as opposed to strategic.

Since the beginning of this century an architectural style and philosophy has developed that best satisfies the criteria to rate it as 'good golf course design'. It has been successfully applied by a mere handful of architects throughout the world, with probably the most famous and well respected exponent being Harry Colt.

However, Colt was not the first to make his mark, for Willie Park Jnr. was highly regarded by both Tom Simpson and Sir Guy Campbell and they were of the opinion that it was he who first began to develop the strategic style – in 1901 – at Sunningdale and Huntercombe.

Park was one of the best professional golfers of his day – the ultimate all-rounder – having trained as both greenkeeper and club maker and masterminding a hugely successful clubmaking business. Also much respected, J F Abercromby was setting out golf courses around the same time, mainly in Surrey, where he also completed Worplesdon for Park.

The strategic style was said to be an adaptation of the characteristics and features found on the Old Course at St Andrews – a design philosophy based on the provision of an alternative playing route for the high handicap player whilst not removing the challenge. The Old Course was originally considered an example of penal design, but with alternate route to green alterations in the mid-19th Century it became considerably more strategic. To perceive the Old Course as the ideal form of strategic design is interesting, because it was, effectively, un-designed and had just evolved over hundreds of years, although *someone* must have first decided where teeing grounds and greens should be located. Now golf course architects were trying to achieve similar results by artificial means.

For the lower handicap player the strategic style provided more challenge – the bigger the risk the bigger the challenge. His best shots were rewarded, his poor shots punished. Strategic golf encouraged golfers of all abilities to improve their game by enabling them to use every club in the bag and build up a wider range of different shots.

Other architects began to make a name for themselves by appreciating and then applying the 'strategic' design philosophy to their own style of course design. In particular, examples of this style were to be found on the sandy soils of heathland and not, as previously had been the case, on linksland. Heathland was almost an inland form of linksland, invariably undulating with random ground cover of heather and silver birch. It was a golf course architect's delight, as the landscape needed very little alteration in order to create an exciting golf course. The skill demon-

'A good golf course is an asset to a nation. Those who harangue about land being diverted from agriculture and used for golf have little sense of proportion. Comparing the small amount of land utilised for golf with the large amount used for agriculture, we get infinitely more value out of the former than the latter. We all eat too much'

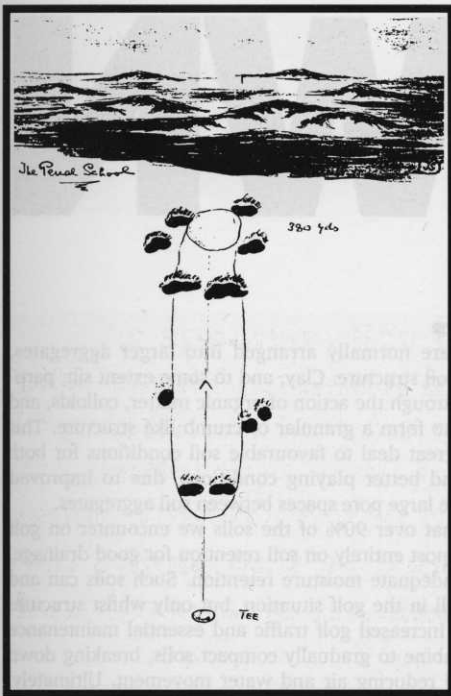
A ma

strated by these architects was essentially that of making an initial analysis of the site, followed by thoughtful placement of greens, tees and hazards. Herbert Fowler was known to have spent two years planning the course at Walton Heath, its opening in 1904 heralded with an exhibition match being played by Vardon, Taylor and Braid – 'The Great Triumvirate'.

Because of his great ability to swiftly recognise the potential in a site, Fowler soon became busy with other projects, notably at The Berkshire (both Red and Blue courses), Saunton, and a total re-design of Royal North Devon at Westward Ho! Along with Park, Abercromby and Colt, he was one of the first golf course architects who could actually be regarded as professional, rather than a part-time designer working in 'spare' time.

Vardon, Taylor and Braid first gained recognition through golfing prowess, later through their golf course architectural skills. Vardon was less prolific in course design than his two golfing opponents, largely due to persistent illness from tuberculosis prior to the First World War. Braid went on to design courses throughout the British Isles and in Scotland particularly, notably Gleneagles Hotel (both Kings and Queens), Dalmahoy, Royal Musselburgh, Brora, and the unsung gem at Boat of Garten. Taylor went into partnership with the ex-greenkeeper, Fred Hawtree and together they designed many fine courses, including the remodelling of Royal Birkdale. They were renowned for setting up the development of many municipal courses in Britain, and in forming the first Greenkeepers Association.

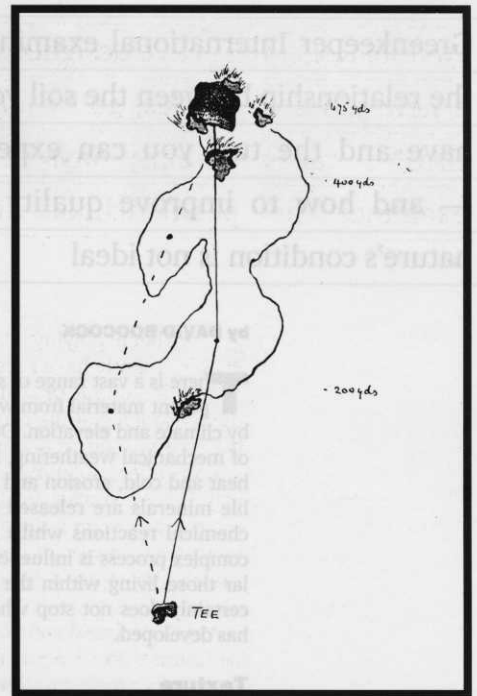
Harry Colt worked with two other architects, Alister Mackenzie and C H Alison. Colt and Mackenzie worked together at Alwoodley, Leeds in 1907/08, where Mackenzie was the Club secretary. Mackenzie was probably best known for his *Thirteen Essential Features of an Ideal Golf Course* and for his experience in the construction of camouflage features in the first World War. He was known also for being outspo-



The Penal School – the bunkers assist the good player to steer his shot and focus distance, acting as lighthouses and framing the green. They are a source of worry from start to finish to the inferior player.



A Strategic hole – the good player who wants to make his second easy must take an initial risk with his tee shot. At this type of hole the true line should never be the centre of the fairway. The inferior player is not worried by the multiplicity of hazards.



A fine test for all – a difficult 4 for the Tiger, a difficult 5 for others.

ter of course

ken and some of his comments were quite provocative. For example, he wrote the following in *Golf Architecture* in 1920: "A good golf course is an asset to a nation. Those who harangue about land being diverted from agriculture and used for golf have little sense of proportion. Comparing the small amount of land utilised for golf with the large amount used for agriculture, we get infinitely more value out of the former than the latter. We all eat too much." As a graduate with degrees in medicine, natural science and chemistry, he would know this better than most! He goes on to say: "The test of a good golf course architect is the power in converting bad inland material into a good course, and not the power of fashioning excellent seaside material into a mediocre one."

After a slump in commissions between 1918 and 1923, Colt set up in business with Alison (also previously a golf club secretary) and J S F Morrison. They worked on commissions throughout the country until 1962, when Morrison died. Alison and Morrison had been involved in contracts as far ranging as the USA, Japan, Australia and Africa.

Sir Guy Campbell, Cecil Hutchison and Stafford Hotchkin were all designing courses in their own right at about the same time, and in 1932 they set up a company purely to specialise in golf course design and consultancy. Campbell and Hutchison were both keen amateur golfers and Hotchkin owned his own Golf Club at Woodhall Spa in Lincolnshire. The course had originally consisted of nine holes, designed by Vardon, with Colt later designed a further nine to extend it to eighteen. Hotchkin bought the course in this completed state and added further revisions with Hutchison's assistance.

Sir Guy, writing in *A History of Golf in Great Britain* in the chapter entitled Links and Courses, defines the three architectural ages as Primitive, ie. natural, Orthodox, from 1848 gutta ball to 1902 rubber core ball, and Mechanical, from 1903 onwards. He claimed that during the Orthodox age

"some of these, almost all of them 'courses' (as opposed to 'links'), outraged nature in every respect. And they are best forgotten". I would tend to disagree with him, for there were notable exceptions: Ganton, Huddersfield, Sheringham, Royston, Royal Worlington and Woking, to name but a few.

From 1947, when the Town and Country Planning Act introduced strict restrictions on developments beyond the areas designated by District Councils, golf course developments were forced to move to sites which were often unsuitable for the style of course which had made Colt, Simpson and Morrison so popular.

It seemed that a second Orthodox Age was beginning, for golf course design really went into a depression. It was the age of building courses on a low budget whilst attempting to achieve high quality results. These courses were supposed to take modern maintenance techniques into account, though the implications of such was not considered in relation to the design of the course. This often meant that big sprawling tees, greens and bunkers were beginning to appear, due in part to the increasing influence of American design and, in particular, the design style of Robert Trent Jones.

Heaths and sandy warrens were no longer available and designers were now forced to turn their attentions to land with stony ground and heavy clay soils. Inevitably, drainage problems began as soon as soil was removed and, invariably though not always, designers had little knowledge of standard drainage techniques. The new courses may have been fine to play during the summer, but in winter they became quagmires and were virtually unplayable and as an alternative, temporary greens and tee-mats would have to be used. This was a time when a number of untrained designers (often ageing golf professionals), stepped in and effectively began a new career.

● Next issue: *The age of the Anglo-American hybrid.*

● The author and golf course architect, Jonathan Gaunt, is a graduate in Landscape Architecture. His recent commissions include the Family Golf Centre, Stevenage, Elemore in Sunderland, the 27 hole Farrington Golf Club, near Bristol, and Breinholtgard in Denmark.

Greenkeeper International examines the relationship between the soil you have and the turf you can expect — and how to improve quality if nature's condition is not ideal

DOWN

by DAVID BOOCOCK

There is a vast range of soil types in the UK dependent on the parent material from which they are derived and influenced by climate and elevation. Other significant factors are the effects of mechanical weathering, ie. expansion and contraction due to heat and cold, erosion and chemical weathering: whereby soluble minerals are released and new minerals created through chemical reactions whilst others become soluble. The whole complex process is influenced by plants and animals, in particular those living within the soil. The process is continuous and certainly does not stop when the material we describe as 'soil' has developed.

Texture

All soils are made up of sand, silt and clay, the relative proportions of which determine soil textural class. Quartz is the usual mineral in sands with particle sizes ranging from 2 mm to 0.05 mm. They have a low surface area to weight ratio (S/WR), minimal chemical activity and low moisture retention. Because sand grains are resistant to further breakdown and compaction, selected grades are frequently used to modify soils.

Silt particles are intermediate in size with limited S/WR and chemical activity. Water retention is high and soils with a high proportion of silt can be weakly structured, thus compacting more readily so that drainage rates suffer.

Clays have a very large S/WR and are active chemically. Water retention is high, although much of this is unavailable to plants. Clay soils are particularly subject to compaction and smearing, which affects drainage rates.

Soil structure

Soil particles are normally arranged into larger aggregates, referred to as soil structure. Clay, and to some extent silt, particles combine through the action of organic matter, colloids, and clay materials to form a granular or crumb like structure. This contributes a great deal to favourable soil conditions for both turf growth and better playing conditions, due to improved drainage via the large pore spaces between soil aggregates.

It is likely that over 90% of the soils we encounter on golf courses rely almost entirely on soil retention for good drainage, aeration, and adequate moisture retention. Such soils can and do perform well in the golf situation, but only whilst structure remains good. Increased golf traffic and essential maintenance operations combine to gradually compact soils, breaking down aggregates and reducing air and water movement. Ultimately, these factors must affect both turf and playing quality that any given soil can support, it having long been appreciated that turf grass species are just as important to year round playing conditions as the drainage properties of the soil.

Links

Over thousands of years grasses have adapted to particular types of soil, depending on drainage, moisture retentive properties and the relative fertility of the soil. Thus on sandy links soil the grass species naturally present are predominantly the finer leaved fescues, both Chewings and creeping reds, together with some browntop bent, creeping bent and other minor species. All are adapted to conditions of free-drainage, good aeration and infertility, where summer drought is part of the yearly cycle.

That such soils are capable of growing excellent turf and can

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