Richard of Wallingford: Abbot of St. Albans, 1326-1335.

THE twenty-eighth Abbot of St. Alban's was a man of outstanding personality, and, despite his humble birth and early death, one of the most eminent men of his age. He was born the son of a working blacksmith; and we are apt to think that, in medieval times, such an one would have had small chance of advancement. But even in those days the Church appears to have had some eye for budding talent, and secured him an Oxford education; enabling him, even in his early manhood, to rise to the position of one of the greatest astronomers, mathematicians and mechanicians of his age and country—a pioneer of those arts and sciences which have developed so marvellously since his day.

The sixth centenary of his election to the high office of Abbot of St. Alban's was celebrated on Saturday, November 27th, 1926, by a gathering of some of our leading scientists—men who were eager to recognise the debt which they owed to their great predecessor. Prominent among these were Sir Frank Dyson, the British Astronomer Royal; Professor H. H. Turner, the Savilian Professor of Astronomy at Oxford; Dr. R. T. Gunther, the Curator of the Ashmolean Museum; Professor Garrod, the Librarian of Merton College; Mr. Percy Webster, the Warden-elect of the Worshipful Company of Clock-makers; Sir Henry Lyons of the South Kensington Science Museum; Mr. E. B. Knobel, Past-President of the Royal Astronomical Society; the Mayor and Town Clerk of Wallingford; the Mayor and Corporation of St. Albans, and many others.

The proceedings opened with a Commemoration Service in the Choir of the Abbey, which was attended by the Mayors and Corporation in their civic robes and by the scientific visitors in Academic costume. One of the features of this service was the recitation by the Dean of St. Albans of an English version of the prayers composed by the deceased Abbot; and at the conclusion of the service a wreath was deposited by the Astronomer

Royal upon the sepulchral slab just within the Altar rails which marks Wallingford's grave.

A meeting was subsequently held in the Town Hall, which was attended by a crowded audience, and at which eloquent tribute was paid by many of the Scientists present to the value of the achievements accomplished by this early pioneer.

The arrangements for the Commemoration were throughout in the hands of a Committee of which the Rev. W. A. Wigram, D.D., was chairman, and to which Mr. E. A. Clear acted as secretary.

The Mayor of St. Albans (Sir Edgar Wigram, Bart.), who took the chair at the meeting, remarked that a few months ago Richard of Wallingford had been little more than a name to him. He knew only that he had been one of their Abbots, that he had been a leper, and that he had been regarded during his lifetime as learned almost to an uncanny degree: but of how great a part he had played in the advancement of Science in his own day, and in transmitting his discoveries to ours, he owned he had previously had no conception. It was to the Scientists of Oxford, and particularly to Dr. R. T. Gunther, that he owed the belated recognition which St. Albans was now according to him.

And perhaps Wallingford himself would not have wished otherwise. His heart must always have been more at Oxford, with his beloved scientific studies, than in the Abbey of St. Albans where he had to become a statesman and a man of affairs. A Scientist, even in our own day, does not look for much recognition from the general public. He is content if his work is known and appreciated in the select circle of his fellow-workers;—more than content if he can carry with him to his grave the consciousness that it will be known and honoured by the generations that shall succeed him. And the first English author of a Treatise on Trigonometry, the first English Astronomer who not only designed and constructed his own instruments, but left such a full description of them behind him that they can be reconstructed to this day from his own sketches and specifications, must have known that there would come a day when his genius would be valued at its true worth.

OPENING REMARKS ON RICHARD OF WALLINGFORD.

By Prof. H. H. Turner, F.R.S.

We are met to do honour to a great Astrologer. I use the word advisedly because I myself represent Astrology in some essentials, and am glad to be chosen to begin the song of praise.

The connection of the Chair of Astronomy at Oxford with New College is comparatively recent, but is a direct consequence of an old injunction laid by William of Wykeham on his Foundation that two of his Fellows should study Medicine; and as a corollary should study Astrology; for it was no use to attempt a cure against the influence of the stars. These words were remembered by the Warden of New College in the latter half of the nineteenth century, when it became necessary to select certain Professors for inclusion among the Fellows. Hence it was but an echo of the past when my eminent assistant, Dr. Fotheringham, undertook to cast the horoscope of an Indian Prince, with a success that was much admired by the native astrologers, whose rules did not contemplate the birth of their prince in Oxford.

But we should scarcely have been here to-day if Richard of Wallingford had been merely an astrologer, however great. He was also an astronomer, a man who was concerned with measures of the stars, and therefore with clocks and calculations, and instruments for aiding the calculations. You will hear those speak who have special knowledge of these appliances; and it needs no words from me to introduce the subject of clocks, now so familiar to all, thanks in some degree to the pioneer work of men like Richard of Wallingford. But perhaps I may offer a word or two by way of explanation to non-mathematicians of the importance of the Rectangulus of which Dr. Gunther will speak—an instrument for facilitating calculation. It requires some experience of calculation to realize how much may depend on a small detail. A good example is afforded by our method of writing figures, which enables us to add columns of figures, carrying the tens to the next column, in a convenient and rapid way. Many of those who do this daily have

never thought how differently they would be placed if we still wrote with the old Roman figures. How would you multiply cxlix by lxxiv? or even add them? Instinctively you would abandon the notation for another before attempting the operation. The change of notation made all the difference to business, as well as to mathematics. Richard of Wallingford made a simple change, not in arithmetic, but in geometry, which is similarly fraught with important consequences. He changed from the curved to the straight, as a method of measuring angles. It is in many ways more convenient to work with flat or straight things rather than curved; we have long used flat maps to represent our Earth's curved surface, in spite of the loss of some faithfulness: and astronomers, who till lately held fast to the spherical shape of the sky in all their calculations, have been induced by the flatness of the photographic plates on which they now make their measurements, to turn their attention to flat or rectangular co-ordinates. Richard of Wallingford made a pioneer change of this kind with his rectangulus: he substituted the straight string of the bow for its circular arc. The "sines" he dealt with represent the straight string, and are possibly so called because the string comes against the archer's bosom (*sinus*). The bow has had developments in more than one direction. In our Anthropological Museum at Oxford, Mr. Balfour has arranged an exhibit shewing how musical instruments have their origin in the twanging of a bowstring which was found to be reinforced by the attachment of a gourd: and how the gourd gradually developed into the body of our fiddles and guitars. Hence the bow takes an honourable place near the fountain head of music. We can scarcely claim that Trigonometry owes as much as Music to the bow, but it is certainly haunted by its image. Richard of Wallingford saw how much easier it is to deal with the straight string than with the curved arc: for the string may be accurately divided in any manner we please, whereas in dividing the curved arc we are hampered by the necessity of remembering the size of the complete circle of which it forms an arc.

Thus was started a notable stream of thought, which has never ceased to flow and to grow. We who stand

by the side of the great river it has now become, and who can drink freely from its waters, are met to-day to throw a pious glance backwards to its tiny beginnings, and to do honour to one of those who had the insight, and the courage, and the faith, to guide its early trickling course.

RICHARD OF WALLINGFORD, THE ABBOT.

By the Rev. W. A. Wigram, D.D.

We honour to-day the greatest "all-round man" on the Roll of the Abbots of St. Alban's; one who was scholar, astronomer, mathematician, mechanic; who, though of lowly birth, rose to be first man of the first abbey of the land, the friend of nobles and of princes—but a leper. Others deal with the pioneer-scientist; I have to speak of the Abbot; one of a series that is, who carries on the lamp given to him for a little, and hands it on the brighter for his bearing.

Born at Wallingford, within sound of that curfew that has never ceased from the days of Norman William to our own, he was the son of a blacksmith of decent status, "whom the poor called rich, and the rich, middle-class"; and it must have been in his father's smithy that the boy learned the skill of metal working that he was to use so well later. Plainly he was a lad of promise, for when he was left an orphan, at the age of ten, he was adopted by the Prior of the local cell of our Abbey, and was sent by him to Oxford, there to study in the "Hall" which the Benedictine abbeys maintained, for the reception of promising students from their local schools. (It was thus, with the erection of lodgings for the reception of lads from certain districts, that the "Colleges" of the English universities began). Richard was then about seventeen, and he was for six years a student at the university, till at the age of twenty-three, he was professed as a monk in the Monastery. It was not without hesitation that he took this step, as he confesses in his prayers; but a monastery—in days when universities were in their infancy—was the only place that gave leisure and plant for learning and art; and ere long Abbot Hugh of Eversden, that "mild and

kindly man," sent him back to College under the ægis of the Abbey. Others deal with his work there.

Eight years later, in 1326, the student was suddenly called, much against his own will, to be a ruler and administrator. Abbot Hugh was dead; and they were troublous days for the abbey which King Edward II had befriended, when that poor king was in Berkeley Castle, and the " She-wolf " and her paramour ruled. Unanimously, the electors chose the Oxford don of thirty-five to the post: and he who had come to the election with the firm conviction that whosoever should be chosen would be the man whom God had called to the work, modestly accepted the task. It was no light work; for poor Abbot Hugh, good easy man, had left the place deep in debt. He had certainly been unlucky, for he had but just finished his Lady Chapel—that gem of " Decorated " architecture that is one of our glories now —when much of the south arcading of the nave fell with a crash, and the burden of rebuilding had to be faced. No wonder that his face, as it looks down from his arches, has a care-worn look! Actually, much of the work we see there to-day is Wallingford's. Hence Abbot Richard started with zeal for economy, and when he had to go to Avignon for papal confirmation, he took but six companions and 30s. for his expenses, and actually managed the whole journey for £15. The " Curia " of Avignon was the scandal of all Christendom just then for its extortions, and the Abbot soon had experience of them. Applauding him to the skies for his apostolic poverty, the Papal Camera discovered flaws, " only curable by long process of law," in his appointment. Richard resigned rather than burden his Abbey, but was at once re-appointed by the Pope, " with fees on the lowest possible scale." This lowest scale, with the needful douceurs, amounted to a total of £953 10s. 11d., say, £20,000 of modern money, or three years gross income of the House! Richard was warned however, that he was lucky to get off with so little, and perhaps he was. His learning had already got him the fame of a magician, and if he had been examined, there is little doubt that his leprosy, soon unmistakeable, would have been detected. Now Pope John XXII, before whom he appeared, had flayed the Bishop of Cahors alive as

a wizard, and had burned all the hapless lepers of Avignon for defiling the springs they drank from. Richard could hardly have escaped both jaws of such a trap. However, he did return safe, and showed himself an admirable abbot, "cautious in prosperity, patient in adversity." It is well that he was not, like a predecessor of his, "entirely ignorant of business as scholars usually are." He strove to reduce the debts of the house, a difficult matter where each of the many departments of the abbey had its own budget and endowment, and also its own power of contracting debts. Further, income was not what it had been. The statute of Mortmain had put a check on legacies to the Church, to the great loss of all. "Not but what we deserve it," says the Chronicler; "it is a judgement on our sloth and ingratitude. We have left off reciting the Athanasian Creed at Morning Prayer." The Abbot set a good example in economy. He refused to live in his own house, and thus was able to apply the whole of its endowment to reduction of debt, the debts of this department alone amounting to £3,000. Let us hope this included the £1,000 borrowed at Avignon. Other heads of departments who would not economize were called sharply to order. Cook, Sacrist, and Almoner sinned in this wise, and they were "put in perpetual silence, with corporal discipline every Wednesday and Friday" (surely a doom hard to reconcile with the order of silence), "whereat there was great sadness in the Abbey." Abbot Richard was a disciplinarian! Naturally there was discontent, and the party against him had a case to urge.

It could no longer be denied that the Abbot was tainted by the horrible disease of Leprosy, from which so many (Robert the Bruce among them) suffered about that time. He was nearly blind of one eye, his face horribly marked—the contemporary portrait shows this mercilessly—and his voice hoarse and painful to listen to. Naturally, the malcontents demanded his deposition, and one Richard of Ildesley was their leader. They appealed to the Papal legate, but the matter came to nothing. The Bishop of Lincoln reported the Abbot "capax officii"; the King was furious at the bringing of a French Pope to interfere in England; and the loyal

monks very nearly lynched the agitator! They were "men of vigour and zeal, albeit zeal not altogether according to knowledge" and Ildesley fairly bolted, "complaining much that the Monks of St. Alban's had not really a good conscience."

Though a pioneer in science, the Abbot was a son of his age in politics, and had accordingly a big dispute with the burgesses of the town of St. Albans. The town was the child of the abbey, under the wall of which it grew; and all of its inhabitants were "natural-born villans" in the "Liberty of Saint Alban," which extended from Barnet and Rickmansworth to Redbourne. Towns had grown up in this land and the Abbot was their Lord by law. He had, of course, no wish to be other than a good Lord, but Lord he would be; while the towns on the other hand craved for self-government, "the villans usurping the title of Burgesses." Hence, there was constant friction; and the *cheval de bataille* was always the Mill-right, which was the Abbot's monopoly. How much they fought over this is clear from a single point of etymology. The term for mill-right, "multure," has come to mean in common talk any exaction that is legal, but unjust! The town had extorted a charter from good easy Abbot Hugh, a grand document in gold and blue, which granted them their own mills, their own assize of bread and beer, their own Mayor and seal, and the right to elect their own M.P.'s. It is true that they had got it by blockading the Abbot in his Abbey, and threatening to burn him and it if he did not grant it! This had been in the troublous days of Edward II, and now they stuck to it, "though it was very expensive." Still, "they thought nothing of that, if they could satisfy their malice." Soon the quarrel blazed up again.

The Abbot's Marshal, says the chronicler, arrested one John the Taverner for his immorality; but when the "villans and the women of the town" resisted, he had to kill his prisoner. On this the townsfolk immediately lynched the Marshal, "killing him openly and feloniously with sticks, stones and forks." Followed appeals to the King, and a grand medley of cross-accusations, till at last his Majesty's judges in Traylebaston had to come down to investigate the whole affair. Abbot

Richard seems to have had some worldly wisdom, for he gave the justices a good dinner and excellent wine as a preliminary, and (whether by virtue of that or the strength of his case) he won all along the line. The Charter had to be surrendered, the town mill-stones given up. (One regrets to report that Wallingford, by way of rubbing the point in, used them to pave his parlour!). The right to elect members was abolished, though nobody cared for that, for they were felt to be merely costly nuisances! The silver seal of the town was handed over, and fixed to the Saint's shrine where every one could see it when he went to pay his devotions! One does not wonder that a later abbot felt it wiser to melt it down, "lest some wicked villan should be tempted to steal it." For the time, the rights of the town were in abeyance; and how deeply the matter was felt appears from what befel in Wat Tyler's day, fifty years later. The first thought of the rebels was to tear up those mill-stones, "and distribute the fragments as relics."

It says much for Wallingford's character, that there seems to have been no personal feeling against him. Indeed the charm of the man was such, that even his leprosy was forgotten by those who spoke with him. Still, the disease sapped his vitality, and at the age of forty-three, he was a dying man. To the last he laboured at his favourite task, the great Clock which he justly regarded as the culmination of his mechanical inventions. "Ought you not to get on with the building of your Church?" said the King to him chaffingly; "Sire, there are plenty who can build a church. If I die, there is none who can finish my clock," said the Abbot;—though he was mistaken for once in the judgement. The shock of a great thunderstorm, when his room was struck by lightning, hastened his end, and on May 25th, 1335, he died, in his forty-fourth year, "having completed scarce half the ordinary span of man's life."

The greatest genius among the abbots of Saint Alban, and a man whose own personal character is shewn in the private prayers in which we joined a while ago; we his heirs in science and in religion join to do him honour.

RICHARD OF WALLINGFORD'S CONNECTION WITH MERTON COLLEGE, OXFORD.

By Professor H. W. Garrod.

One of the Regulations of the English Benedictines in mediæval days required that each of the greater Houses should maintain a certain number of its younger monks as students at Oxford, in order to ensure that their learning should not grow too stale. Most of these students were housed in a special Benedictine Hostel called Gloucester Hall, which was later incorporated in Worcester College; but a very strong tradition connects the name of Richard of Wallingford with Merton College, which was famous in the early fourteenth century for the eminence of its astronomers and mathematicians.

The name of Richard Wallingford, or "Richard of St. Alban's," stands second in the oldest List of Fellows which the College possesses. But this evidence is not quite conclusive; for this List was not compiled till nearly a century after Wallingford's death, and his name in it appears to be substituted for another. On close examination there is reason to believe that the name was originally "Robert," and that this has been partially erased and "Richard" inserted instead.

Now "Robert of St. Alban's" is a name which occurs quite frequently in thirteenth century documents in the possession of the College; and, though I have searched through every document in the College contemporary with Richard of Wallingford, I have been unable to find his anywhere except in this old catalogue. It looks as though the College writer, some time early in the fifteenth century, knowing the strong tradition that Richard had been a Fellow of the College, had "corrected" what he thought to be an error of the previous copyist by substituting the name of Richard, which he knew well, for the Robert of which he knew nothing.

Yet this very reason, which causes us to reject the documentary evidence as unreliable, gives us good ground for believing that the tradition that Richard had been a Fellow of Merton was already well established within a century of his death.

It is recorded that Richard of Wallingford gave a number of books to the College. But to-day the College Library contains no books of his at all. But it does not of course follow that the Library did not contain them at the time that the catalogue was made; for a great destruction of books took place there during the reign of Edward VI, and most of the works of the Merton School of Astronomers disappeared at about that period.

I may mention that, while searching through these records, I found that the College possessed a clock as early as 1288, as proved by the accounts for repairing it. This I think must have been one of the first clocks seen in England, and may have helped to inspire Wallingford in designing and constructing that much more elaborate clock which is now associated with his name.

EARLY CLOCKS AND HOROLOGES.

RICHARD OF WALLINGFORD'S CLOCK.

By R. P. Howgrave-Graham, M.I.E.E.

The universal use of the word horologe, which is said to have as many as twenty variations of form in English alone, has raised almost insuperable difficulties for students of the early history of clocks, for a horologium may be a sundial, a water-clock, or a true weight-driven clock with a balance, pendulum, or other vibratory part.

Recent investigations throw doubt upon almost the whole of the commonly accepted views as to the earliest appearance of genuine clocks in Europe and in England.

The question is fully dealt with in a paper now in the hands of the Society of Antiquaries of London, and, although much still remains very doubtful, the evidence presents a strong case for believing that no piece of work connected with a clock earlier than about 1390 remains in any English church or public building.

On the Continent mechanical calling devices seem to have been in use as early as A.D. 1120 for waking officials of monasteries so that they could rouse the brethren for Matins, but even here the view is held by some that water-clocks could and did perform this office.

There is much to be said for the theory that true clocks appeared first in Italy very early in the fourteenth century, and spread across Europe during about fifty years.

References in Dante's *Paradiso* are very clear, and have the added interest that their date can be closely fixed. Dr. Philip Wicksteed has told me that a letter exists proving that Dante had not written the *Paradiso* in 1318, so that these references lie between 1318 and 1321, when he died. The first is :—

> "Then as a horologe that calleth us
> What time the Bride of God is rising up,
> Wherein one part the other draws and urges,
> Ting! ting! resounding with so sweet a note,
> That swells with love the spirit well disposed."

The Italian *tin tin sonando* is clearly imitative, and its special interest is its strong suggestion of a small portable clock. The other reference is :—

> "And as the wheels in works of horologes
> Revolve so that the first to the beholder
> Motionless seems, and the last one to fly."

In view of Dante's general method in referring to common sights and familiar objects it is difficult to avoid the conclusion that clocks were so well known to his readers that his similes would be widely appreciated.

Whatever may have been the motive power and the restraining mechanism in early clocks we may, perhaps, divide the successive improvements in their aim and purpose into two groups; the first is likely to have been accomplished before the death of Abbot Wallingford :—

(1). Arrangements for automatically striking all the canonical hours of the church in addition to the mere sounding of an alarm or call-bell.

(2). The introduction of the twenty-four hour division of the day, with the corresponding striking mechanism and the use of dials.

(3). The use of quarter-striking mechanism and, later, of quarter-hour dials, and (very late) of minute dials.

Towards the end of the fourteenth century the writings of Chaucer, Froissart, and Dafydd ap Gwilym show that clocks were familiar objects in France and England, but the difficulty as to their first appearance in this country is extreme.

Mr. G. H. Baillie, who has made extensive documentary investigations, believes that all horologes in England were water-clocks or similar devices until Edward III introduced three Dutch horologers in 1368. Proof of this would be a severe shock to masses of old theory and tradition, and, though there is much to be said for it, there remain some facts which support an earlier date for weight-driven clocks.

Two noteworthy groups of facts seem to provide opposing arguments. The first is that unimpeachable records prove the erection, within only about ten years, of a group of horologes at the close of the thirteenth century, when there is evidence of the employment of men whose profession it was to make and attend to them. "Bartholomeus Orologararius" had a loaf a day for keeping St. Paul's clock in 1286. Prior Henry of Eastry erected a great clock at Christchurch, Canterbury, in 1292—"Novum Orologium magnum in ecclesia." The Chapter of another cathedral employed a "campanistarius," or bell-founder, to repair the "organa" and "orologium" in 1284.

Prof. Garrod has supplied a reference[1] to yet another early horologe, of 1288, discovered by him in the records of Merton College during his search for references to our Abbot.

Are we to suppose that a "great horologe" and one requiring a keeper were mere water-clocks, even of an elaborate kind?

An opposing fact is that no reference is known in which the word "clock" is used until 1371, when the burghers of Gloucester received a concession of land for a clock-tower, the clock being described as "clok vulgarit nuncupatur." In the same year workmen at York were to work "if it be all werkday other elles till it be hegh none smytyn by the clocke."

The air of familiarity about both these extracts, however, makes it a little difficult to believe that England was clockless only three years previously.

I have the strongest reasons for believing that there are no actual remains of English clocks earlier than the end of the fourteenth century, and, in passing, may mention that recent investigations seem to sweep away the

[1] See p. 231.

whole deeply-rooted popular legend which assigns important west-country astronomical clocks to the Glastonbury monk, Peter Lightfoot.

This brings us to the condition of astronomical knowledge in the year of Richard Wallingford's abbacy.

By about 1254 the Church's ban on Aristotelian doctrines of cosmology had broken down, and soon gave place to ecclesiastical encouragement. The doctrine of Homocentric Spheres gradually lost favour, and was replaced by the Ptolemaic theory of Epicycles and Eccentrics, which had filtered through Arabian literature and provided a fair explanation of the apparent motions of the heavenly bodies. Indeed the modern relativist might claim equal truth for the Ptolemaic and the Copernican or heliocentric cosmologies. The Ptolemaic theory was popularized by Johannes de Sacro Bosco, or John of Holywood, who died in 1256, whose widely read books exist in numerous manuscripts[2].

Though the four astronomical clocks at Wells, Exeter, Ottery St. Mary and Wimborne show no attempt to represent epicyclic motion, they do show the apparent motion of the Moon round the Earth, and the waxing and waning of the former once in the synodic period of twenty-nine and half days. The usual description of these clocks as showing the Ptolemaic system is scarcely correct, for they merely show a geocentric system in which the planetary motions are ignored, the Primum Mobile and the Empyrean heavens of Dante and his world being omitted.

As regards Wallingford's clock at St. Alban's the most important reference in the *Gesta Abbatium Monasterii Sancti Albani* may be translated thus:—" He also constructed at great expense and with much skill the noble work, the horologe (*nobile opus horologii*), in our church."

It is important that a clock was under construction at the end of the abbacy of Thomas de la Mare, 1349-96, and is thus described:—" At the expense of the Abbot and by the skill and industry of Master ' Laurentius de Stokes ' a celebrated clockmaker (*horologiarius*) and of a certain brother monk of his called ' Willelmus Wal-

[2] One of these was exhibited by Mr. Howgrave-Graham at the meeting.

sham' who had perfected themselves in almost all departments of craftmanship and dexterity of carving, the upper dial and wheel of fortune were admirably completed, having been originally set up through the agency of Abbot Richard but delayed on account of his sudden death and other more pressing expenses. On account of its size and the intricacy of the work the costs were estimated at more than 100 marks."

The interesting points about these documents are that the clock was clearly a large and magnificent thing, that it had a wheel of fortune, a favourite subject for pictures in the Middle Ages, but in this case probably an automaton, and that in de la Mare's abbacy it is definitely stated to have been begun by Wallingford and finished by the later craftsmen.

It is possible, but not highly likely, that Wallingford's horologe was a water-clock and was changed to a balance-and-weight clock at the later date, and it is alternatively possible that de la Mare's men completed it as a water-clock, especially if their work was done in the earlier years of his abbacy; the point will probably never be settled.

Of one thing we may be almost certain, that no clock of Wallingford's period from St. Alban's Abbey survives, or at any rate has been discovered.

Little light is likely to be thrown upon the nature of his horologe, and it is unfortunate that it has been confused with his scientific instruments. From the horological point of view his work will probably remain unexplained and unrepresented by any tangible remains.

WALLINGFORD'S SCIENTIFIC INSTRUMENTS.

By Dr. Robert T. Gunther.

I am privileged to address you to-day, because like your great man of Science six hundred years ago, I am interested in scientific instruments. Indeed, I am advising all and sundry to imitate Richard of Wallingford, and acquire a like taste, because I have discovered that these tools always lead one into the best of company.

One of the chief uses to which early instruments were

put was to determine the time, the relative positions of the planets, and the dates in the Calendar. A week or so ago, the papers were full of suggestions for Calendar reforms, strongly advocated by those who want to have Easter fixed. On this the Astronomer Royal wrote that the way is now clear for legislative action. Someone replied to him that for Parliament to fix Easter would be an impossibility, because Easter is solely a Church festival; and asked sarcastically, "Shall we next read that the Royal Society is pressing the Home Secretary to summon a noted physicist to Whitehall; and there, by his own act, to make that gentleman a Bishop?" Why not? If we turn the Keeper of the King's Astronomical Instruments into an Archbishop of Canterbury, the Calendar can be reformed and Easter fixed with the greatest ease. Now that is what used to happen in the days of Richard of Wallingford. The right and mathematical understanding of the Calendar was one of the most important duties of a high ecclesiastic, which explains why their ranks were recruited from the senior wranglers of those days. William Rede, author of "Astronomical Tables," became Bishop of Chichester; Thomas Bradwardine, the greatest mathematician of his day, became Archbishop of Canterbury; Cuthbert Tunstall, editor of the works of Richard of Wallingford, became Bishop of Durham; and Richard of Wallingford became your Abbot at St. Albans.

There were no silly squabbles then between so-called science and religion, for the protagonists were both Professors of Science and Bishops at once. Richard combined all science and all religion in his day. He was himself an "All-in-one." Our present discontents arise from over-specialization and separation of duties.

We claim then that scientific instruments, by which a man learned in the stars can settle knotty points in the calendar, and become also Abbot of St. Alban's, deserve a few moments' consideration to-day.

Among the Abbot's own books which have been preserved to us, two describe instruments, namely the Rectangulus, and the Albion, dating 1326-27. Both are important, but the treatise on the Rectangulus specially so, for it was an astronomical instrument for making observations and for measuring angles by a

trigonometrical method. Professor Turner has told us how important the first steps in trigonometry were for his science. The Rectangulus was used to measure angles between the planets, and other heavenly bodies. Richard made it, because he found certain objections to the use of the older instruments (the Armillary Sphere, the Astrolabe, and the Torquetum) and so set to work to design an entirely new instrument.

We honour him here to-day, because his work was the first written by an Englishman on "How to make a scientific instrument." It has given rise to a countless progeny. As our first constructive manual, it stands in the same relation to man's education that the first cookery book stands—or should stand—to the education of a woman, and that is an achievement of which Oxford and St. Albans may justly be proud.

It followed not unnaturally that the writer of such books became the founder of an important school of astronomer-physicians; and through their labours the Oxford of the fourteenth century took the place of the University of Paris in the thirteenth century, as the leading seat of instruction in Europe.

To Oxford's superiority we have the testimony of Roger Bacon when he deplored the amount of time that was wasted on mathematical study. He said that he had given up forty years to that subject, but that the entire ground could have been covered in from three to six months. He attributed his poor progress to the four defects of the teachers of Paris at that time, to "their infinite and puerile vanity, their ineffable falsity, their voluminous superfluity, and their omission of all that is worthy." It is due to Richard of Wallingford and his school that a higher standard came to prevail at Oxford in the next century; and their learning was due to the scientific trend of their minds, and was in part based on the use of instruments.

I suppose that in no other case in the world would it be possible to commemorate a savant of the fourteenth century, in the town in which he lies buried, by bringing together almost contemporary instruments, portraits, and if need had been, the writings and correspondence of people whom he had known, and who were his disciples.

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Dr. Gunther exhibited and explained the following manuscripts and instruments, mostly derived from the Lewis Evans collection of Historic Scientific instruments in the Old Ashmolean Museum in Oxford :—

RICHARD OF WALLINGFORD'S INVENTIONS.

1. "Rectangulus." A model constructed in 1926, from Wallingford's own dated and illustrated description of 1326.
2. "Albion." Facsimiles of the manuscript description of 1327, with figures on the dials of which the instrument was composed.
3. "Horologium." Photograph of the Miniature in the illuminated manuscript, showing Richard of Wallingford pointing to his "Horologium," which is usually interpreted as the St. Albans Clock.

INSTRUMENTS CONTEMPORARY WITH RICHARD OF WALLINGFORD.

4. Astrolabe, bequeathed to Oriel College by Simon Bredon, circ. 1340.
5. Quadrant. Of the type known as the "Old Quadrant of John of Montpellier," 1310.
6. Quadrant. Of the type known as the new quadrant of Profacius, circ. 1310. (Photograph).
7. Semersis. Circ. 1350. (Model).
8. Torquetum. Circ. 1350. (Model).
9. Armillary Sphere. Circ. 1272. (Drawing).

(*Our thanks are due to the speakers who have kindly given us permission to place on record in our Transactions the above addresses, delivered by them at the Meeting*).

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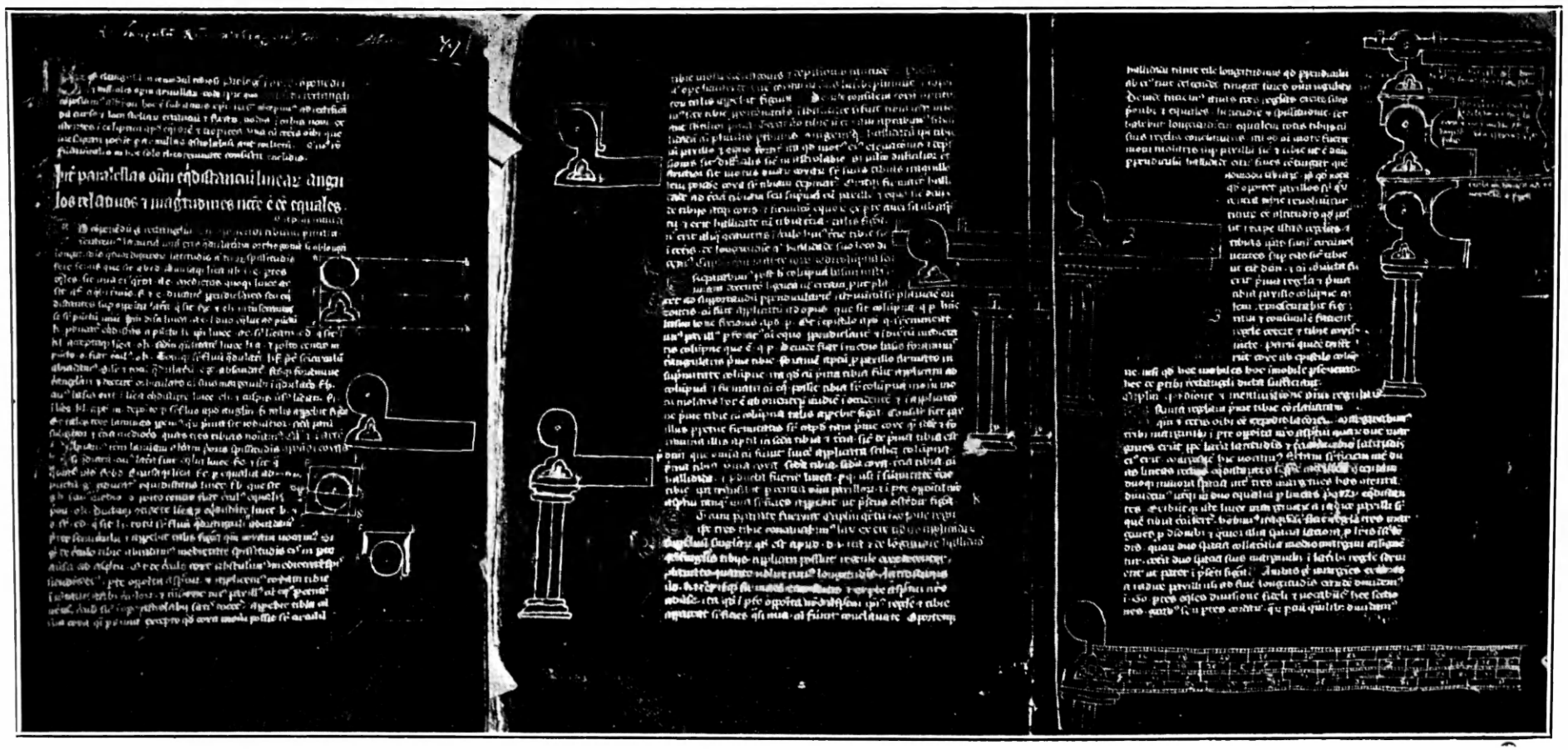
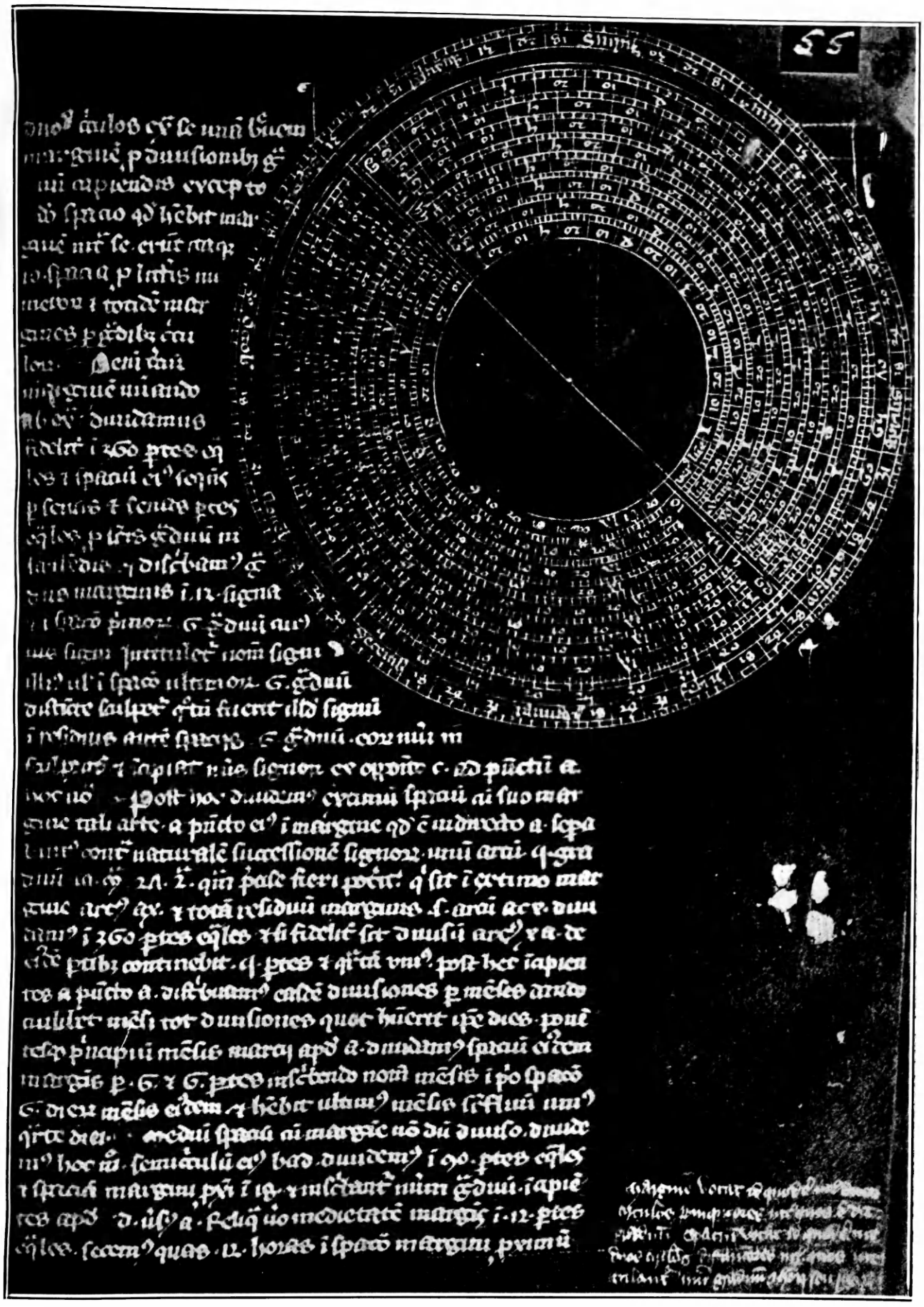


Description of the Rectangulus,
with sketches in margins.



Description of the Albion,
with sketch of one of the dials.

It is felt that it would be a worthy commemoration of a great St. Albans man, who was also one of the first of English men of Science, if, as a result of the interest now aroused in his memory, his existing works were put in an accessible form. These works, of which the principal are the "Rectangulus," the "Albion," and his astrological treatise, the "Prognosticatio," exist in manuscript at Oxford, and have been to some extent embodied in Dr. Gunther's "Early Science in Oxford." Scholars are now producing a text and translation of the works of Wallingford, with an introduction dealing with his life, and the condition of Oxford at the time.

The result will be a unique specimen of a scientific work of the fourteenth century, and a worthy memorial of a great man.

Names of those wishing to subscribe should be sent to the Rev. W. A. Wigram, D.D., Watling House, St. Albans. The volume is expected to be ready in the autumn of 1927 at the price of £1 1s. 0d., which will be payable when the book is delivered.