The Manchester Literary and Philosophical Society.

By C. L. BARNES, Honorary Librarian.

THE centenary of a society being by common consent an occasion for pride, encouragement, and hopeful anticipation, it follows that at a sesqui-centenary these accompaniments should enjoy a proportionate increase. With this advantage in prospect, the Manchester Literary and Philosophical Society, founded in February 1781, will celebrate its one hundred and fiftieth anniversary on Tuesday, Mar. 17, when Sir J. J. Thomson—himself a native of Manchester and an alumnus of Owens College—will deliver an address at 4 P.M. in the Athenæum Hall. An honorary member since 1895, he will be presented with the Society's Dalton Medal, the last award of which was made in 1919 to Lord Rutherford, who, but for the call to Cambridge, would have been president for that and the following year. There will be a dinner the same evening in the Midland Hotel at 8 P.M. During the week, after Tuesday, the Society's house, No. 36 George Street, will be open to visitors from about 11 A.M. to 5 P.M.

The Society is one of the oldest of its kind in existence. Excluding the Royal Society, and various State-aided academies in Continental capitals, which are not on the same footing, there are less than half a dozen provincial scientific societies in the world with so long a history. The house, purchased in 1799, has externally an old-world appearance, with pillars in front and a porch, finely panelled in mahogany. Internally it is most attractive, and preserves an atmosphere of studious calm in a district long ago given up to commercial activities. There are portraits in oils of Newton and Davy—copies of those in possession of the Royal Society—of Percival, Dalton, Joule, and other past presidents: marble, bronze, and plaster busts; and a large number of engraved portraits or photographs of distinguished men of science.

Of Dalton relics the Society has an unequalled collection. Here are to be seen nearly all the crude chemical apparatus with which he worked; his meteorological observations, begun at Kendal, and continued for more than fifty years; many MSS. of his papers; an orrery, a planetarium, and electrical appliances; his medals, including the Copley Medal of the Royal Society; and a few articles of personal property.

Dalton came to Manchester in 1793, as 'professor' of mathematics—in which he had some skill—at the then new Manchester Academy. He joined the Society in 1794, and read more than a hundred papers during his half-century of membership. From 1816 until 1844 he was president, but had previously filled almost all the other offices. He supplemented an exiguous income by taking pupils (at 1s. 6d. a lesson), by lecturing, and writing books. One on "The Elements of English Grammar" (1801) is said to have given him special satisfaction. Though none but caretakers ever lived in the house, Dalton was allowed the

free use of a room in it, and a marble tablet commemorates the fact that here, out of his experiments and cogitations, the atomic theory was developed.

One of Dalton's pupils, though a paralytic stroke brought the tuition to a premature end, was James Prescott Joule, who worthily upheld the Society's prestige for about thirty years after Dalton's death in 1844. Two of the thermometers, with very large bulbs, very narrow bores, and nearly a yard long, used by Joule in his researches, are still carefully preserved, and when compared with a standard Tonnelot thermometer by Sir Arthur Schuster, about forty years ago, were found to be surprisingly accurate.*

The Society found a liberal benefactor in Dr. Henry Wilde, whose name is inseparably associated with the dynamo. He enlarged, improved, and strengthened the premises, and provided a substantial endowment.

Though these three names are more closely connected with the Society's history than any others, the bond between it and Owens College, afterwards the Victoria University of Manchester, which began in 1851, has always been very close. Among presidents from one or other of these bodies may be mentioned Roscoe, Crawford Williamson, Balfour Stewart, Sir Horace Lamb, Osborne Reynolds, Sir W. Boyd Dawkins, H. B. Dixon, F. E. Weiss, Elliot Smith, S. J. Hickson, Sir Henry Miers, and W. L. Bragg.

Nor have distinguished non-academic members been wanting. To dive into the past for a moment, Dr. Thomas Percival, M.D., F.R.S., the leading spirit among the founders, and president for several years, was a friend and correspondent of Benjamin Franklin, two of whose communications, on meteorological matters, were read in 1784. The Rev. William Gaskell, whose sterling merits have been eclipsed by his wife's greater fame, was a member; and William Sturgeon, inventor of the electro-magnet; also William Henry (Dalton and Henry's law is still on the chemist's statute-book), Stanley Jevons, and James Nasmyth, of steam-hammer fame. To these may be added the Rev. T. P. Kirkman (a distinguished mathematician whose name recalls the problem of the fifteen school-girls), John Hopkinson, Sir Joseph Petavel, and H. J. G. Moseley, whose untimely death in the War is still mourned; and even so the list is incomplete. It is worthy of note that Eaton Hodgkinson and Sir W. Fairbairn, both presidents in their day, were the two upon whom Robert Stephenson chiefly relied when planning the Britannia and Conway tubular bridges; one worked out the calculations, the

* The secular rise in the freezing-point of these instruments was examined both by Joule and Schuster. A more recent test by Dr. J. R. Ashworth (*Journal of Scientific Instruments*, Nov. 1930) shows that in the principal thermometer the reading is 15.48 of the arbitrary scale-divisions, or 0.66° C. higher than in 1844: it appears to be approaching a limit exponentially.

other provided the metal work. In more recent times, R. D. Darbishire, Sir W. Bailey, Charles Bailey, Cosmo Melvill, and Dr. H. Levinstein have occupied the chair. Mr. C. E. Stromeyer has held office since 1929.

The Society issues an annual volume of *Memoirs and Proceedings*, and many valuable papers are enshrined therein, as is testified by their inclusion in the Royal Society's catalogue.

A special lecture, to which a premium is attached, is given once a year, and such men as Sir George Stokes, Sir Michael Foster, Sir William Ramsay, Dr. Elie Metschnikoff, Prof. F. Soddy, the late Lord Rayleigh, Sir Joseph Larmor, Sir Charles Parsons, Sir William Bragg, and others of

equal note, have responded to the Society's invitation. Sir J. J. Thomson's name is still to be added.

No mention of the Society would be complete without a reference to its library of 44,000 volumes, consisting mainly of the transactions of other scientific societies and institutions throughout the world. These have been acquired by purchase or exchange over a very long period, and in most cases are complete, or nearly so. The library is an outlier in connexion with the National Central Library.

It is hoped by this celebration to extend the Society's influence and membership, and to make more widely known a record of which it has every reason to be proud.

Experiments in Locomotive Design.

IN a paper on "High-Pressure Locomotives", read before a crowded meeting of the Institution of Mechanical Engineers on Jan. 23, Mr. H. N. Gresley, the chief mechanical engineer of the London and North-Eastern Railway, gave an account of the various high-pressure locomotives constructed in the United States, Germany, Switzerland, and England since 1924. Prefacing his remarks by observing that at no time during the history of the steam locomotive have such radical changes been introduced as during the past ten years, he said that in Great Britain alone there are 23,000 locomotives, on which a sum of £45,000,000 per annum is expended on maintenance, renewal, and running. About 25 per cent of this is the cost of fuel and another 25 per cent the cost of maintenance and renewal. It will be noted that the expense in maintaining locomotives is equal to the cost of the great quantity of coal they consume. From this it is clear that there is a wide field for economy if both the cost of fuel and maintenance can be reduced.

In locomotives with the type of boiler as developed from that incorporated in the *Rocket* by Stephenson, boiler pressures up to 325 lb. per sq. in. have been experimented with, but 250 lb. per sq. in. is approximately the maximum pressure which can be carried in such boilers, having regard to the cost of maintenance. It took a hundred years to increase the pressure from 50 lb. to 250 lb., but during the last few years pressures have leapt up to 450 lb., 900 lb., and even 1700 lb. But while high steam pressure gives greater economy in fuel consumption, it demands complications in design, and care has to be taken that the economies in fuel are not absorbed in the increased cost of maintenance of the boiler and of the machine as a whole. In all the latest high-pressure locomotives, reciprocating engines have been adopted and the use of a compound engine or of a uniflow engine is essential. Two-, three-, or four-cylinder compound engines have all been used in one or other of the engines described.

In the United States, the Delaware and Hudson Railway in 1924 built a main line locomotive with 325 lb. pressure with a two-cylinder compound engine. This locomotive, named the *Horatio Allen*,

was followed by the *John B. Jervis* (1927) with 400 lb. pressure and the *James Archbald* (1930) with 500 lb. pressure. The weight of these engines is between 150 and 160 tons. In all three locomotives the barrel portion of the boiler differs little from the usual type. The firebox, however, is formed by flat front and back water spaces joined by four circular drums—two upper and two lower. At the two sides of the firebox space are water tubes connecting the upper and lower drums, while the roof of the firebox is formed of tubes joining the front and back water spaces. With this type of boiler about one-third of the evaporative heating surface is in the firebox, instead of only about one-tenth as in the ordinary boiler. Superheaters are used giving a steam temperature of 700°–750° F.

The German engines are known respectively as the Schmidt-Henschel three-cylinder compound locomotive and the Schwartzkopff-Löffler three-cylinder locomotive. The first Schmidt-Henschel locomotive was built in 1926, and since then four others have been completed or are under construction. The high-pressure locomotive of the London, Midland, and Scottish Railway is of this type. Four of the engines work with steam at 850 lb. and the other at 900 lb. The boilers of these locomotives consist of two—or, perhaps more correctly, three—distinct parts. Steam for use in the cylinders is generated in two separate boilers working at 850 lb. and 200 lb. respectively, but the greatest novelty in the arrangement consists of the method of heating the high-pressure boiler. All around the firebox are water tubes which are connected to elements in the high-pressure boiler, the elements and the tubes forming a closed circuit partially filled with distilled water. Owing to the heat of the fire, saturated steam is generated in this circuit at 1200–1600 lb. pressure, and this very high pressure steam is used as a medium for heating the water in the high-pressure boiler. One advantage of this arrangement is that, owing to the use of distilled water, there is no scaling or corrosion to cause overheating of the tubes. The weight of the first Schmidt-Henschel locomotive was only 91 tons, but one now under construction for the Canadian Pacific Railway will have a weight of 206 tons.