alty Manual for Deviations of the Compass," who knew the difficulties of that work for his fellow-seamen, should wish to present the subject, on which he had worked so long, in an elementary form more suitable to their every-day requirements. Evans therefore, in 1870, published his " Elementary Manual for Deviations of the Compass," a work which has been very well received by the nautical world, and has been translated into various European languages.

With the exception of some papers read at certain meetings of the British Association, and two lectures read at the Royal United Service Institution in 1865 and 1872, Evans subsequently relaxed his personal investigations into the magnetism of iron ships, and turned more to terrestrial magnetism.

Thus, in 1872, he contributed a paper to the Royal Society, on the magnetic declination in the British Islands, and compiled the magnetical instructions for the voyage of H.M.S. *Challenger*, being again assisted in this, and for the last time, by his old fellow-labourer, Archibald Smith.

Lastly, in 1878, Evans read an able and instructive lecture, on the magnetism of the earth, before the Geographical Society, showing the distribution and direction of the earth's magnetic force and the changes in its elements as then known.

Capt. Evans was elected a Fellow of the Royal Society in 1862. He sat for many years on its Council, and was more than once a Vice-President. He was also a Fellow of the Royal Astronomical and Geographical Societies; he served for many years as member of the Meteorological Committee of the Royal Society, and on the change in the constitution of that body became a member of its Council.

In recognition of his public services the Companionship of the Bath was conferred upon him in 1873, and in 1881 he was advanced to the Commandership of the same order.

Sir Frederick Evans's last public service after his retirement from the Admiralty in 1884 was as the British Delegate at the Congress of Washington for the establishment of a prime meridian and questions kindred to it.

JOHN MORRIS

PROFESSOR JOHN MORRIS died on Thursday, January 7, having been laid aside by illness for several months. Born at Homerton in 1810, he spent almost the whole of his life in or near London. For many years a pharmaceutical chemist at Kensington, he passed all his spare time in exploring the neighbourhood of the metropolis and in collecting from field and book the great store of geological knowledge which was one of his especial characteristics. But science claimed more and more of his time, and at last he abandoned business entirely. In 1855 he was appointed Professor of Geology at University College, London, which post he held till 1877, when he was succeeded by Prof. Bonney. In 1878 the honorary degree of M.A. was conferred upon him by the University of Cambridge.

Morris was elected a Fellow of the Geological Society in 1845, and, whilst in health, was a constant attendant at its meetings. He received the first Lyell Medal in 1876, and has four times received the Wollaston Donation Fund. In the Geologists' Association he has been an earnest worker, having been twice its President, and always one of the foremost leaders at its excursions.

The earliest publication by Prof. Morris was " Observations on the Strata near Woolwich," in the *Magazine of Natural History* for 1835. Most of his own descriptive papers refer to the south-east of England and in the Oolitic districts, but in association with others he has done important work elsewhere. His paper with Murchison, " On the Palæozoic and their Associated Rocks of the Thüringerwald and the Harz," read before the Geological Society in 1855, is still one of the best accounts of those districts in the English language. He was joint-author with Dr. Lycett of an important monograph for the Palæontographical Society on the Oolitic Mollusca.

Considering the enormous amount of information stored in Morris's mind, one is surprised that comparatively so little original work came from his pen, and especially that so few species of fossils except those of the Great Oolite bear his name as their author. For this, however, we may perhaps be thankful; he may have been equally well employed in reducing the number of those already in use. This he did to good purpose in his " Catalogue of British Fossils," the first edition of which was published in 1843, the second in 1854. From that date onwards he was engaged in collecting materials for a third edition, which unfortunately he did not complete. Every working geologist and palæontologist has made constant use of this book, and those who have used it most best know the vast amount of labour which its preparation entailed. It is not a mere list, compiled from various authors; but nearly every species has been critically examined and the synonymy carefully traced.

Fond of conversation, a ready and pleasing public speaker, Morris was always glad to impart his knowledge to others. This knowledge was varied and exact; minerals, rocks, and fossils were equally familiar to him, and he was well read in the wider questions of physical geology.

He was held in high regard by all who knew him; and those who gathered around his grave at Kensal Green came to pay the tribute of personal friendship not less than that of admiration for scientific worth.

DISTRIBUTION OF DRIVING-POWER IN LABORATORIES

A NOVEL arrangement has been adopted at the Physiological Laboratory at Cambridge, and at the Owens College, Manchester, for driving instruments in various rooms by means of a central motor. At the Brown Institution shafting has been used for the same purpose. This method is commonly used for driving machines which require a good deal of power, but it is not suitable for laboratories where the power is often required in many rooms, on different floors and some distance apart, thus causing great complication in the fittings. Again, when shafting is used, the instrument to be driven must be placed opposite a pulley on the shaft; in the arrangement about to be described, the instrument may be moved to any part of the tables, and the tables can be fixed in any part of the rooms.

We will now describe in detail the arrangement as applied in the Laboratory at Cambridge. The motor is an Otto gas-engine. It was found most convenient to place it in the cellar.

In Fig. 1 a pulley, B, fixed to a short length of shafting, is driven by a cord from the fly-wheel of the gas-engine, shown at A. The small pulleys at C are necessary to guide the cord in the required direction. This direction is vertical, hence no sag can compensate for changes of length due to stretching and the varying moisture of the atmosphere. The following arrangement was therefore adopted. Two grooves are turned in the pulley B, over which the cord passes twice, having between the first and second time passed under a pulley which supports a weight, W. Thus, the only effect of a change of length in the cord is to raise or lower the weight.

The short length of shafting driven in this manner by the pulley B is used to distribute the power to various rooms. A cord runs to each room, and forms a separate system, which can be stopped or started independently. This is done in the following manner. Fig. 2 shows a side view of the shafting, to which a number of pulleys are fixed. One of these, E, drives a second pulley, F, which is supported by a frame turning about a pivot, G. The pulley F has three grooves in it. A short leather band passes round the centre groove and round the pulley E; thus, if the centres of the pulleys E and F are brought together, the leather band which receives its motion from E will slip round F without driving it; but on the other hand, if the centres are pulled apart, F will be driven. When the cord H is pulled, the centres are brought together, and when released, a weight, K, gives the necessary

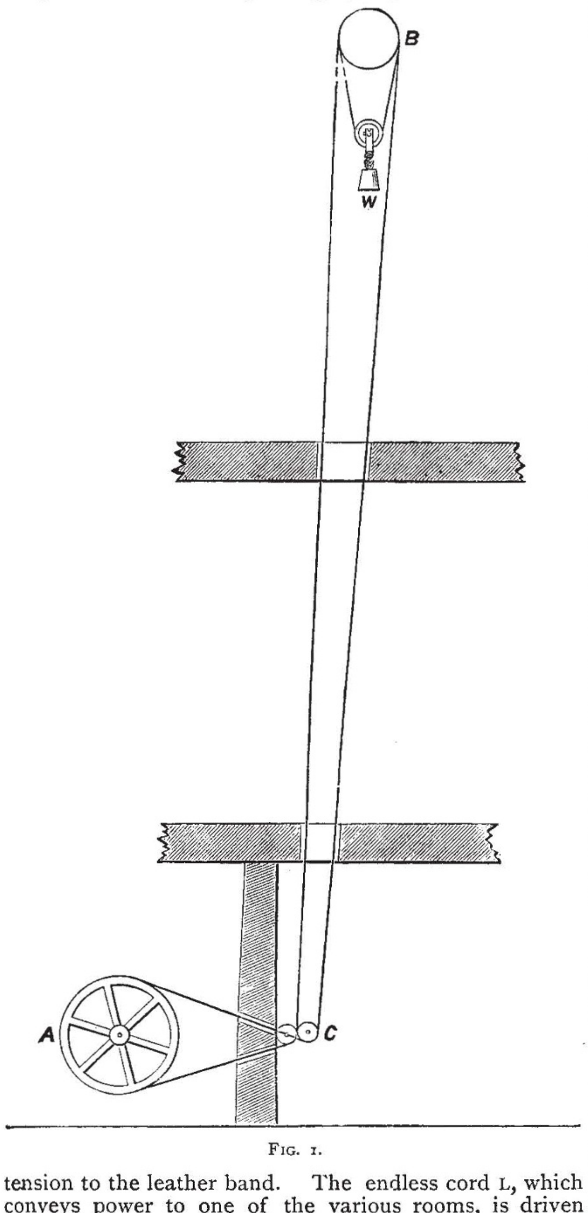

FIG. 1.

tension to the leather band. The endless cord L, which conveys power to one of the various rooms, is driven by the pulley F. This arrangement is something like that adopted for connecting the fly-wheel of the gas-engine with the shafting. The cord L first passes three-quarters of a turn round one of the grooves in the pulley F, under the pulley, M, which supports the weight K, and a quarter of a turn round the other groove of the pulley F. The cord then passes away in a horizontal direction, and is guided by pulleys round angles, either in a vertical or horizontal plane, to the rooms where the power is required. It is then guided in the same manner along the edge of each of the tables on which the instruments are to stand. The weight K, besides giving the necessary tension to the leather band, will take up all slack in the cord L. The cord runs near the ceiling, and is either led over pulleys and down to the tables in the rooms, or up through the ceiling to tables standing on the floor above.

The power is transmitted as follows to the instruments standing on the table from the cord running along its edge. Fig. 3 shows a piece of apparatus designed for this purpose, which has been called a driving-pulley. It is clamped to the edge of the table, and the cord is then made to pass round the pulley, P, as shown. This has the effect of raising the weight K, Fig. 2. The instruments are driven by a light cotton band passing round one of two grooves in a pulley fixed to the same spindle as the pulley P. The larger of the grooves is shown at Q, the smaller is not visible in the figure. The band is kept tight by means of a pulley and a weight, in the manner previously described; this arrangement also allows the

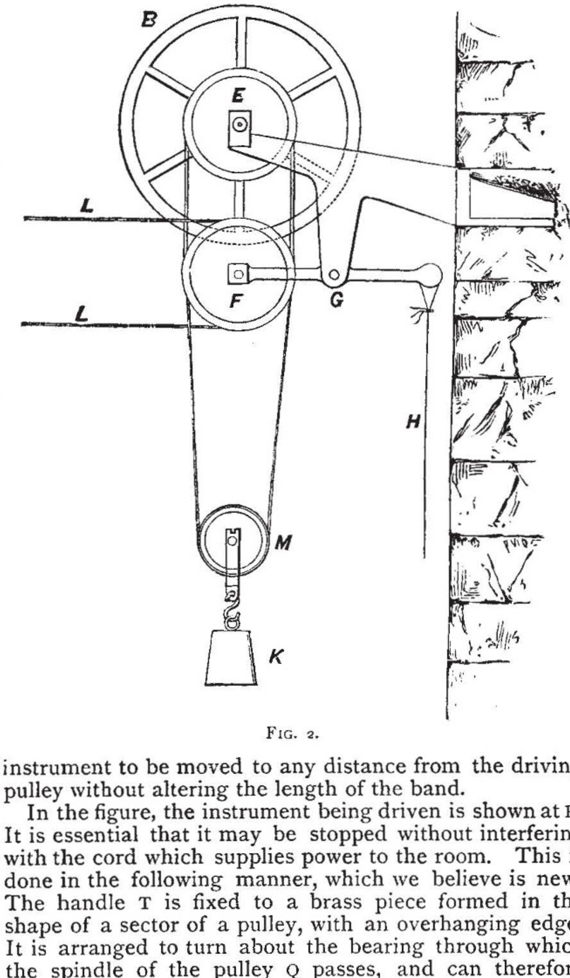

FIG. 2.

instrument to be moved to any distance from the driving pulley without altering the length of the band.

In the figure, the instrument being driven is shown at R. It is essential that it may be stopped without interfering with the cord which supplies power to the room. This is done in the following manner, which we believe is new. The handle T is fixed to a brass piece formed in the shape of a sector of a pulley, with an overhanging edge. It is arranged to turn about the bearing through which the spindle of the pulley Q passes, and can therefore rotate about the same axis as this pulley. The groove in the overhanging edge is in a line with the groove in the pulley. In the figure the cotton band is shown resting in this groove, and not in the groove of the pulley Q; now, if the sector is turned through half a revolution by the handle T, the cotton band will fall from it into the groove in the pulley Q. Thus the instrument is started; the reverse action not only throws it out of gear, but the friction of the cord running in the groove in the sector acts as a brake, and brings it quickly to rest. From the foregoing description it is evident that, once moved, the sector is required to remain in that position until moved again; in fact, it must turn with a certain amount of stiffness. A short piece of cord lies in a groove cut in its edge as shown at S; as the cord is prevented from moving and kept in tension by an india-rubber band, its friction in the groove must be overcome when the sector is turned. The smaller of the two grooves on the pulley Q is not visible in the figure, neither is the arrangement shown for lifting the cotton band out of this groove. The instrument being driven is a rotating cylinder for recording any vertical movements in the ordinary manner. Five grooves of different sizes are cut in the pulley R, and, as there are two grooves in the pulley Q, ten different speeds are possible. The sizes of these pulleys are such that the ten speeds form a geometrical series in which two consecutive speeds are in the ratio of 100 : 140.

The cotton band as well as the main driving-cord can be slipped off the driving-pulley without being cut; it can then at once be removed from the table. From this description it will be seen how the instruments may be driven, as before stated, whilst standing on any part of the table.

This method of distributing power is convenient for

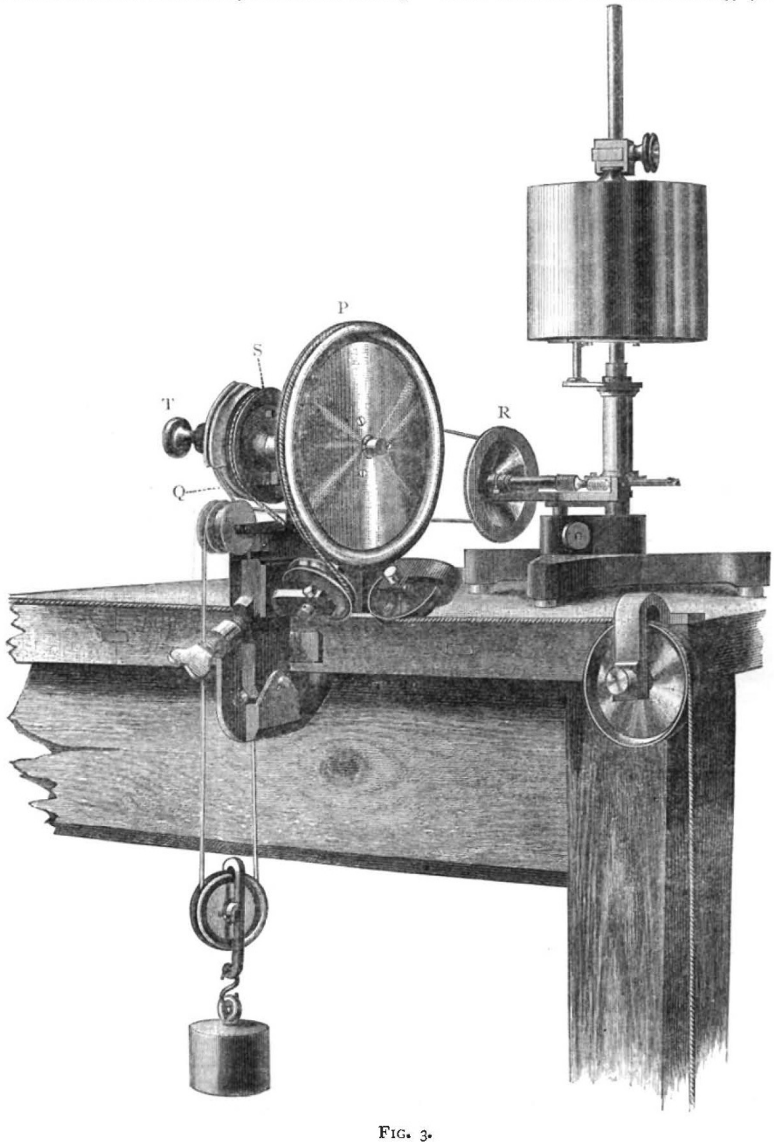

Fig. 3.

laboratories where a large amount of class-work is done, as it removes the necessity of supplying each student with a separate instrument containing clockwork. It is also most useful in original work for driving special pieces of apparatus which may often require more power than can be obtained by clockwork.

Cotton has been found to be the best material for the cords; it has the advantage of running almost silently, and is very durable. The pulleys that guide the cord from the shaft to the various rooms have been designed to run a long time without requiring oil, and with very little friction. The speed adopted is 10 feet per second; a small cord running at this speed can easily do all the work that is required.

A great variety of instruments are driven in the laboratory at Cambridge; among others we may mention a turning-lathe, also a small centrifugal machine which runs at about ninety turns per second, requiring a special driving-pulley.

The whole apparatus, both at Manchester and at Cambridge, has been designed and constructed by the Cambridge Scientific Instrument Company.