tract rather than enlarge the bulb has never been explain­ed ; only we presume it could be prevented by previously annealing it properly. However, such of the original alco­holic thermometers of the *Academia del Cimento* as have been preserved and examined, are said to have undergone no change in their freezing points during a period of more than two hundred years, which rather argues against any change in the dimensions of the glass.

As in meteorological observations it is necessary to at­tend to the greatest rise and fall of the thermometer, at­tempts have been made to construct instruments which might register the greatest degree of heat or of cold which took place during the absence of the observer. In 1757 Lord Charles Cavendish presented to the Royal Society a thermometer to mark the greatest heat, and another the greatest cold. The first consists of a glass tube AB, fig. 5, with a cylindrical bulb B at the lower end, and capillary at the top, over which is fixed a glass ball C. The bulb and part of the tube are filled with mercury, the top of which shows the degrees of heat as usual. The upper part of the tube above the mercury is filled with alcohol, and so is the ball C almost to the top of the capillary tube. When the mercury rises, the spirit of wine is also raised, and runs into the ball C, which is so made that the liquor cannot re­turn when the mercury sinks ; consequently the height of the spirit of wine in the ball, added to that in the tube, will give the greatest degree of heat to which the thermo­meter has pointed since last observation. To prepare for a new observation, the instrument must be inclined till the liquor in the ball cover the end of the capillary tube.

The thermometer for showing the greatest cold is repre­sented in fig. 6 by the crooked tube ABCD. It contains alcohol, together with as much mercury as fills both legs of the syphon, and part of the hollow ball C. The tempera­ture is shown by the rise or fall of the mercury in the leg AB. When the mercury in the longer leg sinks by cold, that in the shorter will rise and run over into the ball C, from which it cannot return when the mercury subsides in the shorter and rises in the longer leg. The upper part of the shorter leg will therefore be filled with a column of spirits, of a length proportional to the increase of heat ; the lower end of which, by means of a proper scale, will show how much the mercury has been lower than it is ; which being subtracted from the present height, will give the lowest point to which the mercury has fallen. To pre­pare for a new observation, the mercury is made to run back from the ball into the shorter leg, by inclining the tube and heating the ball.

Another self-registering thermometer was proposed by Mr Six in 1782. It is principally filled with alcohol, though mercury is also employed for supporting an index. *ab,* fig. 7, is a thin tube of glass, sixteen inches long and five sixteenths of an inch caliber : *cde* and *fgh* are smaller tubes, about one twentieth of an inch caliber. These three tubes are occupied with alcohol, except the space between *d* and *g,* which is filled with mercury. As the alcohol contracts or expands in the middle tube, the mercury falls or rises in the outside tubes. An index, represented in fig. 8, is placed on the surface, within each of these tubes, so light as to float upon it. *k* is a small glass tube three fourths of an inch long, hermetically sealed at each end, and enclosing a piece of steel wire. At each end *l*, *m,* of this small tube, a short tube of black glass is fixed, of such a diameter as to pass freely up and down within each of the outside tubes *ce* or *fh* of the thermometer. From the upper end of the index is drawn a spring of glass to the fineness of a hair, which presses lightly against the inner surface of the tube, and prevents the index from descending when the mercury descends. When the alcohol in the middle tube expands, it presses down the mercury in the tube *hf* and conse­quently raises it in the tube *ec;* so that the index on the

left-hand tube is left behind and marks the greatest cold, and the index in the right-hand tube rises and marks the greatest heat.

Dr Rutherford’s register thermometers, which are more generally used than any other, are described in the article Meteorology, and in the Transactions of the Royal So­ciety of Edinburgh, vol. iii.

The following ingenious contrivance by Mr Keith of Ra­velstone, besides being well adapted for marking the maxi­mum and minimum, may also be employed to register the temperature in a continuous form for almost any length of time. AB, fig. 9, is a thin glass tube about fourteen inches long and three fourths of an inch caliber, close or hermeti­cally sealed at top. To the lower end, which is open, is joined the crooked glass tube BE, seven inches long and four tenths of an inch caliber, and open at top. The tube AB is filled with alcohol, and the tube BE with mercury. This is properly an alcohol thermometer, and the mercury is used merely to support a float E of ivory or glass, with a wire EH for raising one index or depressing another, ac­cording as the mercury rises or falls. The float-wire, by means of an eye at *a,* moves easily along the small harpsichord wire GK. L, L' are the two indexes, made of thin black oiled silk, which slide up or down with a very slight force. The one above the knee points out the greatest rise, and the one below shows the greatest fall, of the ther­mometer.

To prepare for an observation, both indexes are brought close to the knee H. It is evident, that when the mercury rises, the knee of the float-wire will carry with it the upper index L. When the mercury again subsides, it leaves the index, which will not descend by its own weight. As the mercury falls, the float-wire brings along with it the lower index L', which it leaves behind as it had formerly left the upper. The scale to which the indexes point is placed pa­rallel to GK. A cylindrical glass cover is placed over the part GF.

The continuity of the register is to be effected by attach­ing to the float-wire a soft pencil, which is to bear lightly upon a cylinder covered with paper, and revolving on a vertical axis by means of clock-work, once in a month. At each month’s end the paper is to be removed and a clean one put in its place. The paper is to be ruled horizontally with a set of lines to mark the degrees, as on the scale of a thermometer ; and also vertically with lines to note the days of the month, and other smaller divisions of time. See Transactions of Royal Society of Edinburgh, vol. iv.

Owing to the moving force in metallic thermometers be­coming so exceedingly feeble at the outstretch, that the least resistance will make them stop too soon, and then per­haps let them go too far by a start, they are not well suited for register thermometers, though often recommended for this purpose. But Dr Ure’s “ thermostat,” for regulating temperature (Dictionary of Manufactures), depends on the same principle.

Various schemes have at different times been proposed for poising a thermometer so nicely across an axis, that a very slight change of temperature should disturb the equi­librium sufficiently to produce a very sensible change in the position of the instrument. Register thermometers in this form are liable to the same objection as the metallic sort. But the principle of the balance has been employed in various forms, and on a large scale, for opening and shut­ting doors to regulate the temperature of apartments, by admitting just the requisite quantity of cold air. For this purpose, Dr Cumming suspended and counterpoised a large ball and tube containing air, and having its open end im­mersed in a cistern of mercury. The arrangement was such, that as the ball rose or fell with the expansion or con­traction of the included air, it closed or opened the door or window of the apartment. To obviate the effect of changes