also equivalent to a certain number of pounds on the valve, which, being properly estimated, the lever safety valve may be used to indicate with accuracy the pressure of the steam.

Another form of valve has been proposed, as indicating still more correctly the point at which the pressure of the steam is equal to the pressure on the valve. It is a cylinder or flat valve, acted on by a lever and weight; and there are weights on opposite sides of the lever, which has also equal arms. These weights rest on light rollers so as to run down from their places and release the steam entirely, whenever its pressure reaches the pre scribed limit. This is

the valve of the∙French

Academy and Frank

lin Institute.

Another form of valve, also cylindrical, was used by Mr Southern for his deli cate experiments on high-pressure steam. (See Art. Steam.) The cylinder of the valve-seat used in the former figures is prolonged upwards, so as to form a vertical cylinder or tube, in which a plug of metal is exactly fitted. This plug is ground with great care, so as to move freely but steam tight in the cylinder ; and a rod from the cylinder passes up through a hole in the top, and is kept down by a lever and weight. A hole in the cylinder allows the steam to escape whenever the pressure on the valve upwards exceeds the pressure of the lever and weights in the opposite direction. The indications of this instrument are found to be very precise.

Another species of safety-valve has of late years come into use, called the spring-valve. It is of two kinds, with a lever and with out it. The form without the lever is represented in the first of these dia grams, fig. 54. A series of bent springs, sp *sp sp sp,* &c., are placed alternately in opposite directions, in the square frame *g h k l,* and are forced down upon the valve at *n* by means of a crossbar *k h* acting at *m—*a small screw at *m* adjusting the pressure by compressing or releasing the spring.

The other form of spring safety-valve interposes a lever between the safety-valve and the spring. S T, fig. 55, is ( what is commonly called a Salter's spring bal­ance, the box *X y,* containing a spiral-spring, which is compressed in the box, when the end S is drawn away from, or raised above the point S. The finger-screw S, adjusts the degree of tension on the end of the lever. The two last species of safety valve are used in locomotive steam-engines.

A totally different method of indicating the pressure of steam in a boiler, is by means of what is called a *mer­curial gauge,* communicating with the boiler. Mercury is poured into a bent tube, one end of which springs from the boiler, and the other end is exposed to the air, so that the steam by its pressure raises the mercury in the straight limb of the tube to a height above the level pro portioned to that pressure. In the figure *a c d e,* is the bent tube, communicating with the boiler at *a*, and open at the end *e,* the steam presses on the end c of the mercury, and raises the other extremity of the fluid to the height **C.** From calculating the weight of mercury, it is reckoned, that for every pound of pressure of the steam in the boiler, there is an inch of mercury raised in the tube ; so that, if the space *d c* be nine inches, a pressure of nine lbs. on the square inch in the boiler is indicated. Sometimes also a small float of iron is placed on the mercury, which, carrying a slender rod with an index, points the elevation of the mercury on a scale above the gauge. It is evident that this instrument also acts as a safety-valve, inasmuch as the steam, when too strong, must force the mercury entirely over the top of the tube, and make its escape. A double pipe, on a larger scale, with water in it instead of mercury, would answer the same purpose equally well ; only the water would rise one foot and an inch for every pound of pressure of steam in the leg of the double tube, and twice that quantity if the tube were single ; which would give a scale of 16½ feet in a double tube, or 33 feet in a single tube, as the column of water raised above the level by a pressure of 15 lbs. on the square inch.

It is convenient to reckon the pressure of steam in larger numbers than pounds, and the quantity that has been fixed is a weight of 15 lbs., or a stone weight, per square inch ; and to this weight the name of an atmosphere of pressure has been given, simply because the common atmosphere of air presses on all bodies with a weight of 15 lbs. on the square inch, (see Art. Pneumatics.) Thus steam having a pressure of 15 lbs. on the square inch, is called high-pressure steam of the elastic force or strength of one atmosphere. high-pressure steam having a pressure of 30 lbs., is said to have an elastic force of two atmos pheres, 45 lbs. of three atmospheres, &c. Sometimes, how ever, a nomenclature rather different is adopted, and the common steam of boiling water, which exerts no further pressure than merely to balance the atmosphere, is called steam of one atmosphere ; and in this case the elastic steam which has been called one atmosphere would be considered as two atmospheres. This nomenclature will be rendered evident by the consideration of the following table :—

High Pressure Steam of

0 lbs. on the square inch is called 0 atmos. or 1 atmos.

15 1 2

30 2 3