a lid being placed on it to prevent loss of heat by eva­poration. The tube conveying the warm water cannot go above the level of the fluid in it, and hence this form of apparatus is restricted in its application. It is well adapted for hot-houses, for churches, and buildings with all the rooms on the same floor. When the apartments are situated one above another, such as in common dwelling-houses and in manufactories, the boiler must be a closed one, so that the water may be transported to a greater height. Nume­rous forms of apparatus have been recommended, and are now in use for this purpose. Suppose that the boiler is erected in a room on the lower part of the building, and that not only the apartments on the same level, but also those above, are to be warmed ; all that is required is to carry a pipe from the upper part of the boiler through the different rooms, and after traversing these, to make it enter near the lower part of the boiler, as in the apparatus already describ­ed. Thus *a,* fig. 2, being the boiler, the water in it, when heated, will flow in the direc­tion *a b c d ef g h,* and again into the boiler at *i*. If we sup­pose the pipes to traverse dif­ferent apartments, then each apartment will receive heat from the water in its passage through it.

From what has been said of the currents in the fluid, it is evident, that as by the last process there must be a greater difference be­tween the gravity of the water in the different parts of the appara­tus, the current must be more rapid, and consequently the heat from the original source must be more quickly carried away. There is evidently a limit to this ; for when the height be­comes great, the pressure on the pipes is greatly increased, which requires a corresponding strength in the materials, and a nicety in the junctures of the different parts of the appa­ratus. Not that there is any danger from the formation of high-pressure steam, so as to cause explosion ; but should the tubes be faulty at any part, there would be an escape of hot water, which, under the pressure given by the high column, would rush out with great force.

By using the shut boiler there is another advantage gained, namely, that of being able to carry the water down­wards, and again upwards, at any particular part where it may be necessary, and, what is of still greater consequence, to convey it to a level above the boiler. In constructing an apparatus for this purpose, it must be borne in mind, that when the fluid has to rise after having descended, there is always a tendency to a retrograde motion, owing to the difference in pressure at different parts. Thus in a system of boiler and tubes, as in fig. 3, the ascent of the water from *a* to *b,* and its descent from *g* to *h,* and its re­turn to the boiler, go on as in the other forms. At the ' same time, however, when the fluid flows from *c* to *d,* as that in *f e* is colder, and consequently of greater gravity, than that in c *d,* there is a tendency to cause a motion back again in the direction *f cde,* and this will actually occur unless the descending force in *g h* be greater than that in *f e.* This is obtained by taking care to have the ascending pipe of sufficient height, and thus to cause a sufficient dif­ference in the temperature, and consequent gravity, of the water, in the pipe passing from the boiler, and that in the descending tube *gh.* Much must depend on the size of the pipes, and the heat to be given off by the water in its passage along them ; for, as already stated, the greater the difference between the temperature of the fluid in the as­cending and descending tubes, the greater the difference in gravity, and consequently the more rapid the current. It has been found, that when the pipes are not to ascend after having descended, a sufficient current can in general be ob­tained when the exit from the boiler, as in fig. 1, is distant from the entrance to it about sixteen inches. When the pipe ascends after dipping, then the height to which the pipe ascending from the boiler must be carried should be in proportion to the descent and corresponding rise. Thus suppose, in fig. 3, the ascent from *e* to *f* is twelve inches, then the perpendicular height from *i*, where the water re­turns to the boiler, to *b,* ought to be twenty-eight, that is, sixteen inches greater than *ef,* or thereabouts ; because, as already stated, the other circumstances affecting the current will cause a difference in the requisite height of the tubes.

By carrying the ascending tube to a considerable height, it thus affords the means of construct­ing an apparatus in which the ascent, after the pipe has dipt, may be much greater ; and thus it is also that the pipe may be carried be­low the level of the boiler itself. In causing water to flow in an apparatus similar to that of fig. 4, a great deal of heat must be lost by the coil, owing to the great surface exposed ; and the water will therefore become in it proportionally of great gravity compared to that in *a b.* At the same time, however, there is a tendency to a back-flow from *e* to *d,* and also in the lower part of the pipe *i h,* owing to the difference in temperature and gra­vity of the water in it and in *k l.* But if, owing to the great loss of heat from the coil, the gravity of the whole fluid in *e f g i,* be greater than that from *k* to *b,* then the flow­will be established and kept up as long as the abstraction of heat from the coil is continued. It is evident, that by varying the form of an apparatus of this kind, water may be conveyed to the different parts of a building, though some of them are below the level of the boiler.

Different forms of boilers are used when the water is confined in a closed apparatus. Much must depend on the situation and on the particular purpose to which the system of heating is to be applied ; and the same remarks are also applicable to the construction of the furnaces. When the boiler is a shut one, it is necessary to have a cis­tern to supply it with water, which must be placed above the highest part of the tubes. The most convenient place