

CHAPTER XI

GENERAL INFORMATION

AIR.

THE air is composed of nitrogen, 78.5 parts; oxygen, 20.6; aqueous vapor, .86, and carbonic acid, 0.4 part. Air contains about 4 grains of moisture per cubic foot.

Air is increased in volume by elevation of temperature. An increased volume of a constant weight of air, of which the initial volume = 1 at 32° Fahr., heated to a given temperature under atmospheric pressure of 14.7 pounds per square inch, may be found by this rule:

$$(65) \text{ Increased volume of air} = \frac{\text{Given temperature} + 461}{32 + 461}$$

If the temperature be taken at 62° Fahr., as in table on page 14, instead of 32°, the divisor is

$$62 + 461 = 523.$$

The weight of atmospheric air is .08072 pound at 32° Fahr.; under the pressure of one atmosphere at 62° Fahr., the weight is .076098.

Absolute zero being 461.2° below Fahr. zero.

Absolute temperature = 461.2 + degrees *F*.

In the above matter the decimal has been dropped.

SMOKE PREVENTION.

Colonel Dullier, of the Belgian Engineers, has designed an apparatus or device for the absorption of smoke which has been installed at the boiler-house of the South Kensington Museum, London, also at Glasgow, Scotland.

Tests of the latter showed in one case a reduction of the soot in the gases from 73½ grains per 100 cubic feet before treatment to 2 grains after treatment; and in a second case, from 23.3 to 1.5 grains.*

The products of combustion before entering the chimney are taken up one leg of an inverted U-shaped flue, made of galvanized iron, being assisted in their upward course by a steam-jet.

The jet assists in the condensation of the tarry products, and saturates the dust with water vapor. In descending the second leg of the flue the products of combustion are brought in contact with a large number of upward inclined water sprays, which are intended to thoroughly wash the smoke, moistening all particles of dust.

The smoke and water next pass through a chamber containing a helical passage in which they are made to still further commingle, and after all this the gases are allowed to pass into the chimney proper, while the sulphurous wash-water is drained off.

The draft in the flue and chimney, measured with a water-gauge, is said to have shown no diminution after the erection of the apparatus.†

MISCELLANEOUS.

The first mention made of the use of coal as a fuel is in the records of the Abbey of Peterborough, in the year 850 A.D., where is found an entry for twelve cart-loads of "fossil fuel."

To fix bolts in stone-work, Dingler's *Polytechnic Journal* recommends a mixture of 3 parts of sulphur with 1 part Portland cement as superior to either individual constituent.

If cast-iron or bluestone is used for a chimney cap, iron clamps should not be used, according to J. L. Fitzgerald, as they will oxidize and burst the material.

* "Cassiers," December, 1897, p. 182.

† Engineering Record, xxix., p. 385.

BUILDING LAWS OF BOSTON, MASS.

Acts of 1892. That Portion Relating to Chimneys.

Section 68. No chimney shall be corbelled from a wall more than the thickness of the wall, nor be hung from a wall less than twelve inches thick, nor rest upon wood.

All chimneys shall be built of brick, stone, or other incombustible materials.

Brick chimneys shall have walls at least eight inches thick, unless terra-cotta flue linings are used, in which case four inches of brickwork may be omitted.

Other chimneys shall have walls eight inches thick, and in addition a lining of four inches of brickwork or a terra-cotta flue-lining.

The inside of all chimneys shall have struck joints. No wood furring shall be used against or around any chimneys, but the plastering shall be direct on the masonry or on metal lathing.

All chimneys shall be topped out at least four feet above the highest point of contact with the roof.

No nail shall be driven into the masonry of any chimney.

Section 69. Flues of ranges, boilers, and other similar flues, shall have the outside exposed to the height of the ceiling, or be plastered direct upon the bricks.

Section 70. All hearths shall be supported by trimmer arches of brick or stone; or be of single stones at least six inches thick, built into the chimney and supported by iron beams, one end of which shall be securely built into the masonry of a chimney or adjoining wall, or which shall otherwise rest upon incombustible supports.

The brick jambs of every fireplace, range, or grate opening shall be at least eight inches wide each, and the back of each shall be at least eight inches thick.

All hearths and trimmer arches shall be at least 12 inches longer on either side than the width of such openings, and at least 18 inches wide in front of the chimney-breast.

Brick over fireplaces and grate openings shall be supported by proper iron bars, or brick or stone arches.

Section 71. Every chimney in which soft coal or wood is

burned, shall be carried to a height sufficient to protect neighboring buildings from fire or smoke.

Section 72. No smoke-pipe shall project through any external wall or window.

No smoke-pipe shall pass through any wooden partition, without a soapstone ring of the thickness of the partition, with a ventilated air-space of not less than 4 inches around the pipe, nor shall be placed within 8 inches of any wood unless such wood is plastered and protected by a metal shield 2 inches distant from the wood, in which case the smoke-pipe shall not be less than 6 inches from the wood, etc.

TABLE No. 31.

PHYSICAL PROPERTIES OF MATERIALS OF MASONRY, ETC.

All stresses given in pounds per square inch.

Materials.	Ultimate crushing strength.	Transverse strength.	Modulus of elasticity.	Weight per cubic foot.
Brick, flatwise paving.....	{ Max. 20,800 Min. 4,880	3,100	4,000,000	150
Paving brick, Philadelphia specifications :		1,350	2,000,000	
Red shale	{ 9,090 18,000	5,000		
Yellow fire-clay	{ 8,000 10,000	5,800		
Hard building.....	{ Max. 18,400 Min. 3,800	1,250	4,000,000	125
Soft building.....		300	2,000,000	
Concretes, 1 month old, of following compositions : *				100
Cement mortar, 1 of natural cement, 2 of sand.	250 to 500			109
Natural cement mortar and furnace slag.....	250 to 500			120
Natural cement mortar and sandstone.....	250 to 500			126
Natural cement mortar and limestone.....	250 to 500			142
Natural cement mortar and granite.....	250 to 500			142
Natural cement mortar and trap.....	250 to 500			147
Cement mortar, 1 of Portland cement, 2 of sand.....	250 to 500			134
Portland cement mortar and furnace slag.....	250 to 500			137
Portland cement mortar and sandstone.....	250 to 500			153
Portland cement mortar and limestone.....	250 to 500			159
Portland cement mortar and granite.....	250 to 500			159
Portland cement mortar and trap.....	250 to 500			164
Granite	{ Max. 24,400 Min. 12,000	2,700	13,000,000	164
Limestone.....	{ Max. 22,300 Min. 7,000	2,500	8,000,000	
Marble.....	{ Max. 20,000 Min. 4,650	2,850	13,550,000	170
Sandstone.....	{ Max. 18,750 Min. 4,100	2,350	2,815,000	
Slate.....		350	7,000,000	174
Trap.....	22,000			170

* Concretes after six months will be about four times, and at the end of one year will be about six to seven times as strong as at the end of the first month.

—Pencoyd Iron Works, 1898.