CHIMNEY CONSTRUCTION.

The important part fulfilled by a chimney renders it especially desirable that it should be of ample size, well-proportioned and properly built. The function of a chimney is primarily to furnish a sufficient supply of oxygen to the fuel to effect its combustion. The first point to be considered is stability. This is sometimes a matter of some difficulty, but if proper care is exercised the condition may always be attained. A good foundation is the first requisite. Most failures of chimneys have occurred through insecure foundations, which have settled unequally. Where practicable, the load on a chimney foundation should not exceed 2 tons per square foot in compact sand, gravel or loam. Where a solid rock bottom is available for foundation, the load may be greatly increased. If the rock is sloping, all unsound portions should be removed, and the face dressed to a series of horizontal steps, so that there shall be no tendency to slide after the structure is finished.

One very strong reason for making a chimney foundation as broad as possible is the fact that in high winds the pressure on the foundation may be largely concentrated on the leeward side of the shaft so that in some localities where the prevailing winds are quite strong their effect alone may be sufficient to cause unequal settling unless precautions are taken that the foundation is amply large. But in ordinary cases, with short stacks, no trouble need be experienced, for if the base of the foundation be only slightly larger than the shaft it will be sufficiently firm. In the case of large chimneys, however, too great caution cannot be observed. Careful calculations should be made, and the design of the stack so modified, if necessary, that all doubt regarding stability may be removed. All boiler chimneys of any considerable size should consist of an outer stack of sufficient strength to give stability to the structure, and an inner stack or core independent of the outer one. This core is by many engineers extended up to a height of 50 or 60 feet from the base of the chimney, but the better practice is to run it up the whole height of the chimney; it may be stopped off, say, a couple of feet below the top, as shown in Fig. 1, and the outer shell contracted to the area of the core, as shown in the engravings; but the better way is to run it up to about 9 or 12 inches of the top, and *not* contract the outer shell. But under no circumstances should the core at its upper end be built into or connected with the outer stack. This has been done in several instances by bricklayers, and the result has been the expansion of the inner core, which lifted the top of the outer stack squarely up and cracked the brickwork.

In the accompanying engravings, Fig. 2 shows an external and Fig. 3 a sectional elevation of a chimney such as we would recommend for small batteries of boilers, where the height of the chimney does not exceed 100 feet. For a height of 100 feet we would make the outer shell in three steps—the first, 20 feet high, 16 inches thick; the second, 30 feet high, 12 inches thick; the third, 50 feet high and 8 inches thick. These are the minimum thicknesses admissible for chimneys of this height, and the batter should be not less than 1 in 36 to give stability. The core should also be built in three steps, each of which may be about one-third the height of the chimney—the lowest, 12 inches; the middle, 8 inches, and the upper step, 4 inches thick. This will insure a good, sound core.

Fig. 1 shows a plain, simple finish for a chimney top, but one which looks neat if it is well proportioned. Care should be taken, however, that it is not made too short in proportion to the length of the shaft, or it will look "squat." The finish of a chimney should be such that it harmonizes with the style of the surrounding buildings. It costs no more thus, and looks vastly better. The top of a chimney may be protected by a cast-iron cap, Fig. 5, or perhaps a cheaper and equally good plan is to lay the ornamental part in some good cement, and plaster the top with the same material.—*Ex.*

JAMES MONTGOMERY.—James Montgomery, a mechanical engineer and inventor, died at his home in Philadelphia on the 28th of December. Mr. Montgomery was well known in mechanical circles at one time as the inventor of the boiler that bore his name. H entertained extravagant hopes of the saving that could be effected by lengthening the channels through which the products of cumbustion had to pass, and the result was disappointment. The boiler received some application, but it was extremely awkward to make, and the inventor's enthusiastic advocacy failed to put it into permanent use. Mr. Montgomery was one of the first to put a partition between the tubes to divide the products of combustion.—*Ex.*

GAS AS A MOTIVE POWER.

Gas is a convenient source of power, and in towns where it is already supplied for purposes of illuminating, it is at once obtainable in a conveniently moderate quantity.

Moreover, the principle of adopting a large centre of supply, is, on scientific grounds, economical, for it can be supplied in the state of fuel, and involves no more loss in its transmissions than would occur in the transference of any other fuel. But in spite of many attempts to use it for small motors it has only been recently adopted in Canada, while in England and other countries it has been very much adopted.

The original method of using gas was in conjunction with air in such a proportion as to form an explosive mixture which was ignited, and work obtained by the consequent expansion. This method was extensively applied in Europe, but was to a great extent superseded by what is known as the Otto and Langen Motor, which performed very efficient work and vastly superior to some engines in point of economy which have superseded it, but its noise in working was much against its adoption.

Thus, when the Otto Silent Engine was introduced, the application of gas engines as small motors became quite extended.

The principle of action employed is intended to meet the difficulty of utilizing the energy of the gas consequent upon the sudden explosion in the former engines.

The method of doing this is clearly explained in the specification of the patent, and is, shortly, the introduction of a combustible mixture of gases in such a way, so that upon ignition, instead of an explosion ensuing the flame is communicated gradually from one particle to another, thereby effecting a gradual development of heat, and consequently a corresponding gradual expansion of the gases, which enables the motive power so produced to be utilized in the most effective manner.

It must be confessed, however, that the Otto Engine is not perfectly regular in its action when doing light work. Combustion does not take place every revolution. At the same time, with a proper, uniform load, and heavy fly-wheel, this is hardly appreciable, and seems to be a benefit to the cylinder, which during single acting is thereby only heated when combustion takes place, and may account for their running without need of repair for a long period; and when it is considered that the Otto Engine can be run for about 50c. per day, the result is most satisfactory.

The theory of gas engines is yet imperfect, but the absence of a boiler in connection with them gives them a great advantage over a steam engine for small, light work. Gas engines for light work and under certain conditions, is a step in the right direction, and their popularity is likely to be maintained.

THE ORIGIN OF PAPER.

The Chinese claim the honor of producing the first paper ever used in the world. According to their chronology the invention dates as far back as the first century. Their claim is probably a just one, as the Japanese have still in existence certain data in regard to the exportation of paper from Corea to Japan between the years 280 and 610 A.D. Previous to this invention printing had been done upon cotton or silk. Owing to the conflicting statements of various chronological writers, it is impossible to locate the precise date of its first introduction into Europe. Deductions from the mass of evidence would seem to place it somewhere in the thirteenth century. Japan became the first rival of China, and so proficient did she become in the art that she far outshone the original inventors, and eventually took the stand which she now holds. There are, even at the present day, certain branches of this industry in which she owns no equal upon either continent. There are now manufactured at Yeddo twohundred and seventy different varieties of paper. They use bark, leaves and bamboo for producing their pulp. They change the quality of their paper by various combinations of these ingredients. The paper manufacture of the present age, possessing all the advantages derived from centuries of scientific and mechanical inventions, must find it very difficult to realize the intricate and laborious processes accompanying the earlier career of this great industry.—*Exam Ind.*

IT is reported that the Canadian Pacific Railway Company has definitely decided to make Coal Harbor, at Burrard Inlet, the western terminus of the railway, in place of Port Moody.