e, the lower half of which is thus immersed in water, completely bars the passage. It is evident, however, that if the well should leak the water in it may fall below the lower edge of the stone, and the efficiency of the trap be destroyed; but if it be made perfect in the first instance, there can be no danger of any inconvenience that a bucket of water thrown into the sink will not cure. It is from the drying up of the fluid in water-traps that uninhabited houses are so frequently offensive. These well-traps form an effectual bar to vermin, and they may, therefore, be advantageously placed at the entrance of water-closet drains, to prevent rats from getting at the soil-pipes, which they will gnaw and destroy if they can get access to them. Internal drains, or those which go through a house, should always pass under the doorways if possible, in external walls at least. If, however, circumstances should render it absolutely necessary that a drain be taken through a wall, an arched ring or bull's eye should be made for it to pass by

All the traps to the drains should be ventilated, as well as the head of the drain itself, by a tube carried up to the top of the house, and away from any opening where the foul air could be blown into any of the rooms. The sewers should also be ventilated, if not by the gully or side gratings, then by a grating placed over them in the centre of the roadway There have been numerous suggestions for ventilating shafts in the lines of main drainage, but nothing beyond a tall lamp-post has been carried out, and no doubt this is sufficient.

Cesspools and tanks.

In country houses where the drainage is used for manure to the gardens or land, the drain from the closets may be led into a brick or iron tank or cesspool, the surplus water being carried off by an overflow drain. Cesspools are strongest if made cylindrical, and should be bricked round and domed at the top, with a manhole in it for access, which should be fitted with a stone, having a ring in it by which the stone can be raised. But whether they are made to retain fluids or not is not a matter of consequence, if they be placed in a secluded situation, where, if the object be not to get rid of the waste, there is seldom, at least, any desire to retain it. In towns and cities where the common sewering is as complete as it ought to be, and water-closets are used instead of privies, cesspools are unnecessary, as the soil becomes so much diluted by the water that goes down with it, that it flows readily enough through the private drains to the common sewer, and so on with the rest, to the common receptacle. Sometimes, indeed, it may be found necessary to clean out the well-traps before described, but this cannot often occur. Galvanized tanks are occasionally used in some parts of the country, with pumps attached, by which the sewage can be rendered available for the garden. Earth closets on Dr Moule's system, or the cinder-sifting ash closets, are valuable for preventing the waste of an important manure. For workmen's cottages in large towns and villages they must be, of great service, but whether they are adapted to a town house, or are applicable on an extensive scale for the relief of town drainage, is a question which still remains unsolved.

The principal publications on Brickwork are as follows:—Moxon, *Mechanick Exercises*, 4to, 1682; Langley, *London Prices of Bricklayers' Work*, &c., 2d edition, 8vo, 1750; Saunders, *Observations on Brick Bond*, 8vo, 1805, and reprinted in vol. i. of the *Civil Engineer and Architect's Journal*, 1838; Elmes, *Foundations*, 8vo, 1808; Nicholson, *Architectural Dictionary*, 4to, 1819; Davy, *Construction of Foundations*, 8vo, 1839; Dempsey, *Builder's Guide*, 8vo, 1852. The foreign publications are mostly comprised in the list at the end of the Mason-work. For Ornamental Brickwork, see Degen, *Constructions en Briques*, 4to, no date; Essenwein, *Norddeutschlands Backstein Bau im Mittelalter*, folio, 1863; Runge, *Essai sur les Constructions en Briques en Italie*, folio, 1849; Street. *Brick and Marble Architecture in Italy*, 8vo, 1855.

Mason-Work.

The word *mason* is derived directly from the French *maçon*, which signifies indifferently a bricklayer or mason. Du Cange attributes the origin of the word to the low Latin *maceria*, a wall; but a more probable derivation is that from the old German *meizan*, to cut. Among ourselves, at present, we reckon three sorts of artificers—rubble or rag-stone masons, freestone masons, and marble masons. This last branch, however, is rather that of the carver or statuary. The art of working or reducing stone to the proper shape for the mason to *set*, *i.e.*, to place them in the walls, &c., has generally been called *stone-cutting*, and depends very much on the nature of the stone for its details. *Stone masonry* is the art of building in stone.

The mason's tools consist of a handsaw, for cutting soft stones; a drag, which is a flat piece of iron wherewith to finish its surface; chisels and gouges for forming mouldings, gauges and moulds for sinking them to the proper forms; a mallet, chisels, tools, and points for working the harder stones; a level, a plumb-rule, a square, a bevel, with rules of various sorts wherewith to try the surfaces in the progressive stages of the work. Granite is brought to a face by the scabbling hammer or granite axe, and the operation is called nidging. In rubbed work a surface is obtained by smoothing it with sand or gritstone. Marbles are polished by being rubbed with the gritston then with pumice-stone, and lastly with emery powder.

Rubble walls are scaffolded with single, and ashlar-fronted or other gauged stone walls with double-fronted scaffolding,—the former tailing one end of the putlocks in the wall, and the other having an inner row of standard poles, and ledgers parallel to the outer, making the scaffold entirely independent of the wall. In some places, however, it is the custom to dispense altogether with an external scaffold in building stone walls, particularly with gauged stones. With light and plain work this may be done without much inconvenience or retardation; but if the work be heavy or delicate, considerable delay and incorrectness result. Sometimes the finer work, such as that to mouldings, flutes, and foliate or other enrichments, is merely boasted or roughed out before the stones are set, and finished afterwards, but this can be done well only from a secure floor or scaffold on which the workman may feel he can move freely and surely. For large and elaborately decorated structures, such as a public building, a mechanical scaffolding has to be erected, by which some economy is effected through diminishing labour, or some emergencies met attendant on the works themselves. Where the face of a stone is worked in the shop and may have some weeks or months labour on it, it becomes a valuable work worth careful handling. Hence the old-fashioned kind of scaffolding, of poles and ropes, has been much superseded by the so-called whole timber or framed scaffold, with its tramway and crab engines aloft. It is usually formed by laying square timbers on the ground to receive similar uprights, which are secured by iron ties to it; on the heads of these are placed horizontal timbers, which are also secured to the uprights, and the whole is kept from changing position by timber struts and braces. On these another range may be erected, and so on to the required height. Tramways are placed on it, and a travelling crane, worked by hand labour or by steam, raises the heavy weights, carries them to their places, and at once deposits them in the work with great ease. By the use of a steam-lift, with a long arm to reach many feet above it, on the first stage of the frame scaffold, no other scaffold is necessary except a slight one for the use of the workmen to set the stone. The clock tower at the Houses of Parliament was built by a scaffold formed of two timbers, each 2 feet 3 inches deep and 14 inches wide, running across from side to side, on which rails were fixed to carry a travelling platform of the whole width which went the reverse way. To one side of the first named timbers was suspended a platform which carried the machinery for raising the materials from the bottom up the central shaft; they were then raised on to the traveller which carried them at once to the required spot for fixing. When a certain height of work had been done, the huge timbers were raised by six screw-jacks working together, and rested on the new wall, the jacks being removed and prepared for another raising when necessary. The Victoria Tower was erected on a somewhat similar principle, but having two travellers working upon a circular tramway on a strong trussed framing, the ends of each secured to a central drum. To raise the materials a strong under-trussed parallel framing was formed on one side, which brought them up on the outside of the tower.

Scaffolding

Stones used in Building.—It may be useful to give a list of the stones principally used in building, according to their geological formation, with some practical remarks upon each.

Of *igneous rocks* of *volcanic* origin, the varieties which are used on the continent of Europe are those light stones called tufa and pumice, and the stone called peperino. The two former were extensively employed by the Romans in the filling in of vaulting, on account of their great lightness. The latter stone, which is obtained in large quantities near Rome, was used by that people extensively, particularly for substructures, being obtained in large blocks. Of the second division of igneous rocks, the *trappean*, porphyry and serpentine have been used, but chiefly as ornamental coloured stones, and have been generally classed as marbles. Of the third division, the *supersilicated* rocks, granite alone is now extensively employed, not only in engineering works, but in public buildings and dwellings. It is got from the quarries by splitting the blocks with wedges, and is so hard that it cannot be cut by any ordinary saws. It has to be worked first with large hammers, and then reduced by pointed chisels, and consequently is very expensive in building. Machinery is used very largely in cutting and also in polishing it. Some very good specimens come from Cornwall and Devonshire, but by far the best are from Dundee and Aberdeen. A variety of the latter, called Peterhead granite, is only to be equalled by the finest Oriental granites. The Kingstown granite from near Dublin is much used locally.

Of *the aqueous rocks, mechanically formed*, and of the *arenaceous* varieties, gravel is used for concrete, and sand in making mortar. Sandstones and gritstones are very extensively used. These are either laminated, as the York stone, used generally for paving, as it can readily be split into large surfaces of small relative thickness, or compact, as Old Red Sandstones, which stand very well internally, but perish sadly with the weather, as may be seen at Chester Cathedral. The New Sandstones, the best of which is the Calverley stone got near Tunbridge Wells, are easily quarried, but if sawn, the wet saw and sand must be used. The finer grained compact sandstones, which are comparatively free from iron, and form very good building-stones, are very numerous. Such are the Bramley Fall, used for bridge copings, plinths, &c.; the Park Spring, Elland Edge, Whitby, and others, all in Yorkshire; the Hollington in Staffordshire; the Mansfield in Nottinghamshire; and the Minera quarries at Wrexham. A bed of the last is much used at Chester and Liverpool for building purposes, and it has just been introduced into the London market, for which city it is thought it will be very eligible, on account of its lasting qualities; it has been also used at the National Safe Deposit Company's offices in London. Scotland can boast of some of the finest quarries of sandstone, the best, perhaps, being the Craigleith, much used at Edinburgh. The College, courts of law, Register House, Customhouse, Royal Exchange, National Monument, and many churches and private residences there, are built of this excellent material, which has also been extensively exported to Hamburg, Altona, Gothenburg, and other places. Humbie stone has also been much used, both at Edinburgh and at Glasgow, where it forms the Royal Exchange and Royal Bank; it is easier to work than Craigleith. Glamis is also a fine sandstone; the castle there, as well as those at Inverquharity and Cortachy, and Lindertis House, are built of this material. In Fifeshire, at Cullalo, are quarries whence the stones for the monument to Lord Melville at Edinburgh, and that to Lord Nelson at Yarmouth, were obtained. In addition to beauty and durability, these stones have the merit of being capable of receiving the finest and smoothest forms from the chisel of the workman. Another class of sandstones are commonly called *firestones*, as they endure the action of fire better than most others. Of these the best known is the Reigate stone, which is the principal material used at Windsor Castle, Hampton Court, and in many old building round London. The Miners stone already mentioned is another.

Of *mechanically-formed aqueous stones* classed as *argillaceous*, th Clunch only is used in building. It may be seen in Ely an Peterborough cathedrals, and many other mediæval buildings, an is a beautiful material for interior carved work, but will not stan the weather.

Of the *aqueous stones* classed as *chemically formed*, there i none of note but the Travertine, or, properly speaking, Tiburtine This is a coarse grained stone, of warm colour, found in large blocks and extensively used at Rome, both in ancient and modern build ings, of which the cathedral of St Peter's may be cited as an instance, but it is unknown in England.

Of *aqueous rocks, organically derived*, the *calcareous* claim principal attention. The chief of these are the *limestones*, which are classed as compact, magnesian, or oolitic limestones. Of the first, the best, in the south of England, is that called Chilmark, of which Salisbury Cathedral and Wilton Abbey, and many other fine buildings, have been erected. In the Midland counties the Tottenhoe stone, of which Dunstable Priory, Woburn Abbey, Luton church, &c., are built, is an excellent stone. There is also a stone of high quality got at Hopton Wood, near Worksworth in Derbyshire, used at Chatsworth, Belvoir, Drayton Manor, &c. Ancaster stone, near Sleaford in Lincolnshire, has been used for a number of years; also Ham Hill, near Yeovil, in Somersetshire. Of magnesian limestones we may name the Anston and Bolsover Moor stones, used formerly at Southwell Minster, and lately at the Houses of Parliament; the Tadcaster stones, used at York, Beverley, and Ripon Minsters, and very many other buildings; the Roche Abbey, used at the building of that name, and very many other churches in Yorkshire and Lincolnshire; the Brodsworth, near Doncaster; and the Huddlestone, near Sherburne in Yorkshire. These stones contain a great deal of carbonate of magnesia, from which they take their name, are of beautiful texture, and stand well in the country as building stones, but fail in London.

A very excellent limestone for rough walling, especially for Gothic work, is that called Kentish Rag. It is found in large quantities in the neighbourhood of Maidstone; it is very hard, and is worked with large hammers instead of the saw. Jambs, strings, and mouldings are sometimes worked of it, but the hardness makes the work expensive; these, as well as the quoin stones and dressings, are therefore formed of Caen or Bath or other local stones. Kentish Rag does not answer for interior work. Kentish Rag.

The most important subdivision of the limestones used in masonry is the *Oolitic*. They are so called because they resemble, when broken, a conglomerate of globular eggs; they are also named roestones, from their resemblance to what is called the hard roe of a fish. Very good examples of these are the Barnack stone from Northamptonshire, of which Peterborough Cathedral, Croyland Abbey, Burleigh House, &c., are erected, and the Ketton stone, used at most of the colleges in Cambridge, and at Bury St Edmunds, Bedford, Stamford, Doulting in Somersetshire, and at Wells Cathedral and surrounding churches. But the principal English oolites used in masonry are the Bath and the Portland. The former, as its name imports, is found in the neighbourhood of Bath. The chief quarries are the Box Hill, Combe Down, Farleigh Down, and Corsham Down; all these quarries vary in quality at different depths. The Corsham Down is said to produce the finest in quality, and the Box Ground stone to be the hardest; but everything in the use of this stone depends on the bed selected. Large quantities of a similar stone are imported from Caen, in Normandy. This is more compact in texture than Bath, and therefore fitter for carving, but does not appear to stand our climate so well. The best variety of this stone is said to be the D'Aubigny stone. Almost all these oolites can be sawn with a common dry saw, which saves a great deal in the labour of conversion. But, without doubt, the best of all this class of stones is that from the Island of Portland; for beauty of texture, and for durability, it perhaps exceeds any stone in the world. It seems the only one unaffected by the smoke of London; and therefore the greater number of its buildings, St Paul's among the rest, are of this stone. Being of hard texture, however, it must be sawn by the use of sand and water, and is much more expensive to work than the softer oolites. There are between fifty and sixty quarries on the island. The best are said to be those on the north-eastern side; but, as with all stones, there is good and bad in every quarry, and everything depends on the selection. It is said that when Sir Christopher Wren built St Paul's Cathedral, he had this stone quarried and exposed to the weather on the sea-beach for three years, before he suffered it to be used. Oolitic stones. Bath stone. Portland stone.

Of *siliceous* stones, flint is sometimes used for rough walling and for ornamental facing with brickwork; but in England this work is done by the bricklayer, and not the mason.

The only remaining class is that of the *metamorphic rocks*, of which the crystalline or saccharine and the serpentinous limestone are used; but these are all species of marbles, used more as ornamental than as constructive building-stones, and need not be dwelt upon here.

Many of the early buildings of the Middle Ages were entirely constructed of masses of concrete, often faced with a species of rough cast. The early masonry seems to have been for the most part worked with the axe and not with the chisel. A very excellent example of the contrast between the earlier and later Norman masonry may be seen in the choir of Canterbury Cathedral. In those times the groining was frequently filled in with a light tufa stone, said by some to have been brought from Italy, but more probably from the Rhine. The Normans imported a great quantity of stone from Caen, it being easily worked, and particularly fit for carving. The freestones of England were also much used; and in the first Pointed period, Purbeck and Bethersden marbles were employed for column shafts, &c. The methods of working and setting stone were much the same as at present, except that, as the roads were then in a very bad state, and in many places the only means of conveyance was by pack-horses, the stones were used in much smaller sizes. The methods of setting out work were, however, different from those of other styles, as might be expected from the difference of forms. As time went on the art of masonry advanced till, in England, in point of execution it at length rivalled that of any country.

From the regular and determined form of bricks, modes or systems for setting or arranging them may be formed, and any workman, by habit and an exertion of memory merely, may become competent to build a brick wall as well as it can be built, but it is not so with stone used in common masonry walling. The workman in this material has for the most part to deal with masses of all forms and of all sizes, and a continual exercise of the judgment is required from him beyond the tact or skill which may be acquired by practice. For this reason workmen are generally less to be trusted to their own discretion in stone building than even in bricklaying. The young mason should be extremely careful to avoid making the beds of stones concave or hollow; for if this be done, in any case where the stones have to bear much pressure, they will flush or break off at the joints and disfigure the work. The best or highest sort of stone walling is the easiest to set; it is that in which the stones are all tooled and gauged in regular parallelogramic figures, to range in courses and suit the thickness of the wall to which they are to belong; and the most difficult to execute properly is that in which amorphous stones are used, the mason being allowed merely to dress them roughly with his hammer or axe, and fit them in as he best can to form the most compact mass: this is called rubble walling.

From the brittle nature of stone, great tact is required in setting, to prop or bear up the longer pieces in every part, or they will break across, and thus occasion more injury than could accrue if the whole mass had been made up of small pieces. Very long lengths, therefore, should be avoided, even in regular tooled courses, with which the bearing is or should be perfectly even, and a settling down of the work itself is hardly to be feared. There is a certain medium which may be preserved; and although the object is obviously, in stone as in brick walls, to form a compact mass, as unbroken into parts as possible, a mason will act judiciously in breaking a very long stone into two or more shorter ones, and working them in that state, though he thus makes two or more additional joints, well knowing that he has the power of counteracting to a certain extent the ill effect of joints made by himself, but that those made by accident are irremediable.

The observations made in the section on brickwork, on the use of mortar, will apply here also. Of whatever quality the stone may be of which a wall is to be built, it should consist as much of stone and as little of mortar as possible. If the stone be inferior in durability and power of resisting the action of the atmosphere to the mortar, besides the certain fact that the mortar will yield until it has set hard, and so far act injuriously, no ulterior good is gained; and if the stone be the more durable material, the more of it that enters into the wall the better. Indeed, in rough walling, if the stones be pressed together until the more prominent angles on their faces come into actual contact, the interstices being occupied by mortar, it will be better than if a thick yielding mass were allowed to remain between them. Absolute contact, however, should not be permitted, any more than in brickwork, lest the shrinking of the mortar in drying leave the stones to such unequal bearing as the prominent parts alone would afford. Stone being generally of a less absorbent nature than brick, it is not a matter of so much importance that it be wetted before setting; nevertheless, adhesion on the part of the mortar is more certain and more complete, if the stones be worked in at least a damp state.

What bond is, and the necessity for it, have also been shown in the preceding section; and bond is of not less importance in stone walling than in bricklaying. We have also hinted above at the greater difficulty of understanding, forming, and preserving it in the former, and can now only add a few observations in addition that can be of any use, and these with reference to rubble walling particularly. Instead of carefully making the joints recur one over the other in alternate courses, as with bricks and gauged stones, the joints should as carefully be made to lock, so as to give the strength of two or three courses or layers between a joint in one course and one that may occur vertically over it in another. In bonding through a wall, or transversely, it is much better that many stones should reach two-thirds across alternately from the opposite sides than that there should be a few thorough stones, or stones extending the whole thickness of the wall. Indeed, one of the many faults of stone masons is that of making a wall consist of two scales or thin sides, with thorough stones now and then laid across to bind them together, the core being made up of mortar and small rubble merely. This is a mode of structure that should be carefully guarded against. There is no better test of a workman's tact and judgment in rubble walling than the building of a dry wall, or wall without mortar, affords. Walls are frequently built with mortar that without it would have fallen down under their own weight in a height of 6 feet, in consequence of their defective construction,—thus rendering it evident that they are only held together by the tenacity of the mortar, which is very seldom an equivalent for a proper bond of stone. Masons are very apt to set thin broad stones on their narrow edges to show a good face, by which the wall is injured in two ways; the practice tends to the formation of a mere case on the surface of a wall, and it for the most part exposes the bed of the stone to the atmosphere, as a stone is more likely to be broad in the direction of its bed than across it.

Footings. The footings of stone walls ought to consist of the largest stones which can be conveniently procured. It is better to have them of a rectangular form than any other; and if they are not square, their largest surfaces should be laid horizontally. With this shape and disposition they will make the greatest resistance to sinking. When footings can be obtained the full breadth of the wall in one piece, they are to be preferred; but if not, then every alternate stone in the course may be the whole breadth. Each course should be well bedded in mortar.

Rubble walling is either coursed or uncoursed. In the latter sort, fig. 5, Plate XXI., the work is carried on with stones of any sizes, as they occur, and without reference to their heights, somewhat in the manner of the Cyclopean walling of antiquity,—the interstices of the larger being filled up with smaller stones. For this work the mason uses no tool but the trowel to lay on the mortar, the scabling hammer to break off the most repulsive irregularities from the stones, and the plumb-rule to keep his work perpendicular. The line and level are equally unnecessary, as the work is independent of considerations

which are affected by them. An attentive and intelligent workman will, however, make a sound wall with this species of construction, by fitting the stones well together and packing them with as little mortar as possible, yet filling every crevice with it, and carefully bonding through to secure compactness, transversely at the least.

In coursed rubble walling, fig. 6, Plate XXI., the line and level are used, the work is laid in courses, each course being carefully brought up to the same level in itself, though no attention is paid to uniformity in the heights of the different courses. For this species of walling the stones are generally thoroughly dressed by the workman in the gross before he begins building. He is careful to get parallel beds to them, and he brings the best face of each stone to a tolerably even surface at right angles to the beds; the ends, too, receive some little attention, and for this purpose he uses an axe in addition to his scabling hammer. The quoins in coursed rubble walling are generally built with peculiar neatness and precision, and they are set to serve as gauge courses for the rest. This, when well executed, makes a sound and excellent wall. It presents, however, rather a rough and homely appearance, and in finer works must be covered with stucco or cement, or faced with ashlar.

Ashlar is an external rind of gauged stones in equal courses, having tooled or closely-fitting joints to give a wall a neat and uniform appearance; it is axed, tooled, or rubbed, as may be thought most in character with the structure, or that part of it to which it is to belong. Ashlar stones, or ashlars as they are commonly called, are made of various sizes on the surface, as the character of the edifice may require or convenience demand, and vary in thickness from 5 to 8 or 9 inches. Some of the ashlar stones must, it is clear, be used transversely as bond stones, or the facing, having nothing to connect it with the wall behind, would soon totter and fall. Bond stones are generally put in alternate courses, with the backing to the jambs of openings, such as windows, and oftener, if these do not recur within a length of 5 or 6 feet; the bond stones themselves, too, should not fall in the same vertical chain, except when they are in the jambs of openings, but should break in their alternate courses. Ashlar is commonly set in fine mortar or in putty. It is generally recommended that ashlars should not be made regular parallelopipeds, but run back irregularly to tooth in with the backing, the vertical joints being left open from about an inch within the face of the wall, and the upper surface or bed of the stones made narrower than, though perfectly parallel to, the lower. These things may exert a slightly beneficial influence under some circumstances; but the mode of construction involved is so radically bad, that unless the backing is set in a quick-setting cement, or is so well packed as to be proof against its general tendency to settle away from the ashlar facing, no method of the kind can materially improve it. A well-compacted wall of coursed rubble, the courses being frequently made up of whole stones and faced with ashlar, may be made tolerably sound and trustworthy. Brick backing, with ashlar facing, cannot be considered as good, though it has the advantage of not requiring battening and lathing for inside plastering, as the stone-backed wall does. Uncoursed rubble with ashlar has all the disadvantages of both the preceding, with nothing to recommend it before either of them. A thin inner brick wall, like a hollow wall, is very often necessary, where it is anticipated that the rain will be beaten through the stone-work by the impetuosity of the wind. The settlement of these two kinds of work during the setting of the mortar is so different, that the walls often separate; or where this is prevented by bond stones, the walls bulge outwards and bear unequally on their base. These evils are best prevented by using as little mortar as possible in the interior parts of the wall, and not raising the wall a great height at a time.

In order to give an uniform colour to a stone or ashlar wall, masons mix up pounded chippings of the stone they have used with some lime, salt, whiting, and size, and a little ochre, with which they colour the stone as they clean off the work. It is called badigeon, and is used also on plastered walls, where joints are sometimes drawn in colour to represent stone-work. Small defects in the stone are filled up with the same, or with shell-lac and the pounded stone.

There are many different sorts of walling or modes of structure arising from the nature of the materials furnished in various localities. That of most frequent occurrence, perhaps, is a manner in which either squared, broken, or rounded flints are used. These depend entirely on the care with which they are arranged, and on the mortar with which they are compacted, as also on a coursed chain, which is commonly introduced at short intervals of larger stones or of bricks, to act as a bond; the quoins, too, in this species of structure are generally constructed of dressed stones or of brick. Another sort of building is that of Pisé work, which from its economy as well as its general utility, has been much used in various countries. It consists of merely compressing earth in moulds or cases, whereby houses of two or three stories in height can be raised. Strong earths, with a mixture of small gravel, form the best material. The earth cannot be used when it is either too dry or too wet; when prepared it is put into the moulds and rammed down. The openings for the doors and windows must be left at the time of building the walls; and the openings have to be faced with wood for hanging the doors or for inserting the frames. The exterior decorations are best made of stone or brick; wood will not unite very well with the Pisé; the flues are also formed of brickwork. The exterior should be cemented or rough-casted, which should only be done when the wall is quite dry, or the cement will be cast off by the damp. The walls require to be bonded at the angles by thin rough planks to each course of about 3 feet in height, and the interior walls to be likewise so tied to the main ones. Such work has lasted over a century and a half. It was extensively practised at Lyons and in the south of France during the last century. Several attempts have been made of late years to build concrete walls for houses, and with much success. The process is similar to that already described. One patentee has been enabled to produce a cheap material wherewith he has built every part of a house,—walls, floors, staircase, and a flat roof, and even the doors, the material being set in an iron frame, thus rendering the house perfectly incombustible. Several such "monolithic doors" have lately been put up in London in place of plate iron doors.

Pisé work.

Concrete building.

Whatever objections lie against bond timber in brickwork apply with equal force at least to the use of it in stone walls. Hoop-iron bond is not only available in all kinds of stone walling, including the highly-wrought close-jointed kind, but it is invaluable, as it may be used both longitudinally and transversely as it may in brickwork; whilst it compels the building mason to bring his work up to a true and fair bed as often as the bond is to be laid in it. Discharging arches, it must be evident, are as necessary in and to stone walls as to walls of brick, and they may be treated much in the same manner. See fig. 10, Plate XX., and fig. 4, Plate XXI.

When walls are not entirely of masonry, in the ordinary course of economic building, stone is frequently used for copings, cornices, string and blocking courses, sills, landings, pavings, curbs, steps, stairs, hearth-stones and slabs, and chimney-pieces; to these may be added quoins and architectural decorations, or dressings for windows, doors,