PAPERS

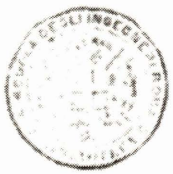
7,192

ON SUBJECTS CONNECTED WITH

THE DUTIES

OF THE

CORPS OF ROYAL ENGINEERS.



VOL. V.

LONDON:
JOHN WEALE, 59, HIGH HOLBORN.

MDCCCXLII.

VIII.—*Memoranda and Details of the Mode of Building Houses, &c. in the Island of Malta.* *By Major* Harry D. Jones, *R.E.*

The Island of Malta is formed of a calcareous rock more or less indurated, affording an excellent building material, but varying very much in quality. The nature of the rock, being in general very compact, permits of its being quarried in large blocks, which, being easily worked, affords great facilities for employing it in every description of building, from the most ornamental to the plainest and most simple in its construction. No particular style of architecture is observable: in the different cities may be seen almost every variety of building, from the large and magnificent hotels of the Knights to the small and simple house of the tradesman, all presenting an appearance of great beauty and neatness, arising from the whiteness of the stone. The Malta stone, as a building material, varies very much in quality; some of it stands exposure to the atmosphere remarkably well;[1] the other and softer quality decomposes very rapidly, but this is of little consequence, as houses and walls are so easily new faced with stone of a better quality,[2] and which has been more generally employed since the English have been in possession of the island. Both the hard and soft qualities are easily worked, and after being dressed by the mason present a beautiful appearance.

[1] The arms of the Grand Master, "*L'Isle Adam*," which were sculptured in Malta stone nearly three hundred years ago, are as perfect as when cut, and may be seen at the present moment in the south front of the building, formerly the Grand Master's residence, in Fort St. Angelo.

[2] The quality of the stone with which the colleges at Oxford are built greatly resembles the Caen and Malta stone. It is much to be regretted that the heads of colleges do not pursue the same plan, and occasionally expend small sums on repairs to the external walls, which would cost little, and would tend not only to the preservation of the buildings, but would give them a much more creditable appearance than the half worn-away walls and quoins which now present themselves on either side of the High Street.

Foundations,—in every case the rock.

Walls—are of two descriptions, single and double.

A single wall is formed of one stone, varying in thickness from 8 to 12 inches. Plate XVI. fig. 1.

A double wall is 3 feet thick, composed of two single walls with the core filled in with rubble stone; the single walls in this case vary from 8 to 14 inches in thickness; the height of the courses is usually 11 inches. When buildings are three or four stories high, the external walls (which are double walls) are increased in thickness by 6 inches for every story more than two above the ground floor. Fig. 2.

Masonry ribs for supporting floors or terraces are arches turned from the double walls, either segments of a circle or elliptical. The spandrels are filled up with squared stone to the level of the upper part of the key-stone, so as to form a horizontal bed for the ceiling stones to rest upon. The ribs are generally 4 feet distant from centre to centre; sometimes it is usual to cut away part of the upper course and key-stones to form a bed for the ceiling stones to rest upon: this plan takes away from the heavy appearance the full depth of the arch-stones would otherwise give to a room. By this method not more than 5 or 6 inches of the key-stone appear under the ceiling. Figs. 3 and 4 3*a* and 4*a*.

a. Flooring stone, 3 inches thick. Figs. 3 and 4

b. Stone chippings, 2 inches thick.

c. Roofing or ceiling stones, 3 inches thick.

d. Arched rib of masonry.

e. Double wall with thorough courses of squared Ashlar.

Cellars.—Cellars are generally excavations in the rock, the stone from which is employed in raising the fabric above them.

The floor is sometimes paved, a small quantity of earth or rubbish being laid upon the rock to form a bed for the paving stones.

a. Paving stone, 6 inches thick. Fig. 5

b. Rubbish.

c. Rock.

d. Double wall.

Cellars and tanks are covered by the floor of the story above them, supported on arched ribs of masonry. Under the *Great Hospital* in Valetta are some very fine groined arched cellars of considerable span.

Floors.—The method of forming the floor is as follows:

Plate XVI. figs. 6 and 7.

When rib arches are not adopted, beams of red pine timber from the Adriatic are placed across the room from one principal wall to the other, 4 feet distant from centre to centre. On these are laid the ceiling stones (*c*), 3 inches in thickness and 10 or 12 inches in breadth; these are placed as close as possible to each other without mortar; on them are spread stone chippings, 2 inches in thickness (*b*): this makes a good bed for the paving stones, and prevents the passage of the sound between one room and another. On this bed the paving or flooring stones, 3 inches thick (*a*), are laid, which are from 18 to 24 inches square. These stones are jointed with fine mortar; when dry, the upper surface is scraped and covered with a thin coat of warm oil; this hardens the stone, gives it a polish, and prevents the floor losing its beautiful appearance by stains, &c. Without being oiled, it cost about 3*d.* per square foot, materials and labour included.

Figs. 8 and 9.

This is the operation for all ceilings and floors except that which forms the roofs, which in Malta are flat, and called terraced roofs.

Ceiling and common roof.—The ceiling stones (*c*) are placed on arched ribs or beams (*d*) 10 inches × 11 inches scantling, as before described; upon them is laid 4 or 5 inches of *forba*[3] (*b*) soaked with water, arranged in such a manner that one part shall be rather higher than the other to give a fall for the rain water to run off. The forba is beaten with rammers, occasionally being sprinkled with water until it becomes nearly dry and formed into a compact body: over the forba thus prepared, a cement, made by a mixture of lime and

Figs. 8 and 9*a*.

puzzolana, or lime and *diffone*[4] in a liquid state, about ¼ of an inch in thickness, is floated, and likewise beaten with rammers until it also becomes nearly dry; the surface is then well worked with a trowel: occasionally water is sprinkled over it during the operation. When the coating of cement is laid on, as many women and children are employed with wooden hand-beaters as can conveniently be placed in a single row extending across the roof of the building; very often as many as thirty may be seen at one time at work. After this operation is performed, and in order to prevent the heat of the sun from cracking the cement before it is thoroughly dry, a thin coat of sand or stone chippings is spread over it; after a few days it is swept clean, leaving a

[3] Forba consists of small stones, mixed with red argillaceous earth excavated from fissures in the rocks, which are generally found to be filled with it.

[4] Diffone is composed of broken earthen pots and pans.

beautiful, even, and polished surface, perfectly impervious to water and of great durability: a square foot weighs about 80 lbs.

Stone roof.—In some cases a roof is formed by paving stones instead of using *forba;* in this case the joints are left open about one inch; these are filled with small stones (*a*) (acting as wedges) and with puzzolana cement well driven down, the whole of them plastered over with cement and well worked with a trowel. This forms an excellent roof, but the weight has a tendency to cause a deflexion of the beams which opens the joints, and it is consequently a leaky roof for the first wet season after the erection of a building, or when a new roof has been laid down. Plate XVI. fig. 9a.

Roof over farm houses.—In farm houses where the breadth of the room does not exceed 9 feet, flat roofs are constructed by single stones 6 inches thick and 7 feet 6 inches long, supported on corbels (*f*); upon these stones 3 inches of forba (*b*) is laid, and this is covered in the usual manner with ½ of an inch of cement of *diffone* and lime (*a*). The walls (*d*) are double, filled in with rubble stone. Passages not exceeding 8 feet 6 inches in width are covered by a single stone (*a*), 6 inches thick, supported by brackets. Fig. 10. Figs. 11, 12.

Tanks.—Tanks are generally excavations in the rock under the body of a house, and except in the city of Valetta (in which only can they be filled with spring water), contain the sole supply for the family. All the rain which falls upon the roof of a house is conveyed into the tank by baked earthen pipes; the water thus obtained remains in an excellent state for years, if not exposed to the light of the day. In the course of years a great quantity of sediment accumulates in the tank; it then becomes necessary at the end of the summer to draw off all the water and cleanse it,—a disagreeable operation, and, if performed long before the autumnal rains commence, attended with great inconvenience and often distress to the occupants, from the want of that necessary element, which in a warm climate is above all essential.

The method of forming a tank is as follows:

After the excavation in the rock has been made, the walls or sides and bottom are rough picked, and their surfaces covered with a coat of cement ½ of an inch thick, well worked with a trowel until dry, water occasionally being sprinkled upon it while working it. The extent and capacity of some of the principal tanks is very considerable. At the barracks at Rabbato in the Island of Gozo, a few years since, a soldier's wife was washing linen near

the entrance of the tank : one of her children fell into it ; and immediately upon hearing the splash and missing one of them, attempts were made by herself and some soldiers with poles and drags to get the child out, but without success. A boat was then brought up from the Marina and launched into the tank ; three days elapsed before the body was found. This length of time may in some degree be accounted for by eddies having been formed by the agitation of the water, but still it may serve to give an idea of the size of the tank.

The water conveyed into these tanks does not undergo any system of filtration. For a few days after a fall of rain the water will be slightly turbid, but soon becomes clear and fit for use, and without any disagreeable flavour.

Plate XVII. fig. 13. *Stairs.*—The stairs in every house are stone, one end resting upon and let into the principal or division wall ; the other rests upon a wall built for that purpose, supported on an irregular arch (*c*) turned from stone columns erected at the bottom and angles of the staircase.

Fig. 14. *Balconies.*—To the windows of the principal floor of almost every house there are balconies, either open or covered ; in both cases surrounded by a balustrade 3 feet high, and in the latter covered in with wood and Jalousie blinds.

Balconies are generally supported upon corbels (*a*) formed of large stones, which are very ornamental : an agreeable shade from the heat and strong glare of the sun, reflected from the white walls and ground around the house, is thus obtained.

Revêtements.—Although the fortifications in Malta are very extensive, there being upwards of 20 running miles of parapet, nothing can be learned from them as to the proper section for retaining walls. In general the revêtement is merely a facing to the rock of a less perishable material than the rock itself, and intended to protect it from the destructive effects of the atmosphere, being made more or less thick according to the decomposed state of the rock : if it has been much worn away, the wall is generally backed in with rubble stone and mortar, in some parts being three or four times thicker than is absolutely

Fig. 15. necessary. In the Cottonera and Santa Marguerita Lines, the revêtements vary from 30 to 70 feet in height, and are built " en décharge." The arches might be converted to many useful purposes, if required, by the military. A few years since they were occupied by the poorest of the inhabitants, and were then the abodes of poverty, wretchedness, and misery.

Mortar.—Some of the Malta stone, when burnt, makes excellent lime : for

common buildings and backing of revêtement walls, the mortar used is merely earth and water mixed, the external joints being afterwards pointed with good lime and sand mortar.

In other buildings the mortar is a mixture of chippings produced in dressing the stones; the chippings are sifted and mixed with lime in the proportion of one part lime and one part of sifted chippings.

In superior buildings the mortar is composed of two parts lime and one part sand.

Cement.—The cement used for lining tanks and for covering roofs is made of puzzolana and lime, in the proportion of four parts lime and three parts puzzolana.

When *diffone* is used (which is broken earthern pots and pans) and mixed with lime, the proportions are five parts lime and three parts diffone.

Names and dimensions of the different descriptions of building stone, and to what purposes applied.

Name.	Length.	Breadth.	Thickness.	To what purposes applied.
Vasi	1 foot	1 foot	11 inches	For building external and division walls.
Double Cantoni	..	10 inches	..	
Single Cantoni	..	8 inches	..	
Ciangatura . .	1 foot 8 in.	to 2 feet	Squared and 3 in. thick	Common paving stone.
Balate forma .	1 foot	1 foot	6 in. to 1 foot	Paving do. (thick).
Capitelli. . . .	3 to 6 feet	1 foot 3 in.	6 to 8 inches	Ceiling and roofing.
Balate di tetto	3 to 6 feet	11 inches	3½ inches	Roofing.
Scalini	3 to 6 feet	1 foot 4 in.	6 to 8 inches	Steps and stairs.
Scarpa	1 foot	1 foot 6 in.	1 foot 6 in.	Revêtements, scarps, parapets, and gun platforms.
Hard	..	..	..	

Hard stone, when dry, weighs per cubic foot (Malta) . 146 lbs.
Do. Do. Do. (Gozo) . 145 lbs.
Soft stone (Malta) . . . . . 122 to 144 lbs.
A flooring stone 18 inches square . . . . . 65 lbs.

Beams for roofs and floors.—The scantling of beams for supporting floors and roofs, as measured in a large building, were found to be as follows:

Between the points of support.	Scantling. in. in.	Distance apart.
22 feet	14 × 9	2 feet 3 inches.
13 feet	9 × 8	feet 9 inches.
11½ feet	11 × 10	3 feet 5 inches.

The greatest distance between the points of support for a beam is 30 feet, and

and gave the apartments an appearance of finish and comfort, which is seldom the case in the private Maltese houses. The interior of a Malta house presents nothing but the bare walls and a polished floor; the former either white-washed or covered with a plain wash of a salmon or buff colour. Since the English have been established in Malta a great improvement has taken place; the walls have been stencilled, and many present an appearance difficult to be distinguished from beautiful paper with a rich border. Fire-places have been constructed generally in houses occupied by the English.

Timber.—Timber is purchased by the tratto.

1 tratto = 7⅞ cubic feet English.

There is a public officer whose duty is to measure all timber upon being discharged from the vessels. After measuring it, he stamps each log with a mark, which indicates the number of tratti for which the purchaser is obliged to pay. It very often happened that timber, when delivered at the engineers' workshops, did not contain, when measured, the cubical contents which it ought to have done according to the mark upon it.

Deals are sold by the bollo, and paid for according to their breadth, which is also fixed by the Government measurer.

1 Bollo	. . . .	11½ inches in breadth.
2 do.	. . . .	12⅝ ,,
3 do.	. . . .	13¾ ,,
4 do.	. . . .	14⅞ ,,
5 do.	. . . .	16 ,,
6 do.	. . . .	17⅛ ,,

Payment is made agreeable to this arrangement, and as all the deals from Venice are cut to the same thickness, *breadth* only is attended to in the purchase.

Sand is sold by the boat load of 6 salms, Malta measure: 1 salm is equal to about 8 English bushels.

Lime is sold by the salm.

Measures.—1 Palm = 10½ inches English.
7 Palms = 6 feet English.
8 Palms = 1 canna, Malta measure, 6 feet 10 inches English.

Weights.—1 Cantar = 175 lbs. English.
1 Tumalo = 94 lbs. English.

The houses, as may easily be conceived, are very substantial; cold in winter,

the scantling 13 × 11 inches. Instead of using these large beams, which are difficult to handle, I caused an experiment to be made with two 3-inch planks, bolted through an intermediate block at each end to preserve the same breadth as when the beam was used: by this mode there was a considerable saving in expense and labour. Often it was found difficult to procure large quantities of perfectly sound and straight-grained balks: by using 3-inch plank these difficulties were obviated.

Plate XVII. fig. 16.

When looking down upon the city of Valetta and the four cities on the opposite side of the Great Harbour, the buildings erected when the Order of St. John was first established in Malta are easily to be distinguished: they have all a pitched roof, and were either the hotels of the Knights, or buildings used for military purposes, such as the Great Hospital of St. John, in which the sick were attended by the Knights, (the principal ward is 600 feet long,) St. John's Church, Artillery Arsenal, and the Bakery. All other buildings have invariably the flat terrace roof.

Fig. 17. Section of part of the roof over the *Auberge de Provence*.

The beams were 3 feet 4 inches distant from each other, and 35 feet the space between the walls.

	inches.	
Scantling.		
a. Tie-beam	12½ × 10	
b. Rafter, length 21½ feet.		
Scantling top . . .	7 × 4	
Butt	8½ × 5	
c. Collar beam, length 16 feet.		
Scantling . . .	6 × 5	
d. Ceiling joist . . .	3 × 3	1 foot 4 inches asunder.
e. Purlins	3 × 3	1 foot 3 inches asunder.
f. Struts	6 × 4	
g. Bracket	11 × 10	Projects 4 feet.

Fig. 17*a*. Is a section of the granary attached to the great military bakery in Valetta.

The beams and ceiling joists in most buildings of a superior order are covered with thin boards neatly moulded round the edges, forming ornamental panels, which greatly improve the appearance of a room. In many of the auberges the ceilings of the principal rooms were coved and lined with canvas, on which allegorical subjects were painted. The timber having perished with age, the canvas was taken down when the roofs were repaired, and a coved ceiling is now rarely to be seen. The effect was extremely good,

degree injured. The stones are suspended and carried in the same manner as pipes of wine and oil by the *gallegos* at Lisbon and Cadiz, and the *hamals* at Constantinople; that is, by poles resting upon their shoulders: as many as sixteen men may often be seen employed in carrying one stone. The Maltese masons are very expert in turning arches of considerable span without the expensive centering to which we are accustomed: in breaking doorways or windows through walls they also show great skill.

In closing these Memoranda, I cannot omit to express my obligations to Mr. Calcedonio Bonavia, the talented and intelligent clerk of works, and also to Mr. Beck, the zealous overseer of works, in the Royal Engineer Department, for the information they so willingly communicated to me on my first arrival in Malta. Any officer who feels interested in his professional duties must, on joining at Malta, apply for information to either of those individuals: the system differs so essentially from what he has been accustomed to at other stations, and the language of the lower classes of Maltese, being nearly pure Arabic, prevents him from interrogating the foreman or workmen, and acquiring information through those channels.

HARRY D. JONES.

Dublin, 15th April 1840

and warm in summer: in this season, when once the walls become heated, they never cool until the rainy season sets in. The thermometer during the summer months seldom falls at midnight more than 2° or 3° lower than what it registered at mid-day; the reverse takes place in winter. Wood is a bad material to use in situations exposed to the influence of the sun, the heat of which absorbs all the juices of the timber, warps and splits it. Common colours in oil are not preservatives in that climate. Where metal can be used, it is preferable to wood.

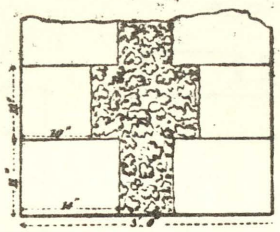
It is only necessary to state that the metal sashes which were manufactured in England expressly for the windows of the Grand Armory in the Palace answered remarkably well. It may excite some surprise when it is stated that in every powder magazine, except those which have been built or repaired by the English, all the doors and shutters are covered with sheet iron, and the locks and hinges are made of the same material! though scarcely a winter passed in Malta during the period I was quartered there without some church or elevated building being struck or much injured by lightning. An accident to a magazine from lightning was never known.

Cones.—Cones for holding corn are simple excavations in the rock, of a pear shape, and about 30 feet in depth. Corn is poured into them, and the mouth or man-hole covered with a large stone (*b*) cemented upon the collar (*c*); this prevents the entrance of damp or moisture from the atmosphere, and in this manner corn is preserved in an excellent state for many years. It may be interesting to mention a circumstance which took place shortly after the English obtained possession of the island. In all excavations in the rock there is a greater or less degree of moisture; this was considered by the English as likely to be extremely prejudicial to wheat, and, with a view to remedy it, a lining of good dry masonry was built, as represented in fig. 18*a*: this excluded the moisture, but destroyed the corn; and, in consequence, the cone so altered is never used except from absolute necessity, and then is always the first to be opened for issues. The moisture from the rock is considered extremely beneficial, even if not necessary, to the long preservation of wheat when closed up, as in the cones.

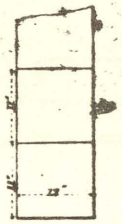
Plate XVII. fig. 18.

Every body who witnesses the Maltese stone carriers when employed in moving a large stone, cannot fail to admire the ready manner in which they adjust the poles and ropes by which it is suspended, and carried to the spot where it is to be used by the masons, without the *arises* being in the slightest

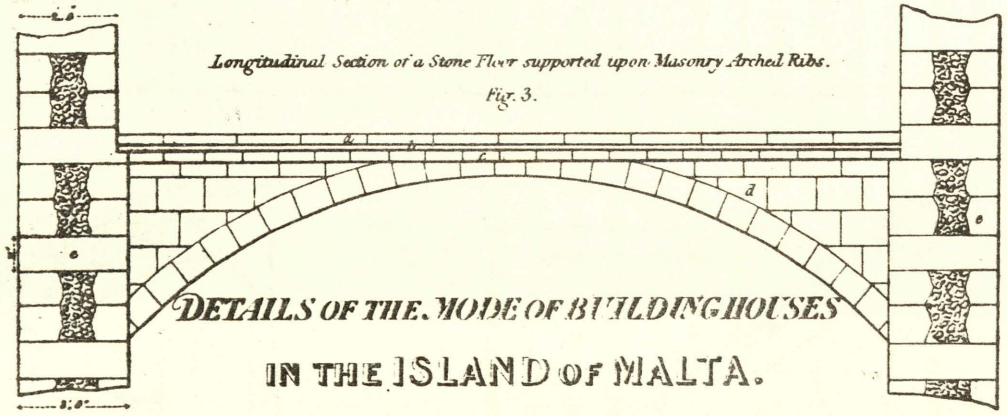
Section of a Double Wall.
Fig. 1.



Section of a Single Wall.
Fig. 2.

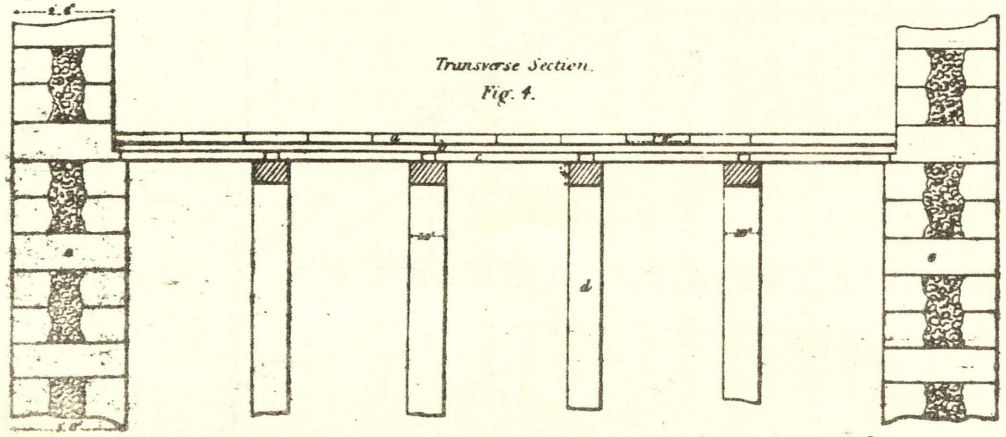


Longitudinal Section of a Stone Floor supported upon Masonry Arched Ribs.
Fig. 3.



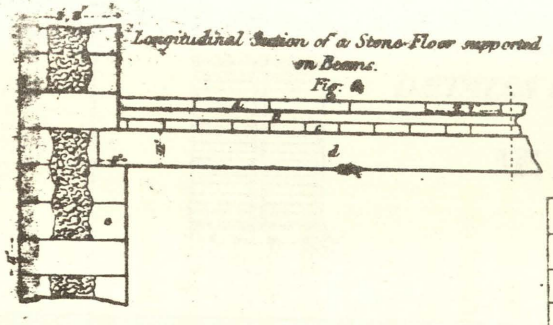
DETAILS OF THE MODE OF BUILDING HOUSES IN THE ISLAND of MALTA.

Transverse Section.
Fig. 4.

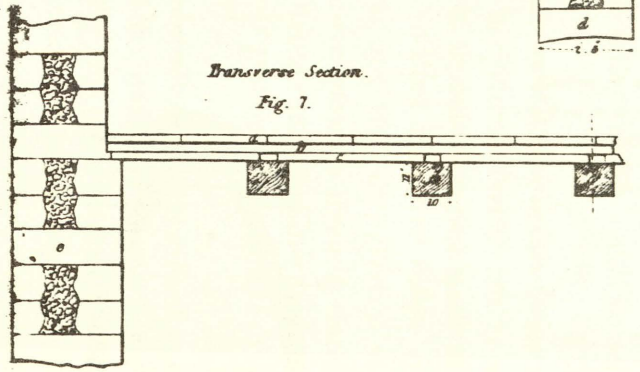


Section of a Floor for Cellars or Coach House.
Fig. 5.

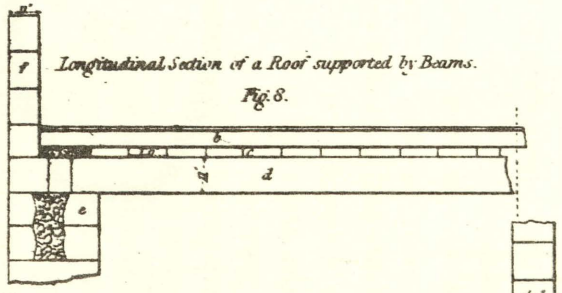
Longitudinal Section of a Stone Floor supported on Beams.
Fig. 6.



Transverse Section.
Fig. 7.



Longitudinal Section of a Roof supported by Beams.
Fig. 8.



Transverse Section.
Fig. 9.

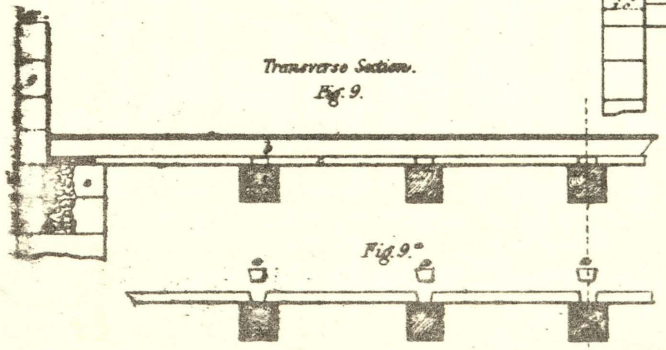
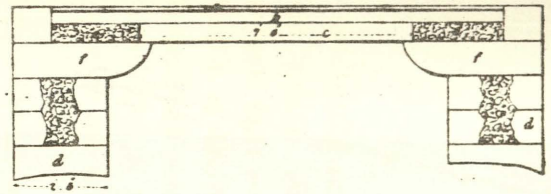
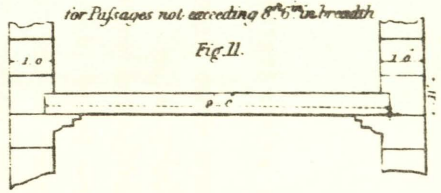


Fig. 9.*

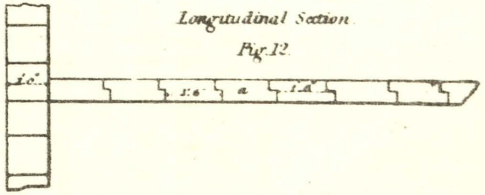
Section of a flat Roof used for Farm Houses.
Fig. 10.



Transverse Section of a Floor supported on Corbels for Passages not exceeding 8'.6" in breadth
Fig. 11.



Longitudinal Section
Fig. 12.



DETAILS OF THE MODE OF BUILDING HOUSES

IN THE ISLAND OF MALTA.

Fig. 15.

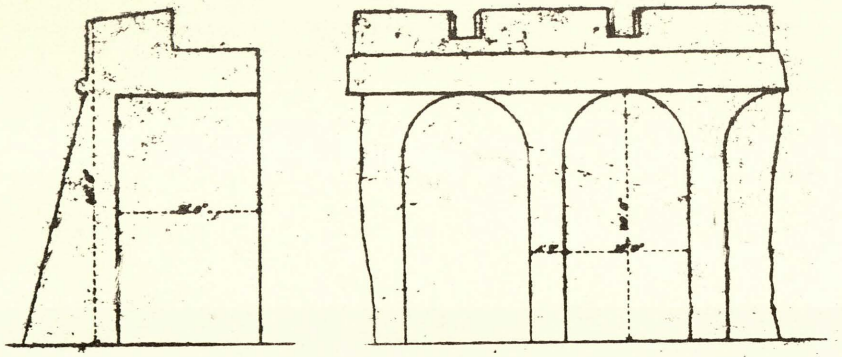
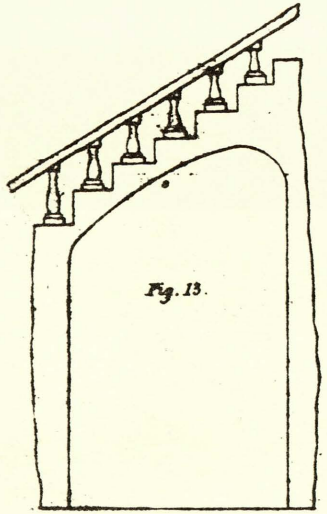


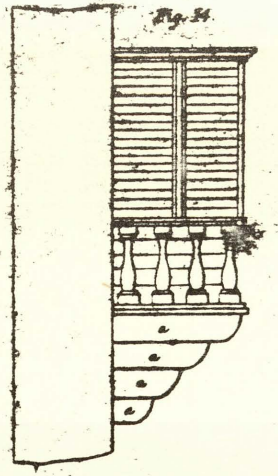
Fig. 13.



Section of Part of the Roof of the Auberge de Provence.

Fig. 17.

Fig. 14.



Sketch of a Cone for holding Corn.

Fig. 18.

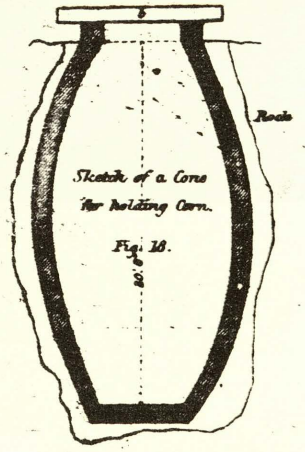
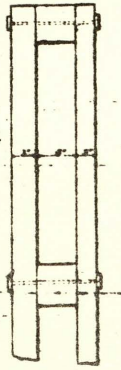


Fig. 16.



Section of the Granary attached to the grand Bakery at Valetta.

Fig. 17.a