

**AN ELEMENTARY TREATISE ON THE  
CONSTRUCTION OF ROOFS OF  
WOOD AND IRON. DEDUCED  
CHIEFLY FROM THE WORKS OF  
ROBISON, TREDGOLD, AND HUMBER**

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649459322

An Elementary Treatise on the Construction of Roofs of Wood and Iron. Deduced Chiefly from the Works of Robison, Tredgold, and Humber by E. Wyndham Tarn

Except for use in any review, the reproduction or utilisation of this work in whole or in part in any form by any electronic, mechanical or other means, now known or hereafter invented, including xerography, photocopying and recording, or in any information storage or retrieval system, is forbidden without the permission of the publisher, Trieste Publishing Pty Ltd, PO Box 1576 Collingwood, Victoria 3066 Australia.

All rights reserved.

Edited by Trieste Publishing Pty Ltd.  
Cover @ 2017

This book is sold subject to the condition that it shall not, by way of trade or otherwise, be lent, re-sold, hired out, or otherwise circulated without the publisher's prior consent in any form or binding or cover other than that in which it is published and without a similar condition including this condition being imposed on the subsequent purchaser.

[www.triestepublishing.com](http://www.triestepublishing.com)

**E. WYNDHAM TARN**

**AN ELEMENTARY TREATISE ON THE  
CONSTRUCTION OF ROOFS OF  
WOOD AND IRON. DEDUCED  
CHIEFLY FROM THE WORKS OF  
ROBISON, TREGOLD, AND HUMBER**



*AN ELEMENTARY TREATISE*  
ON THE  
**CONSTRUCTION OF ROOFS**  
OF  
**WOOD AND IRON**

DEDUCED CHIEFLY FROM THE WORKS OF ROBISON,  
TREDGOLD, AND HUMBER

BY

**E. WYNDHAM TARN, M.A., ARCHITECT**

AUTHOR OF "THE SCIENCE OF BUILDING," AND "PRACTICAL GEOMETRY FOR THE  
ARCHITECT, ETC.;" EDITOR OF "TREDGOLD'S ELEMENTARY PRINCIPLES OF CARPEN-  
TRY," AND "DOBSON'S STUDENT'S GUIDE TO MEASURING AND VALUING"

With numerous Illustrations

SECOND EDITION, REVISED AND CORRECTED



LONDON  
**CROSBY LOCKWOOD AND CO.**  
7, STATONERS' HALL COURT, LUDGATE HILL  
1883

[All rights reserved]

1863. e. 2

LONDON:  
PRINTED BY J. S. VINTAGE AND CO., LIMITED,  
CITY ROAD.



## PREFACE.

---

THE present little work is intended to introduce the student of architecture to the first principles upon which the roofs of buildings are constructed, and to enable him the more readily to understand the larger and more elaborate treatises upon this important subject. The work is divided into two parts, the first part treating upon the subject of wooden roofs, both ancient and modern, and also upon the method of ascertaining the strains which are exerted upon the several timbers of a trussed roof. The second part is devoted to the consideration of modern roofs constructed entirely of iron, a material now generally employed where wide openings have to be covered; and several examples of iron roofs of different design are described and illustrated, the principles of their construction being also explained.

23

24

25

26

27

28



# TABLE OF CONTENTS.

## PART I.—ROOFS OF WOOD.

SECTION	PAGE
1. Object of a roof . . . . .	1
2. Pitch of roofs dependent on climate and the kind of covering used. Pressure of wind on roofs varying with their pitch . . . . .	1
3. Division of roofs into trussed and untrussed . . . . .	4
4. Lean-to, shed, or pent roof . . . . .	4
5. V or M roof . . . . .	6
6. Ridge roofs, with or without collars . . . . .	7
7. Gothic collar roof . . . . .	8
8. Gabled and hipped roofs; valleys and gutters . . . . .	9
9. Roof with principals, collar and purlins . . . . .	10
10. Tie-beam roof . . . . .	11
11. King-post roof; scantling of timbers . . . . .	12
12. Queen-post roof; " " . . . . .	13
13. Covering of roofs . . . . .	15
14. Prof. Robison's method of finding the strains on king or queen trusses . . . . .	16
15. Modern method of calculating the strains on a trussed roof by means of diagrams . . . . .	18
16. Tie-beam roofs of wide span: chapel at Greenwich Hospital; Birmingham Theatre; Drury Lane Theatre . . . . .	22
17. Curb, or Mansard, roof; theatre of Oxford University . . . . .	26
18. Proportions of the timbers of a roof; Tredgold's rules . . . . .	27
19. Iron straps and bolts used in framing trusses; Tredgold's rules as to dimensions; cast-iron shoe to tie-beam . . . . .	31
20. Roofs with sloping tie-beams; Robison's investigations of their mechanical principles; theatre at Edinburgh . . . . .	33
21. Delorme's system of curved ribs; Pantheon in Oxford Street; application to domes; domes of trussed ribs; Register Office, Edinburgh; Halle au Blé, Paris . . . . .	36
22. Hammer-beam roofs: Westminster Hall; Hampton Court; Eltham Hall; roofs of churches in Norfolk and Suffolk; roof of Assize Courts, Manchester . . . . .	40
23. Roof of Leeds Grammar School . . . . .	46
24. Robison's theory of the strains upon the parts of a truss . . . . .	50
25. Robison on the strains on a beam supported at one end and loaded at any point . . . . .	52
26. Robison on the strains upon a beam supported at both ends . . . . .	57
27. Robison on the strain on a beam from its own weight or a distributed load . . . . .	60

SECTION	PAGE
28. Robison on the relation between the strains on a beam and its strength . . . . .	61
29. Robison on the strains on a sloping rafter . . . . .	63
30. Robison on the comparison of the strength of roofs which have different elevations . . . . .	64
31. Robison on strains on parts of a roof arising from the support they give to each other . . . . .	65

## PART II.—ROOFS OF IRON.

32. Introduction of iron into construction of roofs; its advantages over wood; disadvantages; preservation from corrosion; forms of section used in roofs; joints, rivets, bolts . . . . .	73
33. Flat roof with iron joists and girders . . . . .	76
34. Ridge roof with horizontal tie-beam; strains on the several parts . . . . .	77
35. Roof of the House of Lords . . . . .	80
36. Trussed roofs with inclined tie-beams . . . . .	82
37. Pimlico Station of Brighton Railway . . . . .	84
38. Bowstring truss; roof of Cannon Street Station . . . . .	86
39. Roof of Charing Cross Station . . . . .	88
40. " Amsterdam Railway Station . . . . .	89
41. " New Street " " Birmingham . . . . .	89
42. " Lime Street " " Liverpool . . . . .	90
43. Domical roof of Albert Hall, Kensington . . . . .	90
44. Arched ribs with ties; Pimlico Station of Chatham and Dover Railway . . . . .	93
45. St. Pancras Station of Midland Railway . . . . .	95
46. Arched ribs without ties; Metropolitan Station at Kensington . . . . .	96
47. Cremorne Music Hall . . . . .	97
48. Dublin Winter Palace . . . . .	98
49. Agricultural Hall, Islington . . . . .	100
50. Market Hall, Derby . . . . .	100
51. Arched roof of Crystal Palace . . . . .	101
52. Proportions of arched ribs; calculation of strength and thrust . . . . .	102
53. Conical iron roof of Vienna Exhibition; Mr. J. Scott Russell's description of its principles of construction; advantages of conical form . . . . .	103
54. Spherical and spheroidal domes of plate iron . . . . .	111
55. Domes formed of iron trusses or-ribs; Albert Hall roof; roof of British Museum Reading-room . . . . .	112
56. Summary of the different classes of iron roofs . . . . .	112

ON THE  
CONSTRUCTION OF ROOFS.

---

PART I.—ROOFS OF WOOD.

1. THE word *Roof* expresses the covering of a house or other building, by which its inhabitants or contents are protected from the injuries of the weather; it also helps to bind together and give firmness to the walls of the structure. A roof is not only an essential part of a house, but it is often made a characteristic feature of its design; as, for example, the roofs of palatial, public, and private buildings in France, which are denominated the "*Mansard*," and more especially the picturesque roofs of the ancient *châteaux* of France, and the towers and castles to be found in various parts of Germany; in which much attention was often paid to their ornamentation. The timber roofs of many of the old buildings were made much heavier than was necessary for stability, and we consequently find that they have in some cases thrust the walls out of the perpendicular, where these have not been built of sufficient thickness, or strengthened by buttresses to resist their thrust.

In constructing a roof the object of the builder should be, so to arrange its several parts as to obtain a structure as light as possible combined with a maximum degree of strength.

2. In the present Treatise we shall limit the meaning