Burt Franklin: Research & Source Works Series # 148

A HISTORY OF THE MACHINE-WROUGHT HOSIERY AND LACE MANUFACTURERS

A HISTORY

OF THE

MACHINE-WROUGHT HOSIERY

AND

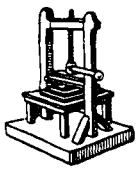
LACE MANUFACTURERS

By

WILLIAM FELKIN, F.L.S., F.S.S.

WITH A NEW PREFACE BY GORDON HANES

Burt Franklin: Research & Source Works Series # 148



Published by
BURT FRANKLIN, NEW YORK
for
THE AMERICAN SOCIETY OF KNITTING TECHNOLOGISTS
1 9 6 7

Published By
BURT FRANKLIN
235 East 44th St.
New York, N.Y. 10017

ORIGINALLY PUBLISHED
LONDON: 1867

Printed in U.S.A.

PREFACE

This is the hundredth year since the publication of Mr. William Felkin's interesting, useful, and now rare book *History of the Machine-Wrought Hosiery and Lace Manufacturers.*

Believing that this book goes far toward remedying the abysmal lack of technical historical knowledge of our Industry, Robert Peel, President of the American Society of Knitting Technologists and Director of Research for Hanes Corporation, has undertaken to republish it. In this venture we are happy to have a part.

The future of our Industry, and indeed of all modern industry, is inextricably associated with innovation. Innovation can come only from intelligent and well-trained technologists. These technicians must have a fundamental knowledge of the tools of the knitting trade, beginning in the time of Elizabeth the First.

This then is our purpose, to provide for future practicers of the knitting arts a readily available and clear look at the past so that they may be prepared to chart the progress of the Industry for the years ahead.

GORDON HANES
Chairman, Hanes Corporation
Winston-Salem, N.C., U.S.A.

October 12, 1966

TO

THE SUBSCRIBERS,

WHOSE KINDNESS HAS ENCOURAGED THE AUTHOR TO PRINT THIS VOLUME,

IT IS RESPECTFULLY INSCRIBED

BY

THEIR OBLIGED AND OBEDIENT SERVANT,

WILLIAM FELKIN.

LIST OF SUBSCRIBERS.

	Copies
His Grace the Duke of Devonshire, K.G., *Holkar Hall*	1
The Right Honourable Lord Belper, *Kingston Hall*	6
Sir R. I. Murchison, K.C.B., LL.D., F.R.S., *London*	1
Sir Rowland Hill, G.C.B., *London*	1
Sir Arnold Knight, *Nottingham*	1
William Hodgson Barrow, Esq., M.P., *Southwell*	1
Thomas Bazley, Esq, M.P., *Eynsham Hall*	2
John Cheetham, Esq, M.P., *Staley Bridge*	2
Hon. G. Denman, M.P., Q.C., *London*	2
Samuel Morley, Esq, M.P., *London*	5
Colonel Sykes, M.P., F.R.S., *London*	1
W. F. Webb, Esq, High Sheriff, *Newstead Abbey*	2
Colonel Holden, *Nuttall Temple*	1
Venerable Archdeacon Fearon, *Loughborough*	1
Rev. Professor Bosworth, LL.D., *Oxford*	1
Rev. James Edwards, *Collingham*	1
Rev. William Jones, *Derby*	1
Chevalier Edward Tailbuis, *Paris*	2
Miss Gotobed, *Cambridge*	1
Mrs. Brewin, *Tiverton*	6
Miss Heathcoat, *Tiverton*	6
Mrs. Hannay, *Leamington*	2
Madame F. Washer, *Brussels*	1
Samuel Adams, Esq, *Sherwood*	1
A. Alexander, Esq, *Hamburgh*	2
Messrs. Andrew and Sons, *Ashton-under-Lyne*	1
Henry Ashworth, Esq, *The Oaks, Bolton*	1
George Bacon, Esq, *Belmont, Scarborough*	2
William Baker, Esq, *Derby*	1
Thomas Bayley, Esq, *Lenton Abbey*	2
John Bayley, Esq, *Lenton Priory*	1
Thomas Sebastian Bazley, Esq, *Agden Hall*	2
Amos Beardsley, Esq, *Bay Villa, Grange*	2
Alderman R. Besley, *Wimbledon, London*	1
Messrs. John Biggs and Son, *Leicester*	1
Richard Birkin, Esq, *Aspley Hall*	2
Thomas Bishop, Esq, *Bramcote*	2
W. C. Boden, Esq, *Ruddington Hall*	1
Potto Brown, Esq, *Houghton, Huntingdonshire*	1

	Copies
L. M. Bucknall, Esq, *London*	2
John Burton, Esq, *Lenton*	1
William Carpmael, Esq, *London*	1
Messrs. Cartwright and Warner, *Loughborough*	1
J. J. Chaffer, Esq, *New York*	1
Edward Charles, Esq, *Bulwell*	1
Messrs. Cliff, Brothers, and Son, *St. Quentin*	4
George Cockle, Esq, M.D., *Cambridge*	2
John Cooke, Esq, *Bradford, Yorkshire*	1
Thomas Coote, Esq, *Bournemouth*	1
Messrs. Cope, Ward, and Cope, *New Basford*	3
Messrs. Copestake, Moore, Crampton, and Co, *London*	6
Charles Cox, Esq, *Basford*	1
Thomas Crofts, Esq, *New York*	2
William Danson, Esq, *Liverpool*	1
Robert Dawbarn, Esq, *Wisbeach*	1
Messrs. Dent, Allcroft, and Co, *London*	3
J. B. Dickinson, Esq, *Wolverhampton*	1
Richard Eaton, Esq, *Basford*	1
John Eaton, Esq, *Tiverton*	1
J. T. Emmett, Esq, *London*	1
H. M. Felkin, *Chemnitz*	26
Robert Felkin, Esq, *London*	1
George Foster, Esq, *Bournemouth*	2
G. E. Foster, Esq, *Cambridge*	4
Edmond Foster, Esq, Town Clerk, *Cambridge*	1
J. P. Gardner, Esq, *Cambridge*	1
Herr A. Geier, *Chemnitz*	1
G. B. Gifford, Esq, *Chard*	1
— Gieve, Esq, *London*	1
J. Sherwin Gregory, Esq, *Harlaxton Hall*	1
Monsieur F. Grèau, *Troyes*	1
Monsieur Louis Le Grand, *Ghent*	1
Samuel Groucock, Esq, *New York*	2
John Hadden, Esq, *Bramcote Lodge*	2
Edward Hallam, Esq, *London*	1
John Harley, Esq, *Beeston*	2
John Harrison, Esq, *Claughton, Birkenhead*	1
J. C. Harrison, Esq, *Dudley House, Whalley*	1
John Hartley, Esq, *New York*	1
John H. Haviland, Esq, *New York*	1
Thomas Hawksley, Esq, C.E., *London*	1
Abraham Hazelton, Esq, *New York*	1
Richard Heathfield, Esq, *London*	1
William Heney, Esq, *New York*	1
William Heymann, Esq, *Leipsic*	1
Lewis Heymann, Esq, *Bridgeford House*	3
Messrs. Higgins, Eagle, and Hutchinson, *London*	1
R. Higgins, Esq, *London*	1
B. H. Hine, Esq, *Mapperley Plains*	3
Messrs. Hitchcock, Williams, and Co, *London*	1
J. W. Hodges, Esq, Mayor, *Leicester*	2
Adam Holden, Esq, *Liverpool*	2

	Copies
Herr C. F. Höffer, *Chemnitz*	1
Herr Geheimrath Dr. Hülse, *Dresden*	1
Imperial Polytechnic School, *Dresden*	1
W. D. Jourdain, Esq, *Kegworth*	2
Herr Charles Kessler, *Chemnitz*	1
Königliche Höhere Gewerb Schule, *Chemnitz*	1
John Laing, Esq, *Hawick*	1
Edward Laycock, Esq, Mayor, *Leeds*	1
J. A. Legard, Esq, *Cowes, Isle of Wight*	1
Herr H. R. Loesner, *Chemnitz*	1
Daniel Mackay, Esq, *New York*	1
Monsieur Maillot, *Lisle*	1
Hugh Mason, Esq, *Groby Lodge, Ashton-under-Lyne*	3
Henry Martin, Esq, *Wolverhampton*	1
A. G. Marten, Esq, *London*	1
Mechanics' Institution, Leeds	1
John Miller, Esq, Mayor, *Barnstaple*	1
Samuel Morley, Esq, *Lenton Grove*	1
Messrs. Morrison, Dillon, and Co, *London*	3
Thomas North, Esq, *Basford Hall*	6
B. S. Oliver, Esq, *Basford*	1
Messrs. Oliver and Sons, *Bollington*	4
James Orrock, Esq, *Leicester*	1
William Page, Esq, *Bobbers Mill*	1
Charles Paget, Esq, *Grange, Ruddington*	2
T. Dennis Paul, Esq, *Leicester*	1
Samuel Paulson, Esq, *New York*	30
Robert Pegg, Esq, *Derby*	2
Edmund Percy, Esq, *Beeston*	1
Alexander Ramsay, Esq, *New York*	1
Frederick Sanders, Esq, *London*	1
R. S. Slater, Esq, *London*	2
Samuel Smiles, Esq, *Blackheath, London*	1
— Smith, Esq, *Derby*	1
W. T. Smith, Esq, *New York*	1
George Sneath, Esq, *Medhurst, Upper Canada*	1
Society of Arts, London	1
Charles Spencer, Esq, *Philadelphia*	3
William G. Spencer, Esq, *Philadelphia*	2
Herr Julius Steinhardt, *Hamburgh*	1
W. Taylor, Esq, *London*	1
C. P. Tebbutt, Esq, *Bluntisham, Huntingdonshire*	6
J. L. Thackeray, Esq, *Arno Vale*	1
G. V. Vernon, Esq, *Manchester*	1
Benjamin Walker, Esq, *Lenton*	1
Messrs. Walker and Co, *Bradford*	1
J. H. Walter, Esq, *London*	1
W. W. Ward, Esq, *New York*	1
Charles Warner, Esq, *New York*	1
Henry Warner, Esq., *Loughborough*	1
John Watson, Esq, *Beeston*	1
Arthur Wells, Esq, *Cavendish Hill*	2
J. Scott Wells, Esq, *Arnot House, Arnold*	2

	Copies
Robert Wherry, Esq, *Wisbeach*	1
Joseph Whitworth, Esq, *Darley Dale*	1
John H. Williams, Esq, *New York*	1
Thomas Wilson, Esq, M.A., *Crimbles House, Leeds*	1
William Wilson, Esq, *Sherwood Hall*	4
William Windley, Esq, *Mapperley Plains*	6
John T. Woodhouse, Esq, *Overseal*	2
T. B. Woolley, Esq, *London*	1
G. B. Woolley, Esq, *London*	1
J. Young, Esq, *London*	1

NOTTINGHAM.

Thomas Ball, Esq, Mayor	2
William Enfield, Esq, Town Clerk	2
D. W. Heath, Esq, Coroner	2
Louis Baillon, Esq, Vice-Consul, France	1
F. Liepmann, Esq, Vice-Consul, Saxony	1
George Alcock, Esq	1
Richard Allen, Esq	1
J. R. Allen, Esq	1
Thomas Ashwell, Esq	1
Messrs. Attenborough, Mellor, and Blackburn	1
J. S. Baldwin, Esq	1
Rupert Baldwin, Esq	1
John Barber, Esq	1
Richard Birkin, junior, Esq	2
Messrs. Bookers	1
John Bradley, Esq	2
William Bradshaw, Esq	1
F. Braithwaite, Esq	1
Joseph Braithwaite, Esq	1
Bromley House Library	1
F. B. Burton, Esq	1
Charles Butlin, Esq	1
W. B. Carter, Esq	2
Chamber of Commerce	1
William Chapman, Esq	1
Thomas Close, Esq	1
William Dearden, Esq	1
Messrs. Dobsons	2
Owen Donald, Esq	1
Moritz Dann, Esq	1
W., C., F., and J. Felkin	4
James Fisher, Esq, *Stoney Street*	1
Messrs. Fleirsheim, Feilmann, and Co	1
Samuel Fox, Esq	3
F. B. Gill, Esq	2
T. F. Gimson, Esq	10
A. Goater, Esq	2
J. D. Gorse, Esq	1
Richard Hardy, Esq	2

	Copies
Thomas Herbert, Esq	1
George Herbert, Esq	1
Thomas Hill, Esq	3
William Hill, Esq	1
Messrs. R. and W. Hopcroft	1
William Hunt, Esq	1
Lieutenant John Hutchinson	1
John Hutchinson, junior, Esq	1
L. Jacobsen, Esq	1
Moritz Jacoby, Esq	2
William Jarman, Esq	1
John Johnson, Esq	2
James Lake, Esq	2
J. W. Leavers, Esq	1
J. Holman Lee, Esq	2
J. W. Lewis, Esq	1
W. Lewis, Esq	1
Messrs. Liepmann, Kohn, and Co	1
William M'Craith, Esq	1
John Manning, Esq	1
Samuel Maples, Esq	1
William Martin, Esq	2
John Maxton, Esq	1
Mechanics Institution	2
Messrs. Moses Mellor and Sons	3
Midland Hosiery Company	1
Stephen Moore, Esq	1
Thomas Morley, Esq	1
A. J. Mundella, Esq	3
Samuel Newham, Esq	1
James Oldknow, Esq	1
J. W. Oldknow, Esq	1
Thomas Overbury, Esq	1
James Page, Esq	1
Samuel Parrott, Esq	2
William Pattison, Esq	1
People's Hall Library	1
John Place, Esq	1
W. H. Ransom, Esq, M.D.	1
W. A. Richards, Esq	1
William Richards, Esq	1
J. G. Robinson, Esq	1
G. B. Rothera, Esq	1
S. H. Sands, Esq	1
James Severn, Esq	1
Messrs. Shaw and Son	1
George Shepperley, Esq	1
A. Simkins, Esq	1
George Simons, Esq	1
Edward Smith, Esq	1
Henry Smith, Esq	1
Joseph Smith, Esq	1
W. R. Smith, Esq	1

	Copies
Charles Sneath, Esq	1
R. H. Speed, Esq	1
G. E. Stanger, Esq	1
Edward Steegmann, Esq	1
William Stiff, Esq, M.D.	1
R. J. Sykes, Esq	1
Richard Taylor, Esq	1
J. N. Thompson, Esq	1
John Thompson, Esq	1
William Vickers, Esq	2
William Vickers, junior, Esq	1
John Wheatley, Esq	1
Joseph White, Esq	1
William Whitehead, Esq	1
William Williamson, Esq	1
Stephen Wills, Esq	1
William Wright, Esq	2
Joseph Wright, Esq	1
G. P. Yates, Esq	1

INTRODUCTION.

SOME of the most interesting and useful works to be found in modern literature have been written on subjects which, while tending to gratify a universal and desirable curiosity as to the natural and scientific world around, have shewn how, by the activity and ingenuity of individuals, nature and science have been made contributive to highly important results, and have furnished a wholesome stimulus to endeavours thus to benefit mankind. With such a view the present work has been undertaken. It possesses this specialty: that, with the exception of two principal names, Lee and Strutt, every one of the many English inventors described, was a *working handicraftsman.* And while the two first local historians were professional men, the three last (including the present author) were also originally in that class; a fact not without significance. We will go on to describe our literary predecessors.

Robert Thoroton, M.D., published, in 1677, his *History of Nottinghamshire*, in a large folio volume, closely printed in small type. This writer was born in 1622, and was a descendant of an old family settled at Thoroton in that county. Having taken his degree at one of the Universities, he practised through life at Car-Colston, Nottinghamshire, where he was buried in 1678. He was a great royalist. His father-in-law, Serjeant Bown, had collected at much expense materials for this history, which the Doctor verified and completed, forming a work of extraordinary topographical and genealogical research and authority. It contains

a very important paragraph upon the origin of the stocking-frame, which is cited, and its tenor and value discussed in our memoir of Rev. William Lee.

The next local historian was Charles Deering, M.D., who was probably a German by birth. His education and learning indicated a respectable parentage. He was master of many languages and was otherwise highly accomplished. Having graduated at Leyden, he became secretary to the British embassy at St. Petersburg. The circumstances which brought him to Nottingham are not known. He practised there for some years with success. He married; but his wife dying after a short union, her loss injured his temper, and his manners became morose, causing the alienation of most of his friends. His practice gradually declining, he fell into deep melancholy and distress, and thus died in 1749. Not leaving sufficient effects, the corporation of the town contributed to the expenses of his burial, as a *posthumous* mark of respect for his undoubted talents. It was thus reserved for an alien to write the first historical account of Nottingham, his adopted abode. He was assisted in the antiquarian part of the work by John Plumtre, Esq., who also superintended its publication in 1751, after the author's decease. Deering appears to have employed the enforced leisure of his later years, in making researches necessary for the compilation of his work. His notices of the ancient trades of the town are valuable; some of them referring to the hosiery manufacture will be found in the following pages.

Mr. John Throsby, the son of a mayor of Leicester, of which town and county he wrote historic accounts, republished Thoroton's work with extracts from Deering and continuations of his own. His only reference to the stocking trade is in a paragraph concerning the petition of the frame-work knitters to Cromwell for a charter.

No further attempt of importance to write upon the staple trades of the three midland counties was made, until Mr. John Blackner composed his *History of Nottingham*, which was published in a quarto volume in 1816. Henson describes him "as skilled in the manufacture of both hosiery and lace; but from a lengthened indisposition he was rendered unequal to the task" (of compiling the history) "and the expectation of approaching dissolution, which soon took place, compelled him to expedite its termination." Blackner has given a large space to the origin of the stocking-frame, and its course of improvement, until the invention of warp and bobbin net machinery. With these he does not grapple—"because, from the number of different constructions, every minor improvement cannot be mentioned. The principal parts of the machines have been traced to their origin, and to those persons whose names have been mentioned, I conceive the great merit of invention to be due." In doing this, his political and personal prejudices sometimes led him astray; causing Henson to speak of him "as a singular man, well known for his credulity and for his veracity." This volume has not afforded us much assistance.

Mr. Gravener Henson began a *History of the Frame-Work-Knitting and Lace Trades;* and, in a moderate sized octavo volume published in 1831, brought his account down to the year 1780, but there ceased from the want of public support. This arose from his diffusive manner, and some peculiar opinions set forth with needless prominence. It contains much information on the rise of the manufacture of tissued fabrics, and the early course of those on which he specially treats. He had a practical knowledge of most kinds of looms, and describes them correctly, though in a technical manner. Being familiar with local inventions, he had materials to work upon, and it is to be regretted

he did not finish his history. His printer, seeing that instead of one volume, several on his plan would be necessary, advised him to condense. He had not the nerve to do this, and gave up the work. Henson wrote with surprising facility and grammatical correctness. His petitions to parliament, memorials to ministers, and letters to public men were striking, but injudicious: often containing libellous invectives. Once, being directed to draw up a memorial to the Treasury on the difficult subject of the 'Export of Machinery,' he brought the next day twelve foolscap pages closely written, without interlineation or blot; which, after being compressed and expurgated much to his chagrin, was a cogent and effective document.

In 1828, G. Henson published a list of one hundred inventions and alterations in the stocking and lace machines. Though not absolutely correct, it is convenient for reference, especially as to the contending claimants for improvements. He left behind him 'Notes of inventions and improvements of lace machines down to the year 1850.' These having been placed in our hands temporarily, have rendered valuable aid.

He wrote many articles upon local trade, the claims of workmen, combination laws, and kindred topics, giving parliamentary evidence on some of them. These papers shewed much vigour, but were deficient in exactitude. His roving spirit led to the knowledge of the proceedings of smugglers all round the coasts of England, Scotland, and the west coast and northern frontier of France. The names of these he offered, in 1835, to the English Customs. In the hosiery trade he had a list, in 1838, of one hundred and twenty-seven men who dealt in materials obtained by fraud, and another of all those who paid wages by truck. Being an adviser of workmen in trouble, and in combinations and strikes, he was more than once imprisoned during a

suspension of the Habeas Corpus Act; and often talked with pride of his examinations by secretaries of state, and familiarity with Government officials. In person he was thick set, with short neck, keen small eyes, and a head very broad at the base, rising up angularly to an unusual height.

Mr. Henson was a native of Nottingham. He had little early education, but afterwards read much. He possessed an extraordinary memory, and delighted in the histories of manufactures and commerce. He knew most of the laws of his own country and France regulating these matters. His first employment was in the stocking-frame, then in point net, and afterwards in bobbin net, and he knew many of those who had improved those classes of machines. A recent writer places him amongst the 'worthies of Nottingham.' Others differed from this; for which his dogmatism and warm temperament may account. We do not doubt his desire and efforts were to forward the interests of the trades he had so much at heart. He died at the age of 67, in 1852, at Nottingham, in humble circumstances.

The writer of this volume entered the stocking-making business in 1808, and the lace trade in 1819. In each he has been called upon to take an active part; and, since 1828, a public position in many of the transactions of both, until 1864. The knowledge of persons and events thus necessarily acquired, he has been often urged to embody in such a work as the present. Having been freed from other pressing duties, he has devoted the whole of the seventy-second year of his life to this effort. It has been a laborious one, from the necessity of giving an account of many inventions, patents for which, in numbers and prolixity of specification probably unexampled in any other manufacture, have had to be investigated. The short notices of these in the Patent list, issued from the Office

in London since this work was written, fills a volume of 1070 pages. The present author has accounts of 388 English patents in hosiery, and 331 in lace—719 altogether, many of them of immense length. The study of these mechanical descriptions is not favourable to elegance of composition, which may account for some defects in this volume. Such an intricate mass of details must also, after employing the utmost care, produce errors in narration. But in regard to the most important point of all, the author is conscious of having pursued one course—that of cautious inquiry into facts and bringing to them an unprejudiced mind, in order to form and express a sound judgment in regard to them; so that if not always unquestionably right, he is never intentionally wrong. The plan of the work is open to some objections, but no arrangement seemed free from them. A separate view is given, as far as possible, of what each inventor accomplished; that being the easiest for the memory to retain, by approaching nearest to classification of machines. To have given a regular chronological account of invention would have been impossible. The history of the trades has been confined to prominent events in consecutive epochs.

The author desires the acceptance of his best thanks for the assistance rendered by friends interested in the completeness of the volume, both at home, in France, Saxony, and the United States. Their contributions are invaluable.

W. F.

Nottingham,
March 15th, 1867.

CONTENTS.

CHAPTER V.

STOCKING-WEAVING AND THE CHARTER—1610 TO 1750.

CHAPTER VI.

THE DERBY RIB HOSIERY-FRAME. MR. JEDEDIAH STRUTT.

CHAPTER VII.

MODIFICATIONS OF THE HOSIERY-MACHINE—1760 TO 1800.

CHAPTER VIII.

HAND MADE LACE.

CHAPTER IX.

LACE MAKING ON THE STOCKING-FRAME.

CHAPTER X.

THE WARP HOSIERY AND LACE MACHINE.

CHAPTER XI.

BROWN'S FISHING NET MACHINE.

CHAPTER XII.

HORIZONTAL LACE PLATTING MACHINES.

CHAPTER XIII.

LACE MANUFACTURE—1800 TO 1810.

CHAPTER XIV.

THE TRAVERSE BOBBIN NET MACHINE.—MR. JOHN HEATHCOAT.

CHAPTER XVIII.

THE SINGLE TIER LEVERS' BOBBIN NET MACHINE.

CHAPTER XIX.

THE PUSHER BOBBIN NET MACHINE.

CHAPTER XX.

THE GASSING, BLEACHING, AND FINISHING OF LACE.—MR. SAMUEL HALL.

CHAPTER XXI.

IMPROVEMENTS IN DOUBLE TIER LACE MACHINERY.

CHAPTER XXII.

MR. JAMES FISHER AND MR. WILLIAM CROFTS.

CHAPTER XXIII.

THE BOBBIN NET LACE TRADE.

CHAPTER XXIV.

THE JACQUARD FANCY LACE MANUFACTURE.

CHAPTER XXV.

THE BOBBIN NET MANUFACTURE.—1837 TO 1866.

CHAPTER XXVI.

THE MACHINE-WROUGHT LACE MANUFACTURE OF FRANCE.

CHAPTER XXVII.

THE MACHINE HOSIERY MANUFACTURE.—1810 TO 1835.

CHAPTER XXVIII.

THE MACHINE HOSIERY MANUFACTURE.—1836-46.

CHAPTER XXIX.

THE HOSIERY MANUFACTURE.—1847 TO 1867.

CHAPTER XXX.

SAXON HOSIERY MANUFACTURE.

CHAPTER XXXI.

MACHINE-WROUGHT HOSIERY.

CHAPTER XXXII.

CONCLUSION.

ILLUSTRATIONS.

A HISTORY OF THE MACHINE-WROUGHT HOSIERY AND LACE MANUFACTURES.

CHAPTER I.

THE OLD HAND WEAVING-LOOM.

AUTHENTIC and instructive History is a carefully selected and well ordered narration of events; a consecutive statement of facts and opinions, whether religious, political, social, or scientific, which have transpired in past ages, bearing upon the condition and welfare of mankind.

Whatever department of historical enquiry is pursued, the mind intuitively seeks to investigate and ascertain its source; the fountain from whence to follow the course of that stream of events, which it is desired to trace out.

The origin of empires and states is for the most part hidden in the uncertain mists of antiquity, and is usually mythological, rather than ascertained and real. Very learned men differ greatly as to the point of time when, in regard to any one of the great national divisions of the human race, fabulous legends cease, and truly reliable records begin.

An inquiry into the origin and progress of the useful arts, that "large field of knowledge open to the advantage of men," is prompted by the like desire to begin at the beginning; and is found to be surrounded with equal obscurity and difficulty. So much has this been felt that an often controverted question has arisen, as to whether or not the knowledge of the arts practised in antidiluvian ages was the result of innate genius,

called into exercise by the immediate daily necessities of man's life; or whether derived by him from the direct instruction of his Maker.

Archbishop Whately asserts, "that wholly untaught savages could never invent anything, or even subsist at all. The existence of various instruments amongst partially civilized people, indicates the communication of instruction at some period from a being superior to man himself." It is argued that man could neither make, nor civilize himself; and that it is most consistent with reason, and with what may be gathered from Scripture on this subject, that man was advanced by his Creator, soon after He had formed him, to a state above that of a mere savage, if he were not so endowed originally.

The practice of steeping stalks of plants and pounding the inner fibrous bark of trees, to obtain materials for clothing; securing hair and wool from skins to spin into yarn; making lines and hooks as well as nets for fishing and hunting; basket wattling and weaving from flags and rushes, with other arts; are spread so almost universally, and so nearly of one type, as to refer them to one source only. It is urged also, that if the primitive arts were self-discovered and self-taught, it is altogether unreasonable to suppose they would have remained, in the main, without improvement for three thousand years or more. Moreover, with the gifts of intelligence, mental power, and moral perception, expressing themselves in speech and action, the Maker of man would otherwise endow him suitably to the necessities of his being. He must eat, to live; he would be, indeed was, directed what to eat, and what to avoid. He received a command to dress and keep a garden. The meaning of the words and method of obeying them, would be shewn him. The qualities of animals and vegetables must have been in some measure opened up to him, or he could not have given the one distinguishing names, or successfully cultivated the other; and without primary instruction, Adam could not have known how to subordinate anything to his use.

But to what extent soever knowledge of material objects, with their powers and uses, was imparted to

man, it would be only so far as to stimulate him to improve them, and lead to the acquisition of more. God does for man, ordinarily, only that which he cannot do for himself. So, on the very first occasion for the exercise of ingenuity, our first parents "sewed (joined) fig-leaves together." This effort was imperfect, but in the right direction; and, so God made (Kitto says, 'taught them to make') "coats of skins, and clothed them." Cain built a city, which was not the act of a semi-savage; for, however rude its construction, skill was required to contrive, and knowledge to execute such a work. Of his descendant Lamech's sons, one was the first nomade, "a dweller in tents," possibly only covered with skins; but a pastoral cattle breeding life is one of observation, skill, and foresight. Another was the first instructor of artificers in copper and iron work. This implied the finding and smelting the metals, a thing hardly to be discovered; together with the possession of tools, and ability to use them. The third son was the first to handle the harp and pipe in music—requiring an attuned ear, and skill in workmanship. If a family thus advanced in art, lived two hundred and fifty or three hundred years after the expulsion of Adam from Eden, it is not unlikely that other primitive arts, not named in scripture, but necessary to man's comfort, were practised within the next fourteen hundred years previous to the flood. For though mankind degenerated into a state of terrible depravity, that was by no means inconsistent with a considerable amount of civilisation and general knowledge. To draw out the locks of hair and wool, and to spin them by distaff and spindle, has been a practice for certainly four thousand years; and to weave them into cloth by that oldest textile instrument, the weaver's loom, is an art equally traceable up to nearly the time of Noah. So that both may very probably have been employed in producing clothing for the antidiluvian world. He might see fit to suggest the loom, who directed the construction of that wonderful prototype of naval architecture, the ark; and some centuries later, gave to Bezaleel the special wisdom, necessary for the curious and splendid work of the Tabernacle.

But if not thus suggested—and it was due to the genius of man—the life long experience and observation of almost a thousand years might suffice for the discovery of the loom; and what was thus known, must, through Noah and his sons, have survived the flood. The eldest of these sons saw the rise of three mighty empires, Babylonia, Assyria and Egypt; in each of these, some of the arts, at least, were known, and carried to a high degree of excellence and importance, at the time their names first occur in history. The architecture of those earliest ages survives to attest this fact, by works mighty enough to puzzle modern science as to how they were performed, and to fill the minds of beholders with astonishment at the marvellous results. And long before the time of Abraham, the art of weaving—more useful, though less noticed historically—had so spread, that Babylon was famed for its textile manufactures; and so continued till its down-fall. For it had a great customer in Tyre, as mentioned in those remarkable chapters 26th and 27th of Ezekiel, describing the commerce of the latter city, and stating that Babylon traded there; exporting to Tyre "its blue cloths, embroidered work, and chests of rich apparel." The like is there said of Syria and Mesopotamia also. Egypt was the early home of the linen cloth manufacture (probably, with India, that of cotton also) as is proved by sepulchral paintings, of the gathering and preparing flax and weaving it into cloth. The inhabitants of Egypt produced, and clothed their princes and nobles and priests, with fine twined linen, exporting it also to Tyre and Greece. Pharaoh clothed Joseph in vestures of fine twined linen suitable for a prince. The cerements of their embalmed dead were of cloth generally of coarse texture. The Israelites became very perfect in the art of weaving, while serving the Egyptians; and in the wilderness under the instruction of Bezaleel. "For all the women who were wise hearted spun, and Bezaleel worked the work of a weaver and in embroidery."

The sacred books of Hindostan shew that weaving of cotton goods was practised there, from nearly the time of the flood; this is further evidenced by the castes connected with it. From the same epoch, the most ancient Chinese historical works date the use of the loom;

almost identical in its shape and functions with that now employed by them; upon it, they wove silk, as well as cotton and wool. All the preparatory arts of growing silk, cotton, and wool, spinning and reeling, winding and warping, are fully described; as also the subsequent ones of dyeing, fulling, embroidering, and fashioning into clothes.

The city of Damascus, perhaps the oldest existing city in the world, was almost from its foundation known, and some centuries afterwards became famous, for its textile manufactures. This it has continued to be until the present time. How long it was before silk was employed as a material, and the loom was adapted at Damascus to weave patterns of various design, and in the gorgeous colours so dear to Eastern taste, is not on record. If the weaving-loom were originally invented, to devise the shuttle and its bobbin, to extend some hundreds of threads as a warp along the ground, dividing them into two alternating sets; hanging the gearing aloft on the branch of a tree, the weaver seated on the ground, with his feet in a hole moving the treddles—as was often the primitive manner of Eastern weaving—would require great compass of thought. How much more, to introduce the Arabesque ornaments, and even to inweave in graceful wreaths of Arabic characters, the multitude of extracts from the Koran, which appear in the sacred silken Banner of Mahomet and of War, which is of immense size, the production of a Damascene loom, and the original of which was woven centuries ago. In all ages the most costly and precious stuffs from the loom have been reserved for royal and sacerdotal purposes. The cloths manufactured in Asia Minor, and dipped in Tyrian purple dye, were always worn by rulers from Cyrus and Alexander, to the Ptolemies and Cæsars, as the sign of imperial authority. It is probable, that impelled by the love of pure and bright hues, the Asiatics understood and practised the arts of the fuller and dyer better in the first fifteen hundred years after Noah, than at any time since, until within the last century.

The town of Gaza was known from ancient days as an important cloth weaving place. It was not far

from Tyre, and on the high road from Syria and the East into Egypt, so the productions of its looms were celebrated far and wide. At a time when silk materials for clothing were valued in Syria weight for weight in gold, the manufacturers of Gaza adopted the plan of taking in pieces the heavy silk fabrics obtained from the East, and dividing the thick threads of which they were composed by untwisting them with great care, they re-wove these finer strands into a semi-transparent tissue, which was, from its lessened cost, much used in Greece, and eventually in Italy. This was about the time when a Roman Emperor refused his wife a sumptuous silk dress because of its cost. Pliny and Seneca held up to ridicule the use by their country women of "gowns of glass" made from these slight materials, "clothed in which they could not justly say they were not naked." The fabric in question was called after the place of its origin, and is known in French as La Gaze, in English, Gauze.

It would seem from this account, that the supply of silk was as yet solely obtained from the farther East, Hindostan, and China.

The practice of weaving being the universal employment of women from the remotest ages, was so familiar and generally understood, as to furnish writers, sacred and profane, with many touching illustrations and similes. Children are familiar with Bible examples: "I have cut off like a weaver my life." "My days are swifter than a weaver's shuttle." "They weave a spider's web." Similar allusions occur in classic literature.

These manufactures of cloth by the use of the loom, were thus practised and spread abroad in ancient times throughout all Asia. It is worthy of notice that the first countries where we read of them, Babylonia and Egypt, were those where sciences, especially that of Astronomy, had their first development. There seems at first to be a wide distance between the contemplative sciences and useful arts, but it is more in appearance than reality. There is in truth a close underlying connection between them. The arts are ever assisted and ennobled by science: which itself loses its speculative tendencies when in combination with art. They,

by their united operations, stimulate invention and shorten or lighten labour; and by the use of agents and materials in new forms and quantities, they procure those novel results which enrich mankind, by adding to the common stock of comforts and conveniences of life.

Let this early art of weaving cloth therefore have attributed to it the merit and importance which are its due. "The first want of man after food is clothing: this art supplies it; its utility, therefore, is inferior only to that of agriculture."

From Egypt, Palestine, and Asia Minor, the weaving art passed long before the age of Homer into Greece, and thence, over all the shores of the Mediterranean. It penetrated Italy and Spain. Probably by way of Constantinople it spread over Illyria, Dalmatia, and the German tribes, and descending the Rhine, reached the Low Countries and France. By the Flemings, weaving was brought over and firmly settled in England; and thus reached Scotland and Ireland.

This course occupied in the whole about two thousand years, and is one of deep interest to the student of history. It was marked throughout, like the general operations of manufactures and commerce, by the contending forces of religious persecution or toleration; political despotism or freedom; hospitality to aliens, or a narrow and exclusive policy towards strangers. But its utility was a vital irrepressible power, and overcame every obstacle. At length, the rude and hitherto almost unchanged old loom has been made the subject of surprising improvement, and has been for plain goods more than doubled, and for fancy articles more than quadrupled, in its power and speed of production. In a word, it has within the last century become the *Power loom* in England, and *Jacquard loom* in France.

Soon after the introduction from the Low Countries, and settlement of the weaving art by the Flemings at Norwich, Sudbury, &c., the great importance attached to the business was shewn by the legislative enactments of the Normans and Plantagenets, intended to regulate and (as was the opinion of the time) to foster the rising woollen manufactures. These were then the objects of special attention, because of the capacity

of England to grow the wool that might be required to supply them with materials. The speaker of the House of Lords was seated on a woolsack, to remind him and the Peers of the value of the woollen trade. The tax on imported wool was remitted under Edward I. An act of the third Edward made its export a felony. None but English-made woollen cloths might be worn. They were prohibited import, under pain of forfeiture of the goods, and imprisonment of the importer. Foreign weavers were invited to come over here; which they did, in such large numbers, as to thoroughly establish the business, in which, by their skill, industry, and capital, they became the principal employers and merchants. Within the next two hundred years, England had attained the position of a large cloth exporting nation. In 1463—75, articles were prohibited import; and in 1483, 1 Richard III., many more were added to the list. As to a large part of this list, the prohibition was not repealed until 1819.

In the Woollen Cloth Act, 5 Edward VI., twenty-three districts in England give names to woollen cloths, and five to cotton. Six special classes of cloth had been defined by 37 Edward III., chapters viii. to xiv.; and ordered to be alone used. Clothiers were commanded to make no other. These regulations were re-enacted three times, up to the reign of Henry VIII.; and again, by other subsequent acts: but after existing 240 years, they were abolished by James I., in the first year of his reign.

Cotton wool was used in England for twisting into candle wicks before 1298, and was largely imported from the Levant by 1430. In 1640 it had become extensively spun, and made into cloth in Manchester, from whence the three noble minded brothers Chethams supplied the London market with fustians, &c.

The rate of remuneration for labour was also made the subject of legislation throughout this period. A plague in 1346, and consequent mortality, had so lessened the population as to have doubled, and in some trades, trebled wages. In 1350, it was enacted that the former ordinary scale should be paid and received; an oath being taken by both masters and

men to pay and receive no more; *i.e.*, for day labourers, 2*d.* a day (6*d.* of our present money), and 3*d.* (9*d.*) in harvest; carpenters and other artificers to receive the same. In 1495, it is said that a day labourer could earn in a week the price of a sheep. By the statute of labour passed in 1563, the rate of wages was ordered to be fixed by the Justices. During the Wars of the Roses, the favour shewn to foreign artizans, by exemptions from imposts, and in other ways, having caused them to outnumber the native work people in many places, especially in London, where there were 1500 in excess, and the English had generally become their servants in trade—Cardinal Wolsey, while presiding in the Court of the Star Chamber, got this state of things arbitrarily reversed, by a peremptory enactment, that foreign weavers and artificers should invariably serve under English employers. Such was the state, political and social, of the times, that this extraordinary measure seems to have been carried into effect, without material opposition or any commotion whatever. This act of that great statesman has been highly praised, even in the present century, by more than one writer, as a politic and patriotic one. But it cannot be wise policy to repress genius, or teach contentment with low national attainments. Neither does true patriotism require the return of ingratitude for favours received at the hands of foreigners by withholding their just and well earned reward. This legislation probably did much to retard and injure the progress of this and other branches of our national manufactures.

These preliminary observations in regard to the weaving-loom have been offered because of its antiquity and world wide use; the simplicity of its construction; its standing absolutely alone, until three centuries ago, in textile mechanical invention; the vast importance attached to its introduction and use in this country by Kings and Parliaments; and the relation its most essential parts bear to the machinery eventually devised and employed in the fabrication of lace,—this being one of the subjects treated of in this work.

CHAPTER II.

HAND-KNITTING.

A QUESTION of much interest presents itself on entering upon the events that transpired in the sixteenth century, and which is directly connected with the manufacture of hosiery by machinery. It is inquired, at what time, where, and by whom, was the art of elastic loop hand-knitting first practised? No positive answer can be given on any of these points.

It has been seen that no rival machine was devised for performing textile operations. But the mind would be ever engaged in selecting natural productions to serve as materials; and in searching out useful processes and inventions, in which they might be employed by well directed skill and labour. The brain and fingers of men are scarcely ever at rest. They will twist and intertwine; double and redouble cordage; loop, plait, knot, and knit, in ways almost infinitely various. In like manner, under man's plastic management, silk and flax and wool acquire superior fineness, strength, and brightness; and have thus become better prepared for textile use. Sinewy arms and dexterous hands are in fact the natural machinery by which he operates often very beautifully and effectively, without any adventitious mechanical aid whatever. Thus observing the peculiar qualities of the various objects around, his mind suggests uses for them; and seeing what is to be done, at length finds out the way to do it. By this tentative course, river flags were formed into baskets; reeds, and the inner bark of trees were changed into paper; the outer rind into ropes; bullrushes were interlaced and made into an ark, which, plastered with bitumen, might safely glide down the stream; and wattled twigs of the willow, shaped boat fashion, perhaps after the great ship of the

Deluge, and being covered with skins, were found sufficient to bear adventurous mariners over stormy seas.

From the time of the Pharaohs and of Job, fishing nets were used. These were made by using one line only, usually a cord of hemp or other strong twisted fibres, wound on a bobbin placed in a shuttle held in the hand, by which meshes were formed, whose corners were so firmly knotted as not easily to be broken; and if broken, the cord would not run out any further. These nets were of course non-elastic.

In elastic looped hand-knitting, one continuous thread only is employed in the construction of the web; there is therefore neither warp nor weft. Two or more skewers of wood or iron, called needles, are used. One of these is held in each hand. A first series of loops having been formed on the left hand, the right hand needle is inserted into the first loop on the other pin; the thread is passed round it, and it is drawn through, when the stitch thus worked into is slipped off upon the web already wrought. Thus the loops are formed side by side successively upon the needles; not one looped on its immediate predecessor, as boys form loops down the length of a string; but each passing through a loop, formed in a previous row next below it. The web may be either produced round, as in a stocking, and widened or narrowed at pleasure; or in a straight line of any desired width, with a perfect selvage on each side. Simple patterns are easily made, by looping in different ways; and variegated designs, by the introduction of additional colours. This tissue is perfectly elastic, which is the quality that most adapts it for usefulness. It can be extended without permanent enlargement or distortion in its shape; and consequently adjusts itself with ease to the size of any part of the body for which it has been made, and on which it is worn; and when drawn off, returns to its former state. It has, however, a corresponding disqualification; if the thread be broken or left loose, the whole tissue may be unroved, or may unrove itself by pressure, loop by loop, with great rapidity. Hence the importance of strong even yarn or thread, and sound fabrication.

The simplicity of the operation, and the ease with which it may be learnt and performed, make it probable, as some have asserted, that this kind of knitting as well as others, was known and practised, if not by the antediluvians, by their immediate descendants. It is true, that no plain record or description of such a process has come down to us. But it is contended, that some of the references to stuffs and their production in ancient times, cannot be made to harmonize with their being manufactured on the weaving-loom. The inference sought to be established is, that as tissues answering to those described as having been anciently wrought, could be produced by hand-knitting in a way far more consonant to the circumstances under which they were said to be wrought, it is fair to presume that this was the process employed.

The passages chiefly relied on are in the Iliad and Odyssey. In the third book of the Iliad, Iris visits Helen. Pope, in his translation of this descriptive passage, says—

> "Her, in her palace at her loom she found—
> The golden web her own sad story crown'd;
> The Trojan wars she weaved—herself the prize."

It is objected that it is not probable these princesses and their maids in Troy should be occupied in a kind of workshop, in which each laboured at a weaving-loom; and that, a figuring loom; also, in order to produce such a fabric as that described, one of such magnitude and intricacy of movements, with so great a variety of materials, as would require a multitude of sleys and treddles; the continued selection of threads for weft; and the action of two persons, one on each side of the machine, to throw the shuttle to and fro. Pope probably knew weaving only as being performed with warp and woof. The words of the original may be literally rendered, "She was weaving a large web; double surfaced and variegated; in which she interwove the many Trojan conflicts." Cowper translates thus: "She found her weaving a gorgeous web, inwrought with fiery conflicts." Mr. Wright, in his late translation, says—

> "Her she found
> Within her palace walls, weaving a robe
> Of double texture, large, of purple dye,
> Wherein she traced the many grievous toils, &c."

The Earl of Derby, in his still later work, gives this version—

> "She, in her chamber found
> Her whom she sought; a mighty web she wove,
> Of double woof, and brilliant hues: whereon
> Was interwoven many a toilsome strife
> Of Trojan warriors," &c.

Chapman, in his homely phrase, says—

> "She found Queen Helena at home
> At work about a weed, woven for herself.
> It shined like fire, was rich and full of size,
> The work of both sides being alike; in which
> She did comprize the many labors warlike Troy endured," &c.

No mention is therefore made by Homer of the loom in this description, and to adjust its various parts to a loom, the mighty web, the double texture, and historic action, wrought in brilliant hues, would be a task to be performed with difficulty even in modern times: more practicable however for women in ancient Troy with knitting needles than on the weaver's loom. In whatever way performed, it must have required, to fulfil the poet's picture, admirable skill and patience.

In Hector's parting with Andromache, Pope uses the word 'loom,' twice. "In Argive looms our battles to design" &c. Mr. Wright here uses it also: "Carried to Argos.....there in labor of the loom employed." And Lord Derby gives it in like manner—

> "Haply in Argos, at a mistress' beck,
> Condemned to ply the loom."

But it is submitted whether it may not be rendered, "There you shall weave the web, under the command of another."

In the conclusion of the same affecting scene, Pope uses the term 'loom', and so does Mr. Wright—

> "Now home; there ply thy proper arts—the loom
> And distaff; task thy maidens there."

Cowper says—

> "Hence then to our abode; there weave, and spin,
> And task thy maidens."

Another reference to this employment occurs, when news is brought to Andromache of Hector's death. She

is described in the same words that are used in reference to Helen, and thus given by Cowper—

"She in her chamber at the palace top,
A splendid texture wrought; on either side
All dazzling bright, with flowers of various hues."

Mr. Wright's version is—

"She in a chamber of her lofty palace
Wove a large double purple robe, inlaid
With rich embroidery."

The Earl of Derby thus renders it—

"In her house withdrawn,
A web she wove, all purple, double woof,
With varied flowers, in rich embroidery."

Further extracts add to, rather than diminish, the difficulty of supposing these weavings to have been accomplished by Helen and Andromache in the loom. If to lessen it, narrow plain woven stuffs were to be used as the ground work for rich historic embroidery, in colours to be applied by the needle or hook, the difficulty is only partly removed; the stuffs had a double loop, a double face, "each side alike, strewed curiously with various flowers." How even this could be done it is very difficult to understand.

In the description Homer gives in the Odyssey of the labours of Penelope, weaving a web by day which she unweaves at night, further mystery occurs, which it is thought cannot be otherwise solved than by the supposition that her work was a knitted web. If loom woven with warp and weft, very far more time would be required to take it to pieces than to weave it. There would be no time for the Queen to rest, if indeed the warp could remain uncut and so again each morning be found ready for use. But if it were knitted work, the labour of the day though long pursued, could be unroved in a few minutes and without any difficulty.

Whatever judgment may be come to upon the question, between loom-weaving and hand-knitting in the case of Homer's princesses, there can be no doubt that the tabernacle veil and curtains, together with the tissue from which Aaron's breastplate, ephod, and vestments were made, were wrought of various materials and in different colours in the weaving-loom, and afterwards

elaborately embroidered by hook or needle. So also was the longed for prize of Sisera's mother, "a prey of divers colours, of needlework on both sides." The art of ornamentation by embroidery seems to have been carried to great perfection in the earliest times. It is for the happiness of man that woman ever seeks to add to the merely useful that which is graceful and effective in form, colour and design.

The coat worn by Jesus before his crucifixion is described as being without seam, woven (margin 'wrought') "from the top throughout." How this could be effected upon the common loom, cannot be even conjectured. But if hand-knitting were then known, it might have been 'wrought' so as to answer the description perfectly, in that manner. The garment must have been one of a superior, probably costly character, or it would not have been so highly thought of, or so minutely described. And if the peculiar characteristic of hand-knitted web, that of roving out and thus becoming worthless were there, and known to the soldiers, that would be a sufficient motive for their casting lots upon it, rather than dividing it. This coat might thus have been the result of the blessed mother's tender care for HIM who was ever uppermost in her thoughts; or of the pious regard of one of that band of holy women, who attended the steps of this wonderful Person, through his life, and ceased not their ministry till with reverend care they had prepared his body for the grave.

But if knitting by hand were practised in the east before the Christian era, it is surprising that no direct historic mention should have been made of it until about the reign of our Henry IV.

It is true that in ancient times the leg was a part of the body which was left uncovered, and this practice was continued till comparatively modern times. Afterwards they were partly or wholly bandaged, as in Scotland and Italy to the present day.

When hose were first worn, they were cut out by scissors from cloth of wool, linen, or silk, according to the rank of the wearer for the most part, and sewn up. This, especially in heavy materials, resulted in ugly and uncomfortable seams.

The practice of wearing woven woollen caps, by the peasantry of England and Scotland, dates far back towards the Norman conquest. These were replaced by knitted caps; but at what particular time, is not recorded. When Chatterton published the poems which he attributed to Rowley, the opponents of their genuineness pointed out a supposed anachronism, bearing on this question of the time when hand-knitting first became known in England, in a singular manner. Under date of 1461 the poet introduces these lines—

"She sayde,
As herr Whytte honds, Whytte hosen were knyttinge,
Whatte pleasure ytte ys to be married."

As, up to the time the Rowley controversy arose, it had been the general belief that in 1461 hand-knitting was unknown here, the triumph of the unbelievers in Chatterton was great when these words were noticed. But so far as this passage was concerned it was of brief duration. Further examination brought to light the fact, that by an act of Henry VII., chap. 17, A.D. 1488, the price of felted hats was stated to be 1*s.* 8*d.* (or 5*s.* of present money), and of knitted woollen caps 2*s.* 8*d.* (8*s.*). An article of common wear in England, such as these caps were, must have been for years knitted here before they would be placed in an act of Parliament. There were eight acts of Parliament relating to clothing passed in the seventy-five years between 1488 and 1563, in several of which knit woollen caps are spoken of. In that of 1548 about twenty-six trades are named. In that of 1563, called the statute of servants, it was enacted that every person not being possessed of twenty marks (£13. 6*s.* 8*d.*) rental, should wear on Sundays and holidays, when not on travel, a woollen knit cap, on pain of forfeiting 3*s.* 4*d.* (10*s.*) 'a-day.' This statute mentions thirty trades, which were not allowed to hire for less than a year. Amongst these are *hosiers*, clothiers, cloth-weavers, knee-cap-makers, &c. Twenty-four were allowed to take apprentices, though their parents had not lands or tenements; amongst these were turners, mill-wrights, linen and woollen weavers, fullers, &c.

Before 1530, the word 'knit' was well known in

England; and not unfrequently met with in the writings of that time. "I knitt bonnets or hosen." "She that sytteth knyttinge from morning to eve, can scarcely win her bread." In the household book of Sir Thomas L'Estrange of Hunstanton in Norfolk, under the date of 1533, is an entry: "peyd for 4 peyr of knytt hose VIII^{s}." these were for himself; and again in 1538, "peyd for 2 peyr I^{s}." these were for his children. An act of Parliament of Edward VI. was passed in 1552, which names the several articles of "knitte hose, knitte peticotes, knitte gloves, and knitte slieves."

It is probable that knitting stockings would, from the difficulty of forming the heels and feet of right shapes, follow knitting caps, only after some interval of time; and fine hand-knitting upon silk for hose, to be worn by kings and nobles, would follow much later, from the great additional skill necessary in such minute looping, and the excessive pressure on the eye attending the labour, whether in the production of white or black silk hose. Howell, in his *History of the World*, says, "that magnificent monarch Henry VIII. ordinarily wore cloth hose; except there came from Spain, by great chance, a pair of silk stockings" King Edward VI. was presented with a pair of silk stockings by Sir Thomas Gresham his merchant, and the present was much spoken of. Queen Elizabeth in the third year of her reign was presented by her silk woman, Mrs. Montague, with a pair of knitted black silk stockings, which this person's young serving women are said "to have quickly become so dextrous in knitting, that from thenceforth Elizabeth never wore cloth hose any more."

Although some have thought that the art of knitting woollen caps and hose came from Scotland to England, which is not improbable, the above reference of Howell to Spanish silk hose, combined with other circumstances, lead to the probability that *silk knitted* hose at least first came from Spain to us; and that the Spaniards learned the art through the Moors, from the Arabians, to whom the world has been indebted for so many other useful arts.

An account drawn from Stow has become popular,

and is to the following effect: "That in 1564, one William Riley, apprentice to master Thomas Burdett, having seen in the shop of an Italian merchant, a pair of knit *worsted* stockings from Mantua, borrowed them and made a pair exactly like them, and these are said to have been the first stockings of woollen yarn knit in England. They were worn by the Earl of Pembroke who had been one of the Council of Edward VI. The citations and dates above given shew that this statement is not correct. Knit woollen hose were made in this country long before. There is little likelihood that *woollen* knit hose should be imported from Mantua. But, wrought of *silk*, they would be suitable to Mantuan trade. Riley might have learnt to knit already. And if the youth saw, borrowed, and imitated knit *silk* hose, it was a feat worthy of the marked notice of Stow; and the stockings would be worthy of the powerful nobleman who is said to have worn them.

The practice of knitting hose, when once known, soon became general as a domestic employment; not of the lower classes only, but amongst the middle and higher classes also. In 1577 the peasants' wives, Harrison states, "used the bark of alder trees for dyeing the stockings they had knitted." The practice of dyeing the materials for knitted stockings, or of dyeing the work when done, has been continued by the peasantry in Scotland and France down to the present time.

In 1576 Gascoigne the poet says, the greatest ornaments of dress were, "knit silk stockings and Spanish leather shoes." When Queen Elizabeth visited Norwich in 1579, some children appeared before her, spinning worsted yarn, and some, knitting hose of that material. That the use of silk hose was soon by no means confined to royalty and courtiers, appears from the apostrophe of Prince Henry to Poins in Shakespeare's second part of Henry 4th.

"What a disgrace to me to remember thy name, or know thy face to-morrow; or to note how many pairs of silk hose thou hast; namely, these and those that were the peach coloured ones."

It has been suggested by Beckman that this art of hand-knitting may have resulted from that of wire

working as seen in the screens at Lubec Cathedral, wrought in 1572, and in St. John's at Wismar; where the ends of the wires cannot be found; these are said to be made by the Devil. There can be no doubt, that the introduction of this tissue, of so novel a kind, yet so useful and profitable, justified Elizabeth's anxiety for its prosperity, and her caution in regard to any interference with its progress.

Before dismissing it from further consideration, it is pleasant to quote the language of Beckman, who, in the fourth volume of his valuable *History of Inventions*, gives the following elegant description of hand-knitting: an occupation which, even down to the commencement of the present century, like hand-spinning on the wheel, was pursued throughout every rank of female society, from the palace to the cottage:

"It may be so easily acquired, even by children, as to be considered almost an amusement. It does not interrupt discourse, distract the attention, or check the powers of imagination. It forms a ready resource, when a vacuity occurs in conversation; or when a circumstance occurs, which ought to be heard or seen, but not treated with too much seriousness; the prudent knitter then hears and sees what she does not wish to seem to hear or to see. Knitting does no injury either to the body or to the mind. It occasions no prejudicial or injurious position; requires no straining of the eye sight; and can be performed with as much convenience when standing or walking, as when sitting. It may be interrupted without loss, and again resumed without trouble; and the whole apparatus for knitting, which is cheap, needs so little room and is so light, that it can be kept and gracefully carried about in a work-basket; the beauty of which displays the expertness, or at any rate the taste of the fair artist. Knitting belongs to the few useful occupations of old persons who have not lost the use of their hands. Servants, soldiers, shepherds, and the male children of the peasants who are unfit for hard labour should learn to knit, for it may be a pleasant and profitable employment for the leisure even of the male sex."

G. Henson, *History*, p. 36, gives an interesting view of the situation of the people in the reign of Elizabeth, in relation to manufacturing and other employments:

"The wages of every trade were fixed by laws; no person could work at any trade who had not been apprenticed to it. None but persons of respectability could be apprenticed to most trades; as it required their parents to have a certain weekly income. The handicrafts were mostly confined to corporate towns; and belonged to trade companies, who made their own bye-laws; which, upon being registered

by the Lord Chancellor, were acknowledged as legal; these trade companies chose the magistrates, who were amenable to the working class for their election. In the greater number of trades, hiring must be by the year; being under the age of thirty, and unmarried. Wardens were appointed by each trade to prevent fraudulent practices in the fabrication of manufactures. The merchants traded in companies, incorporated according to the lands to which they traded. Husbandmen in the villages were equally stationary, and their course marked out by law; their wages were fixed by the justices, their hours of working, and even their meals, were defined. They could not leave their villages or counties without a testimonial from the clergyman, or other respectable person. The feudal law, which required personal service instead of rent, was nearly abrogated; and a cottage with a comman right existed in almost every parish upon unenclosed lands."

A brief account of the kinds of machinery employed at the beginning of Elizabeth's reign will be useful, before proceeding to relate the notable invention of a machine soon after, which was intended to supersede (were that possible) the useful art of hand-knitting, and was destined to become the fruitful parent of the other almost innumerable textile inventions, which, with itself, are to form the subjects of this History. This list will serve to shew what scanty means were available at that time, for assisting to accomplish such an arduous and unprecedented design.

Water power and windmills had been employed for ages in grinding corn: also in later times in fulling, milling, and dressing cloth. The latter processes were as yet so imperfectly performed, however, that those cloths which were exported were sent in the unfinished state in which they issued from the looms. Carding and combing long wools by hand were well understood; but worsted was not allowed to be exported. Even the spinning wheel was, as yet, but little employed; the spole and distaff being commonly used. The looms for woollen and cotton weaving were very numerous and universally spread, but were constructed in almost their primitive simplicity, only varied in width and gearing to suit the materials and the articles to be produced; such as broad and narrow cloth, blankets, linsey woolseys, and linens or flannels. At Norwich, calendering machines were used. Mills for scribbling cloth had been devised, but their use was prohibited for fear of injuring the texture of the article, and

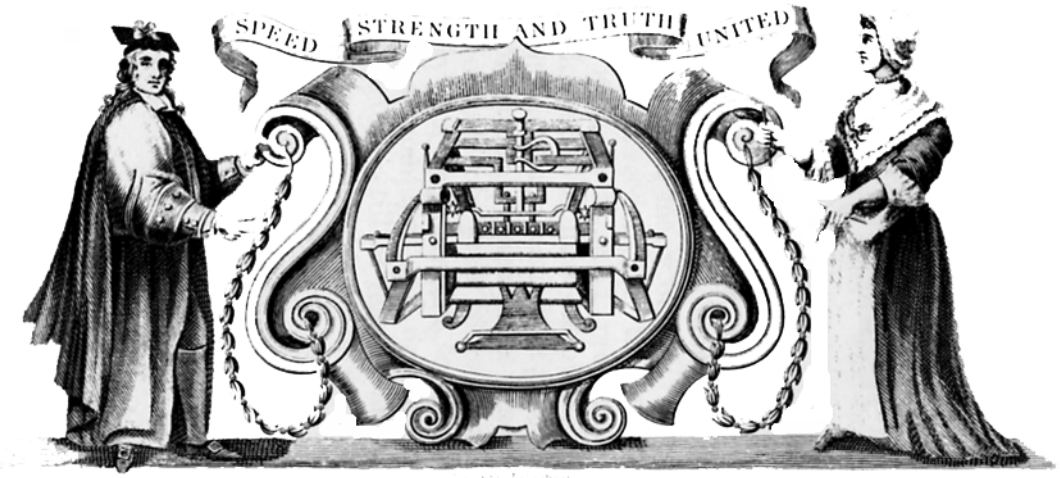
taysells (teazles) were re-employed for that purpose by order of Parliament. In like manner, cotton fustians might not have their nap raised by iron instruments, or machines, because of injuring their wear. Iron wire drawing was used for chain armour, as also wire of the precious metals for the use of gold and silver lace-makers, and for figured weaving purposes. This was early practised, to supply the demand for garments made from cloth of gold and silver. There were simple machines for platting stay-laces, and making silk or cotton fancy braids, to be wrought into needle-works. The turning-lathe was very much used. Casting of hollow cannon having been preceded by forged ordnance was long practised; till about 1730 it was followed by well constructed machinery for boring them. Metal pins were introduced from France in 1543. Within but a very short time after, machines had been constructed to be used in making pins. Hitherto, they had been filed to a point, and the head had been soldered on by hand. Great opposition was made to this novelty; but utility and cheapness prevailed in its favour. The common sewing needle was brought hither from India, after the discovery of the route by the Cape of Good Hope. Before that time sewing was performed in the method still used by shoemakers. A man discovered the method of punching the eye in steel needles; having kept his secret, he realized a large profit by it.

Although it may be truly said, that inventions in machinery and improvements in manufactures have been coincident with the decline of feudal governments, yet little progress had been made in this direction till the middle of the 16th century.

The very limited use of machines here indicated, shews that mechanical science was then but in its infancy in England; and it had advanced but little further in any other part of Europe. But the maritime power of the English had begun to be established and was soon followed by a mercantile marine, bringing in materials from distant parts to supply future manufactures; giving us the use of the natural products of the world, as if grown on our own hills and valleys; and while indefinitely increasing foreign commerce,

supplied means of comfort and enjoyment to the people formerly unknown. To bring about such a result it was necessary that a host of monopolies granted for the profit of nobles, money holders, and royal favourites, crippling commerce, and tying up the hands of manufacturers, should be swept away. So numerous and galling were they, that even the jealousy of Elizabeth in regard to trenching upon this part of her prerogative as of every other, was braved; and in the House of Commons, in a debate upon the abuse of monopolies, it was sarcastically asked "whether bread was not of the number?"

In the early part of the reign of James I. in proportion as the principles of constitutional government were brought into operation, many of these odious privileges were abolished. Freedom of thought was thereby stimulated in its exercise, and prompted the prolific brain of the inventor to new discoveries. By one or other of the important applications of practical mechanics to purposes of utility, which have since been made, processes have been rendered more easy and simple; new machinery has been created; and that already in use rendered less complex, and its results more abundant and satisfactory; till at length, articles of beauty and luxury in every department of manufactures, have been placed at a cost previously unthought of, in the hands of the consumer.


SPEED STRENGTH AND TRUTH UNITED

CHAPTER III.

INVENTION OF THE STOCKING-LOOM BY REV. WM. LEE.

If from reasons of state or social policy already hinted at, the construction of machines to replace or shorten human labour had, as yet, been little attempted; the time was now fast approaching when the arms, hands, and even fingers of men were to be imitated, not only in their ruder labours, but in some of their more intricate and difficult operations. The principle, that to shorten human labour by mechanical skill and power, is to increase riches and capital, and furnish more and better paid employment and consequently comforts to the artizan, has not even yet become sufficiently understood in England. In Elizabeth's time its benign light had only just begun to dawn upon a few of the more advanced minds in the nation. It was reserved for a mere incidental circumstance to furnish the first striking example, in modern ages, of its beneficent operation.

It will be anticipated that this example was the invention of a loom, capable of perfectly imitating the hand-knitter's movements, and producing the like results with manifold speed. At that time, to think of devising an instrument of the complex and nice adjustment required to effect this and to attempt it without any previous experience of his own or others, pointing to suitable methods and means, shewed a masculine will; and to carry it into effect, exhibited innate mechanical genius of the highest order on the part of the inventor.

The history of this important step in manufactures, as sketched by various writers, is not a little diversified, and in some points contradictory. It is not surprising that the origin of the older weaving and knitting processes should have been shrouded in mystery and doubt, when there is so much obscurity in the early

history of the stocking-frame as to cause these diverse statements, as to the place where the person by whom, and the reasons for which, this machine was invented. When they shall have been recited, it will probably be found, after all, not very difficult to arrive at a conclusion satisfactory to the mind of the impartial inquirer.

The discussion, though necessarily involving some repetition, is of sufficient interest and importance to justify a reliance on the reader's patience, for which, in this and some other instances, further apology is forborne.

Aubrey states that the inventor of the stocking-frame was a student of Oxford, and probably of Magdalen Hall. And Aaron Hill, in his Account of the Rise of the Beechwood Oil Invention, published in London, 1715, relates as follows, but gives neither name, date, or proof:

"The credit of the invention is due to an Oxford student, who was driven to it by dire necessity. The young man, falling in love with and marrying an Innkeeper's daughter, lost his fellowship by it, and soon fell into extreme poverty. They became miserable; not so much from their own sufferings, as from the dread of what would become of their unborn infant. Their only support was from knitting stockings, at which the woman was very expert. But sitting constantly together, and the scholar often fixing his eyes on the dexterous management of the needles by his wife, he thought it was possible to contrive a little loom to do the work with more expedition. This thought he communicated to his wife. He joined his head to her hands, and the endeavour succeeded to their wish. Thus the stocking-loom was mounted, by which he made himself and his family happy, and left this nation indebted to him for the export of silk stockings in great quantities, to the very countries from whence we before used to bring them, at a loss in the balance of our traffic. He became a man of considerable wealth."

In Evelyn's *Numismata*, p. 163, "Mr. Lee, or Leigh, a curate in some obscure part of Sussex," is mentioned as the inventor. Probably the name of the county is given by mistake for Nottinghamshire.

A writer in *Bibliotheca Topographia Brittanica*, No. 7, says, "the stocking-frame has been attributed to a Mr. Robinson, curate of Thurcaston, Leicestershire," but gives no further details.

The name of Robinson occurs nowhere else in connection with this invention. Aaron Hill's account

may be reasonably considered a version of those about to be given in reference to Lee, only mistaking the university.

These, together with a claim which has been made to the invention on behalf of France, which will be afterwards stated, seem to comprise all other names than that of Wm. Lee.

These statements of Aubrey, Aaron Hill, and others, tending to discredit the more generally received idea that Wm. Lea of Calverton, was the student at Cambridge, and of St. John's an M.A., have caused very rigid inquiries to be made in both universities, which have resulted in shewing that he was not of any Oxford College, and that he was not a Fellow, and never expelled from St. John's, or from any other College in Cambridge. It so occurred, however, that while these inquiries were prosecuting in many directions, as to the Collegiate course of Wm. Lee, attention was drawn to Hunter's *Hallamshire*, 1819, p. 141, in which is the following entry, taken from the books of the town trust of Sheffield: "1573. Item: gyven to William Lee, a poore scholler of Sheffield, towards the settynge him to the Universytie of Chambrydge, and buyinge him bookes and other furnyture (which money was afterwards returned) xiii*s.* iiii*d.*"

Upon this Mr. B. Woodcroft, F.R.S. of H. M. Patent Office, and who has bestowed very laudable pains upon this entire subject, remarks:

"The fact that Sheffield sent a William Lee to Cambridge, just before the invention of the stocking-frame, and at the very time probably when the other William Lee was there, is a singular coincidence in point of date, name, and University. Lee, from Sheffield, would be probably about 17 years of age when sent to College in 1573, and 34 in 1589, the year when the stocking-frame is said to have been invented; and 55 in 1610, when he (*i.e.* the inventor) is stated to have died."...."The Sheffield Wm. Lee probably matriculated as a sizar of Clare hall, 26th May, 1570; B.A. 1573-4; M.A. 1577."—Cooper, Article on Wm. Lee, in *Athenæ Cantabrigiensis.*

Next to the statement, in a petition to Cromwell in 1656, afterwards to be more fully described, asking for a charter, the earliest strongest evidence, and as it would appear to the author, that which ought to be perfectly satisfactory authority for the statement which is

most generally accepted, as to the origin of the stocking-loom, is that which is given by Dr. Thoroton, at page 297 of his *History of Nottinghamshire*, folio edition, dated 1677, compiled by himself and his father-in-law, Serjeant Bown. It is as follows:

"At Calverton was born Wm. Lee, Master of Arts in Cambridge, and heir to a pretty freehold here; who seeing a woman knit, invented a loom to knit, in which he or his brother James performed and exercised before Queen Elizabeth, and leaving it to one Aston his apprentice, went beyond the seas, and was thereby esteemed the author of that ingenious machine, wherewith they now weave silk and other stockings &c. This..Aston added something to his master's invention, he was sometime a miller at Thoroton, nigh which place he was born."

The copy of Thoroton's folio, from which this extract has been taken, is in the Bromley House Library in Nottingham, and there is *written* on the margin of the page over against this paragraph, evidently several ages ago: "Ex relatione Johannis Story, Gent." The following further extracts from Thoroton will be interesting as to this family: At p. 296 the freeholders of Calverton in 1612 are enumerated, amongst whom is John Lee's. The name appears in Thoroton's account of several of the parishes around and near Calverton.

"3rd Edward 6th. All pastures and woods and the new Park in tenure of Godfrey Lee, remain to the most Rev. the Archbishop and church of Southwell."

In 1612, the owners of Southwell and East Thorp are said to be "Gervas Lee, Esq. &c." At p. 351,—

"Edward Lee, son of Gervas, is tenant of Overhall. In Norwel church, Notts. Arms are in the chancel," (1677) "granted (1564, 6th of Elizabeth) by Sir G. Dethick, alias Garter, to Elizabeth Lee, daughter of John Lee, of Stamford, Lincolnshire, wife to Sir John Lyon, Knt. an Alderman of London, and her posterity for ever."

And on a monument for Gervas Lee, Esq. in the same chancel, are similar armorial bearings. "All these bearings have Royal Quarterings." At p. 361, in 1612, Thomas Lee Gent is found amongst the list of owners at Sutton, in the hundred of Thurgarton. And that this family, at least in some of its branches, located in that immediate neighbourhood, were of some consideration as holding landed property, it may be further cited from Thoroton, p. 425:

"That Ed. Lee claimed amongst others against Roger Copley, Esq. the third part of the manor of Scafterworth, Notts. with its appurtenances; and the third part of twenty messuages, ten cottages, three hundred acres of land, forty of meadows, twenty of wood, three hundred acres of more, and 3*s.* 4*d.* rent—with appurtenances in Scafterworth, and five adjoining parishes in the division of Bassetlow." "Also the like claim against Richard Devenyshe, Esq., and against Sir Richard Carew, Knt." And further at p. 427, "that Henry VIII., in the 38th year of his reign, gave by letters patent to Sir Richard Lee and his heirs, the Grange and farm of Walkeringham, Notts. and all the lands meadows and pastures there, late belonging to the Monastery De Rupe alias Rock, in Yorkshire, then estimated at 114*s.*"

The places whose names occur in the above extracts are all not far distant from each other, lying in the same district. It will be observed that Thoroton gives Calverton the honor of being the birth-place of Lee. Most succeeding authors assign it to the adjoining parish of Woodborough, but state him to have officiated as a Clergyman at Calverton; one or two mention his being the Curate there. It is remarkable that this is not referred to by Thoroton, nor any other particulars of Lee's early life; and that though serjeant Bown and Dr. Thoroton resided all their lives in the immediate vicinity, the latter in active practice as a physician, and must have known Aston and Lee's brother at least by repute, probably personally, as having been during the latter part of their lives engaged in constructing and employing stocking-frames, they should have been content with the brief reference quoted above from their generally copious work. The volume was published only sixty-seven years after the death of William Lee. The facts were then accessible; so far as the brief notice goes, there seems no reason to doubt their accuracy; especially as the Doctor was manifestly impressed with the interest attaching to a person so well known and with the importance of the invention itself.

It is a vain regret, but it is impossible not to regret that nothing can now be ascertained as to Lee's youth or early education, or his distinguishing characteristics. These all seem, as has been well observed, to have been now long lost, even to local memories; partly, it may be, by the general dislike with which his invention was at first received by hand-knitters; and partly by his stay at Calverton, being so soon closed through his

removal to London, never to return; but principally through the business being for the first one hundred and fifty years, chiefly carried on in and near London, from which source, indeed, much of what is known to have taken place in the origin and early progress of stocking-making has come down to the present time. Nevertheless, there has been so much of interest taken by successive generations of the inhabitants of Woodborough and Calverton in this matter, as to have become embodied in traditions, which have several main particulars in common, and the substance of which will be found in relations about to be given.

The parochial registers of that period commence in this, as in many other instances, so late as to render imperfect assistance in this inquiry. The following letter, bearing on this subject from the Rev. Samuel Lealand Oldacres, Incumbent of Woodborough, dated 25th May 1859, is in answer to one addressed to him, by Mr. Cooper of Cambridge:

"In reply to your letter of May 20th, inquiring about Wm. Lee, the inventor of the stocking-frame, I have nothing useful to communicate. The parish register for Baptisms begins with 1547. John Lee had a daughter baptised in September 1577: Nicholas Lee had a son Christopher, in 1582; another son in 1583; Thos. Lee, in 1586; Isabell, in 1580; *William* 1592; He cannot be the Rev. W. L. who died in 1610; Mary, 1598; Nicholas, 1600. These last seven were all of N. Lee.

Marriages begin with 1573. Nicholas Lee was married October 1582; but his first child was baptised in April of the *same* year—

The register of funerals begins 1572; and at length we find something of Wm. Lee — Lee, the sonne of Wm., was buried March 1579. Perhaps this was a son of the inventor of the stocking-frame.

Wm. Lee, perhaps the father of the one your enquiry is about, was buried in 1587.

The family of Lee, or Lees, for it is spelled both ways, have continued in this parish to the present day. They are now farmers, butchers, joiners, cottagers, and owners of property, in the place. The brothers Thomas, William, and John, of one family, were lately Churchman, Methodist, and Baptist, respectively. They have a tradition that an Ancestor of their's was the inventor of the stocking-frame; and that he lived in a part of an old house now standing.

"The Parish of Woodborough contains a number of hosiery frames for stockings, gloves, shirts, &c. The stockingers are registered as Frame-Work-Knitters. Neither the ages nor business of any persons interred formerly were registered, nor the names of the ministers officiating were entered in the early registers."

The Author has had the opportunity afforded to him

of examining the parish registers of Calverton. For this he is indebted to the kindness of the Rev. S. Oliver, who has been for forty years the Vicar; and who, from the interest he takes in his predecessor in the ministry there, most willingly rendered his aid in the search. The registry begins 6th October, 1568, 21 years only before the date of Rev. W. Lee's invention; and could not therefore include a notice of his baptism. The following entries occur in it, viz., of—

"The baptism of four sons of William Lee, viz. Edward, in 1574; Robert, 1577; John, 1580; *James*, 1582. William Lee, the Elder; (sic) was buried 1595."

This implies that there was a Wm. Lee the younger, and who, if Thoroton be correct as to the Inventor being heir to the freehold estate, would be older than any of the four registered brothers, and probably born before the registry begins. For one—

"Robert Galfer married Elizabeth Lee in 1588, and also John Smythe married Dorothy Lee in 1590"

who might be two unregistered sisters older than the four brothers, and younger than the oldest, if that were Rev. W. Lee.

"Anne, the wife of Wm. Lee, was buried Jan. 1589-90. John Wrighte married Agnes Leighe, 1598. Wm., son of Ed^{d}. Lee, baptized 1606, and Henrie, son of John Lee in 1622. Marie, daughter of John Leigh, buried 1629. Ann, daughter of Henerie Lee, baptized in 1641. Ed^{d}. Lees married Jane Martin 1660. Margaret, wife of Ed^{d}. Lees, buried 1661. James, son of Wm. Lee baptized 1696, and Elizabeth, daughter of Wm. Lee in 1703. Henry and Barth^{w}. Lee buried in 1712. Sarah, daugher of Joseph Lee, baptized 1721, and ——— in 1723; Wm. Lee, buried 1729; and Elizth. Lee, widow, 1730; and John, son of James Lee 1734. There were baptized, Mary 1733, and Bartholomew 1739, children of John Lee; in 1733 John and Sarah, and in 1736 Wm., the children of James Lee. In 1761 John, son of Thos. (a farmer). In 1768 Catherine, and in 1773 another Catherine, daughters of Tho^{s}. Lee; in 1771 John, and in 1773 Hannah, children of Bartholomew Lee."

Finally, the following entry occurs in its regular order in the register, but reserved to this place, because of its importance:

"Buried, Joseph Lee, Stockiner, the last of the Family of Stocking-Frame Inventor Lee, in this Parish, 17 April, 1755."

The Incumbent who made this entry seems to have been a careful observer of the events of the times, and

susceptible of much Christian sympathy with the adverse circumstances of his parishioners who, like those at Arnold, Woodborough, and other large neighbouring villages, were mostly frame-work-knitters. For example, amongst other notices of events, he says, under date 1765—

"The Stocking manufacture very bad last year and this. Scarce half work to be got, or half bellies to be filled. The Lord have mercy on the poor!"

His reference to the extinction of the family to which Rev. W. Lee belonged, would not be inserted without there being conclusive evidence to his mind on the various points included in it.

The Glebe house at Calverton was standing in the reign of Elizabeth, and consisted of one sitting room and kitchen on the ground floor, a chamber over each, and an attic: some addition has been since made to it. The living was then only of £4 yearly value; therefore Rev. Mr. Oliver reasonably suggests that Lee, who certainly ministered there, would not do so as Curate, which has been stated, but as Incumbent; and has no doubt that he occupied for his sitting room the apartment in which these notes were taken by the author. He further stated that according to tradition the first frame was constructed and worked in a building at Woodborough; Lee causing the hose made on it to be sold at Nottingham.

Nothing has hitherto transpired to shew what became of Lee's freehold estate. The brothers who are said to have all been taught by him the art of frame-work-knitting, would be at the time of his invention respectively 15, 12, 9, and James, the youngest, only 7 years old. A certain space must have intervened before the latter could take any part, much less the important part he eventually sustained in his brother's affairs in London and Rouen. He would be 28 years of age when his brother died, therefore that assistance would be quite possible.

There is every reason to be assured from full inquiry at the time, of the accuracy of the petitioning London frame-work-knitters' statement to Oliver Cromwell in 1656, in regard to the origin of the machine-wrought

hosiery trade, and as to the machine "being an English invention by William Lee, Gentleman," (he had early laid aside his sacerdotal character). It was made the subject of strict investigation by the city authorities to whom it was referred; its truth was vouched for by them; and the Protector granted the charter accordingly. The existence of this charter has been long denied; but it is dated 13 June, 1657, and was enrolled in the city archives, 14 July the same year, after examination by a committee, and their report thereon.

Richard Cromwell acted on a petition from the same body referring to the recent charter, in which were again inserted the words "it being an English invention, &c.," by ordering the seizure of forty stocking-frames about to be exported. This was in 1659.

In 1663, Charles II. granted them a new charter on a similar petition from the same body, and in which was repeated the words, "it being an English invention."

Dr. Howel, writing in 1680 his *History of the World*, ascribes the stocking-loom to the Rev. Wm. Lee, "who on an engine of steel, manufactured silk hose, &c."

In 1751, Dr. Deering says, in his *History of Nottingham*,—

> "That the inventor of the stocking-frame was one Mr. Wm. Lee, M.A., of St. John's College, Cambridge, and who was born at Woodborough, near Nottingham."

This writer appears to have visited that village and the adjoining one, to learn if anything could be then ascertained as to the personal history of this remarkable man. He subjoins what was probably the result of his enquiry:

> "Traditional story says, that Lee was deeply in love with a young townswoman of his, whom he courted for a wife; but whenever he went to visit her, she seemed always more mindful of her knitting than of the addresses of her admirer. This slight created such an aversion in Mr. Lee against knitting by hand, that he determined to contrive a machine that should turn out work enough to render the common knitting a gainless employment. Accordingly he set about it, and having an excellent mechanical head, he brought his design to bear in the year 1589. After he had worked a while, he taught his brother and several relations to work under him; and for some years practised this, his new art, at Calverton."

It is, however, possible that Deering derived this account

mainly, if not from the frame-work-knitters' petition to the Protector, as some think, from Stowe, who in his *Chronicle* says—"In the year 1599 was devised and perfected the art of knitting or weaving silk stockings, by engines or steel looms by Mr. Lee, M.A., of St. John's College, Cambridge. Tradition attributes the origin of this engine to disappointed love and pique against a townswoman who slighted him. She got her livelihood by knitting, and to deprive her of employment he constructed this frame."

Anderson, in the latter part of the 18th century, ascribed the invention to the Rev. W. Lee, M.A., St. John's, Cambridge.

Rees's *Cyclopœdia* contains an excellent article under the head of 'Stockings,' by an unknown hand; who, however, was perfectly master of the construction of the machine, an accurate description of which he has given. His account of its invention is as follows:

"This gentleman, Wm. Lee, it is said, was expelled the University for marrying contrary to the statutes of his College. Thus rejected, being ignorant of other means of subsistence, he was reduced to the necessity of living on what his wife could earn by knitting stockings. This gave a spur to invention; and by curiously observing the working the needles in knitting, he formed in his mind the model of the frame which has proved of such singular advantage to that branch of our manufactures."

The writer gives no hint from what source these particulars were obtained.

Blackner in the *History of Nottingham*, published in 1815, says—

"The inventor of this machine was Wm. Lee, the owner of a small freehold estate at Woodborough, the place of his nativity. Deeply smitten with the charms of a captivating young woman of this village, he paid his addresses in an honorable way; but she seemed always more intent on knitting stockings, and instructing pupils in that art than upon the caresses and assiduities of her suitor. He determined therefore to mar her knitting, in order to change her to his views. The former he accomplished in 1589, by the invention of an engine or frame for knitting stockings; a curious and complicated piece of machinery possessing six times the speed of the original mode, and capable of an endless variety of substantial and fancy productions. He gave up the fickle fair one to secure wealth and future fame."

The author gives no authority, especially for that additional particular, of the lady giving instruction to

pupils in knitting, which was a very probable circumstance, from the popularity and profit of the art—facts well ascertained from other sources.

G. Henson gives a somewhat more extended and florid account, in his unfinished work published in 1831:

"A single man, William Lee, a clergyman of the Established Church and curate of Calverton, by the strength of his own natural genius, threw a new light on the powers of production by inventing an engine to knit by machinery; increasing speed twenty-fold. The attempt was new, and had much to discourage it; and he suffered much in accomplishing his arduous undertaking....This gentleman, it is universally said, originated this machine in consequence of disappointed love. He paid addresses to a young woman in his neighbourhood, to whom, from some cause, his attentions were not agreeable; or, as it has been with more probability conjectured, she affected to treat him with negligence to ascertain her power over his affections; whenever he paid his visits she always took care to be busily employed in knitting, and would pay no attention to his addresses; and pursued this conduct to so harsh an extent, and for so long a period, that the lover became disgusted: and he vowed to devote his future leisure, instead of dancing attendance on a capricious woman,.. to devising an invention that should effectually supersede her favourite employment of knitting. He succeeded, and in vain did she (afterwards) try to reclaim his attentions. She found, too late, she had carried her humours too far....The stocking-frame remains in attestation of the greatest triumph of mechanical genius then, or for many ages known."

About the year 1833, Dr. Ure investigated the history and machinery of both the hosiery and lace trades, partly with the assistance (amongst others) of the present author, and gives the result as to the invention in his history to this effect. After mentioning the account of Wm. Lee's supposed expulsion from the University as the result of his marriage, consequent distress, his wife's knitting and his invention of the machine to increase their means of living, Ure intimates his opinion that the following is the more probable statement of the facts of the case:

"It being an ancient tradition around Woodborough, his birthplace, that Lee in youth was enamoured of a mistress of the knitting craft, who had become rich by employing young women at this highly prized and lucrative industry. By studying fondly the dexterous movements of the lady's hands, he became himself an adept; and had imagined a scheme of making artificial fingers for knitting many loops at once. Whether this feminine accomplishment excited jealousy, or detracted from his manly attractions, is not said; but his suit was received with coldness, and then rejected with scorn. Revenge

prompted him to realize the idea which love first inspired, and to give days and nights to the work. This, ere long, he brought to such perfection, as that it has since remained without essential improvement the most remarkable stride in modern invention. He thus taught his mistress that the love of a man of genius is not to be slighted with impunity."

Mr. C. H. Cooper, the late lamented town clerk of Cambridge, and one of the most learned antiquaries of this age, bestowed much laborious research upon the life of William Lee, preparatory to introducing a notice of so distinguished a Cambridge man and mechanician into his work (now passing through the press) *Athenæ Cantabrigienses*. The following extract from that article, which has been obligingly furnished for our use, gives the confirmed opinion of Mr. Cooper, previously expressed by letters from him, as the result of his enquiries:

"William Lee, who was born at Woodborough in Notts., and who is said to have been heir to a good estate, was matriculated as a sizar of Christ's College in May 1579. He subsequently removed to S. John's College, and as a member of that house, proceeded B.A. 1582-3. We believe that he commenced M.A. 1586; but on this point there appears to be some ambiguity in the records of the University. In 1589, at which time it is stated he was Curate of Calverton, about five miles from Nottingham, he invented the stocking-frame."

The writer then quotes Deering's account of the love affair, and its supposed influence on Lee's mind and conduct; and after reciting, very briefly, some of the main incidents of his future life and death, concludes thus:

"The testimony of those who lived soon after him, and the inscription (on his picture) which we have given, will probably be accepted as fair proof that the merit of this important invention is really due to Wm. Lee, M.A., of St. John's College, Cambridge; and therefore we cannot but regret that the materials for the biography of this most ingenious person are so scanty, and that we have been able to add but little to the facts respecting him which were previously known."

In this expression of regret every admirer of great but unfortunate talent must join. But under this dearth of circumstantial information as to Lee's personal life, it is not so much with what Lee was as a man, as with what he attempted and accomplished as an inventor, that at this distance of time it is possible to deal satisfactorily. In this respect there is happily enough known to satisfy reasonable curiosity.

Before proceeding to a description of that singularly interesting process by which Lee arrived at the construction of the stocking-frame, it is proper to state in reference to the lack of personal notices of him just glanced at, that very diligent search has been made at the state paper offices, and at the British Museum, for letters or papers written by or having any bearing upon "William Lee, *the inventor*." Particular stress was laid upon a careful examination of Baker's MS. collection at the Museum; Baker having been himself a Fellow of St. John's, who spent his life in college in making laborious collections of everything curious and interesting connected with it. He died in 1740; and could not fail to collect any existing documents relating to so remarkable a genius as Mr. Lee. In the Catalogue of or Index to these MSS., by four members of the Cambridge Antiquarian Society, dated October 1848, p. 101, Wm. Lee is referred to at letters XIX. 314, 8, and at p. 100, a note of Wm. Lee, XII. 224, is mentioned. But, if in the collection, they could not be found after repeated search.

It is not surprising, that with such large results as those flowing in a constantly widening stream from a source so comparatively obscure, much romance should during late years have been mingled up. In this instance the romance has been clever and captivating, and pictorial art has illustrated the tale with greater talent still. Whether the imaginative has not too far trenched on the domain of the real, so far as it is known, the reader of this chapter will be enabled to decide.

It is intended that all that is positively known of Lee, as well as all that has an indirect bearing on the salient points of his career, shall be recorded here, so far as is possible, therefore the following principal incidents of two popular stories founded upon Lee's invention are appended.

The exhibition of a picture in 1847, painted by A. Elmore, A.R.A., a few years ago, called the "Origin of the stocking-loom," was accompanied by an explanatory paper; of which, as it contains positive assertions on this subject that do not admit of proof, a short abstract will be given. This is the more needful, as the

work was in its execution highly creditable to the artist, and consequently has become extensively known and admired:

"Wm. Lee was a native of Woodborough: entered St. John's College, Cambridge; whence he appears to have been expelled in 1589, for marrying against the statutes. Whether he had attained a fellowship, for which then, as at the present day, matrimony would constitute a disqualification, or whether as an ordinary student he subjected himself to expulsion by entering upon that state, we have not at hand the means of ascertaining. It is enough for our purpose to know that *he was expelled;* and being without means, was driven to take up his abode in a wretched cottage with his young wife and infant child.... There is in the scene, the young fair wife, for whom he had lost all; and the infant, whose coming enhanced their perplexities, which it yet consoled....The painter has seized the point at which the poor student conceived the idea, suggested by his wife's occupation of knitting, of a machine for making stockings. The moment in which a new fact in Art or Science flashes on the mind, is perhaps the happiest in the life of an inventor. But as it was the first pleasure, so it was the last, that resulted to him from it. He settled at Nottingham, and laboured five years in carrying out his invention. He solicited the patronage of Elizabeth: but her masculine mind doubtless regarded the invention of stocking weaving by a *man*, with contempt; for his petition was unnoticed. He had as little success with the trifler, James I., and Lee passed over to France, where, so far as patronage was concerned, he was more fortunate. Henry IV. and Sully warmly espoused his cause, and matters went prosperously with him for a while. The death of his royal patron, however, flung a cloud over his prospects. He shared in the persecutions which befel the Protestants in France; and finally died of grief and despair in Paris....Many a heart has been literally broken on the *wheel*, whose revolutions have made the fortune of thousands.."

About the time when the subject of this invention was thus brought prominently before the public, a novel, professedly historical, in three volumes, was published under the title of the *Nut Brown Maids*. The author speaks of obligations to Fuller's *History of Cambridge*, Burton's *Anatomy of Melancholy*, Charles Knight's *Old England*, Cook Taylor's *Romantic Biographies of Queen Elizabeth's reign*, and Lucy Aiken's *Elizabeth*. But notwithstanding this array of names, the work shews, in regard to the life of its hero, Lee, how far imagination may travel apart from the pathway of ascertained facts; and it is moreover in striking contrast as to almost every important event stated in its course and in its denouement, with the above relation of the pictorial biographer.

As these volumes have been extensively read, and are certainly "curiosities in literature," at least to the frame-work knitting community, an analysis, but the briefest possible, is here given:

"A visit of Queen Elizabeth to Cambridge, introduces Lord Hunsdon, son of Lady Mary, sister to Anne Boleyn, first cousin to Elizabeth. His dissimulation and Latin, alike bad, and his custom of swearing, made him appear a worse Christian than he was. Wm. Lee, of kin to the Champion Lee of Ditchley, destitute of patrimony from confiscation, is at college; 23 years old; of pale, hard, cold aspect; well knit frame, and an inner fire. He is offered promotion in arms by his sovereign, and declines it. The only son of a widow, she starves herself to sustain him at College. Cicely Yorke, daughter of a man of good family, had compassed the new and intricate manner of stocking knitting; 'the looped invention of the Low Countries.' So she sat 'knitting Flanders hose, her many meshes of reason and memory, picking up and letting down.' With her Lee falls in love, and marries her secretly. She continues to knit in her lowly retreat. He preaches in his College, Trinity; and hopes for a curacy, but is disappointed. Dean Whitgift discovers the union on finding them together; it is avowed, and they go to Nottingham, to which both are strangers. In the upper story of a high gabled house leading to the castle, Lee proposed to receive scholars, but from his reserved manners, he found himself after some time with but three pupils, and bemoaned his shipwreck. His wife then undertook to teach girls with a brave heart: but her school also proved a failure. The author here speaks of the noisy, ramshackle artizans of this weaving town. He moreover says, 'It is a well accredited fact, that Cicely maintained her husband, children, and herself, by that art of knitting, which she had learnt in her maiden home.' Their lot realized the legend of Champion Sir Henry Lee, the head of his house, 'More faithful *than* favoured.' Wm. Lee recovers his spirits, draws patterns, buys planes, files, and pincers, and is in fact constructing the stocking-loom. At length he shews his wife a stocking wrought upon it, saying, 'mayhap, they will call them Will Lee's hosen'. To his chagrin, she regrets his success as detrimental to the hand-knitters' employment. The news of the machine spreading abroad, brought crowds to see the loom, on which a meshed web shaped to the human form was made. Demoniacal power was strongly surmised; and the overthrow of even the old weaving-loom predicted; so an assembled mob in their fury 'smashed the machine,' amidst cries of 'No mock weavers to ruin our own old Nottingham cloth.' But the idea of the machine 'once created, could not be *un*created.' Lee is described as appealing to Elizabeth, and presenting her with silk hose, which he had wrought on his frame. She promises him a patent of monopoly, and her support; and Lee 'enjoyed a blessed peace and safety under her all-powerful protection.' He remodelled and improved his loom; and carved on the beam, 'More faithful *and* favoured.'"

Upon these legends it may be remarked that Lee was certainly *not* expelled from either University. There is

no reason at all to believe he was ever married, but many things concur to lead to the contrary opinion. Both these writers take Lee with a wife to Nottingham to reside. There is not a trace of his ever living there, and of course none of the lonely construction or riotous demolition of his first frame there. Had any one of these things occurred at Nottingham, the fact would not have remained till now unwritten in the well authenticated annals of that place.

Even these do not exhaust the number of notices of Lee and his machine, which have been made public. Those that remain to be cited, refer chiefly to its being claimed as a French invention or occurrences which are said to have transpired there. Nicholls, in his *History of Leicestershire*, vol. I. part II. p. 621, in a note says, that there is prefixed to a poem published by T. Baldwin of Hinckley 1776, and addressed "to the hosiers, frame-work-knitters, and frame-smiths, of the several counties of Leicester, Nottingham, and Derby, &c., on the Rise, Progress and Present State of the ingenious Art of Frame-Work-Knitting," the following historical note:

"The English and French have greatly contested the honour of the invention of the Stocking-Frame. But whatever pretensions the French may claim to this invention, it was certainly invented by William Lee of St. John's College, Cambridge, in the year 1589. It does not appear that Wm. Lee ever received any hint from any person whatever, relative to this great invention. But, according to tradition, Mr. Lee paid his addresses to a young lady of great beauty and fortune; and one day he surprised her in a grove, knitting a fine silk stocking. It was in this grove that the young lady gave Mr. Lee an absolute refusal of her hand; which so offended Mr. Lee, that he declared he would invent a machine that should be a means of spoiling the knitting trade. So, it seems, either love or revenge was the first moving cause to this great invention.

However, as soon as Mr. Lee had completed his stocking-frame, he petitioned Queen Elizabeth for her royal encouragement. This petition was rejected. Therefore, despairing of success in his own country, he went to France, and applied to Louis XIII. for his royal encouragement and protection. Accordingly, Mr. Lee continued for some time at his court; and the French King was so pleased with the ingenious art of Frame-Work-Knitting, that he had a frame made of silver for his own use, and really learnt the art of Frame-Work-Knitting himself. And the said silver frame is kept in Paris, as one of the greatest curiosities in France. After the King had set the royal example, most of the French nobles learnt it. But Louis XIII. as a greater encouragement, issued out an order that all persons that were willing to serve an apprenticeship to the art, should be allowed

to wear a sword; which honour no other mechanic is allowed in France.

Some years after, Mr. Lee received an invitation to return to his native country, which he accepted; and soon after, the art of Frame-Work-Knitting became famous in England; and Charles I., with a great many of his nobles, learnt it. And it is said, that as Mr. Lee had gained so much honour at home and abroad by this invention, his former lover nobly gave him her hand, and crowned his wishes and ingenuity with her person."

Nicholls closes the note by judiciously remarking, "I quote this paragraph as matter of curiosity, without vouching for its historical exactness." No doubt, it includes some corroborative points in regard to the invention being due to the William Lee, to whom it has been generally attributed. All that relates to Louis XIII. and the stocking-frame in his court and times, is apochryphal. If founded in facts, they would have been related by eminent French writers who are silent upon them. Charles I. and his nobility were otherwise engaged than in stocking weaving. The testimony to Lee's death abroad and its melancholy circumstances, is too strong to be shaken by the contrary statement above quoted. This, with the consummation of Lee's happiness it professes to record, may be probably the result of popular and natural desire that the genius and affections of such a man should have been crowned with public honours and the pleasures of domestic life.

In Rees' *Cyclopœdia*, the writer of the talented article upon "Stockings," states that the English and French have much contested the invention of the stocking-loom; and goes on to give the following extract from Chambers' *Dictionary of Commerce*, which embodies the view of M. Savary on this subject:

"Waiving all national prejudice, the matter of fact seems to be, that it was a Frenchman who first invented this useful and surprising machine; and who, finding some difficulty in procuring an exclusive privilege which he required to settle himself in Paris, went over to England, where his machine was admired, and the workman rewarded according to his merit. The invention thus imparted to the English, they became so jealous of it, that for a long time it might not be exported under pain of death, or communicate a model of it to foreigners. But a Frenchman, by an effort of memory and imagination, first set it up in Paris, in 1656, upon the idea that he had formed of it in a voyage to England; and this loom has been the model of all those since made in France, Holland, &c."

The writer of the article goes on to say:

"This account seems erroneous, as it is now generally acknowledged that this machine was mounted, in 1589, by Wm. Lee, M.A., of St. John's College, Cambridge, a native of Woodborough, near Nottingham."

M. Savary says, in support of the claim of France, that "the English cannot give the name of the inventor." In this he is mistaken. Thoroton had published it a hundred years before, as has been seen already. But M. Savary himself does not give the name of the person who is said to have invented and carried the frame to England, or of him who took it in his memory back again to France. Roland de la Platiere states that:

"He heard at Nismes, in Colbert's time, the first loom was smuggled from England, at the risk of life to several persons, by one Cavellier, and introduced into France; and that in fifty years there were some thousands of these looms in Nismes and its neighbourhood."

It must be remarked, in passing, that though it was illegal to export machines from England, the penalty never was death; in 1696, by an act of William III. a fine was levied and the property confiscated.

M. Savary says, no doubt accurately, that the stocking manufacture was first established in Paris, in the Bois de Boulogne, by John Hindret, in 1656. The first French encyclopœdists ascribe the invention to the English; as did Voltaire in "Le Siecle de Louis XIV." Berlin, 1751, 12mo. vol. II. p. 118:

"On sait que le Ministere acheta en Angleterre le secret de cette machine ingenieuse, avec laquelle on fait les bas dix fois plus promptement qu' a l'aiguille."

This opinion in France remained undisturbed for a long time. Beckman, in analysing the statements to the contrary, which he does at some length, thinks them weak and unsatisfactory; refers particularly to the London frame-work-knitters petition to Cromwell; and remarks on their statement of the author and circumstances of the invention as being an English one:

"That every thing relating to it must have then been fresh in the memory of those who drew it up, and that every circumstance could then be easily examined, and the petitioners must have been sensible that any misrepresentation for which, however, they had no reason, could easily be contradicted. My object," he goes on to say,

"is merely the question, Who was the inventor, in what country, and at what time, did he live? I can say, after the most diligent research, it does not appear subject to any doubt....To perfect the practice of hand-knitting was a great thing: but not so astonishing as the invention of the stocking-loom, which was not, like most great discoveries, the result of mere accident, but of talent and genius.... It appears to me, proved beyond doubt, that the stocking-frame was invented by Wm. Lee, an Englishman, about the end of the 16th century."

To this conclusion, it is most likely the great majority of his readers will, with the present writer, unhesitatingly come.

CHAPTER IV.

THE STOCKING-LOOM, AND REV. WM. LEE, CONTINUED.

THE mechanical formation of a web, constructed of the knitting mesh, is so different to the simple passing of the threads in the common weaving-loom, the only contrivance for producing a tissue then known, that to effect it required original power of analysis and combination, of an unusual kind. Forces must be applied in ways and for purposes which probably before had never been thought of, certainly never attempted. And instruments, to operate like human limbs and joints, had to be devised. The difficulties were immense. Lee, a student and clergyman, could have little theoretic and no practical knowledge of mechanics, and there were few persons to whom he could apply for aid.

Having become curate in the Church of his native village of Calverton, his first essays were made there; and either from the artizans of that village or the superior ones to be found in the neighbouring county town of Nottingham, he must look for the manual skill in working upon wood and iron, which would be necessary in carrying out his design. It has been already stated that there is no sign of his ever sojourning, much less living at the latter place. It is expressly said that the machine was made, as well as afterwards worked at or near Calverton. His plan would no doubt be, to secure the most clever and teachable artizans of each trade, willing to do his work, that Nottingham could then supply; and thus step by step make quiet progress under his own eye, close to his own home.

It has been an old saying in this district, "The little smith of Nottingham, can do the work no other man can." But this vaunting proverb had then not been realized, whatever by forge and hammer, file

and plane, may have been since done there. Yet it was already well known for superior manufactures in iron and steel articles. Three of its streets were named from these trades:—Bridlesmith Gate was so called from its being the mart for bits, bridles, snaffles, and other horse furniture. Girdlesmith Gate, from girdles and steel ornaments. Smithy Row speaks for itself. The smiths also supplied Nottinghamshire and the neighbouring counties with "plough irons, coulters, shares, stroakes, harrow-teeth and nayles." The reason assigned was "the plenty of coals to be got, and of iron made in these parts." It seems also that wood-work in turning, carving and cabinet-making, was prosecuted in Nottingham and the northern parts of the county with much success. The excellent close grain of the wood obtained from Sherwood forest made it capable of being used for the finest purposes, and was just at hand at Calverton; so that part of the inside work of his loom as well as the outside could with safety be make of that material. One need not wonder, therefore, to read that "his first machine was almost wholly of wood."

During the three years in which it is believed Lee employed himself in prosecuting his invention, he is said to have used up a large portion of his patrimonial means; even to suffering privation, while labouring with intense zeal and anxiety in efforts, often very seriously baffled, but as constantly renewed; and which he believed would enable him to realize an immense fortune. These expectations absorbed all other avocations, interests, and affections. To realize them he neglected every other means of existence; finally, on the completion of his great work, resigning his duties and position as a clergyman. If upon his success, he also gave up the strengthening and ennobling influence of high religious principles, he purchased it at too dear a rate: for they alone could guide him through the waywardness of court favour and neglect which he was afterwards to encounter, and sustain him under the future and final disappointments that awaited him.

Wm. Lee had a brother, James Lee, who there is little doubt was practically instructed during the putting the frame together in its use. He seems to

have been his brother's best workman in it, and his constant companion and confidential assistant throughout the remainder of his life. By them other relatives and connections were taught the art of frame-work-knitting. They thought the employment so honourable, as to wear silver work needles, suspended by silver chains at their breasts. This practice was continued by frame-work-knitters, so late as the reign of Queen Anne. The frame was completed in the year 1589; and worked, for probably about two years, at Woodborough or Calverton, with varying profit. The prejudice in favour of hand-knit-hose had to be overcome, while finding a market for those wrought on the machine.

The course which the invention of the stocking-frame took, from its first inception in the mind of Lee to its completion, was not left on record by himself, or any of his contemporaries. But the machine being so soon transferred to London, and to a particular spot Bunhill-fields Saint Luke's, from whence its use radiated amongst other parts to Spitalfields, and after a few years to Godalming in Surrey, added to its forming at an early epoch the basis of an incorporated London trade company, raised the curiosity of frame-work-knitters, then in the first class of skilled workmen, in order to ascertain the steps by which an *engine* so wonderful to the people of those days, could have been completed. Consequent on the inquiries thus excited, the elder stocking-makers and hosiers in and about London, where the manufacture was for a long time principally carried on, were never tired of relating the difficulties encountered by Lee, and the methods he adopted for overcoming them.

The information upon this subject given by Henson, cannot, in the main particulars, be far from correct; the nature of the machine and its processes corroborate its general accuracy. He states it to be drawn up from the accounts received in answer to enquiries put to Mr. Hardy, Twister's Alley, Bunhill Row, London, who was apprenticed to the stocking-making business in 1711, and died in 1790, aged 90; and from Mr. Wood, Godalming; also, from an ancient frame-work-knitter, who was apprenticed in Nottingham, in Queen Anne's

reign, and who died in Collins's Hospital, Nottingham, aged 92. All agreeing mainly in their statements, and confirmed, as to the machine, by the working parts depicted upon the shield of the arms of the frame-work knitters' company, adopted at their first incorporation in 1657, and shewn by the engraving given in this work.

About eighty years ago, a statement was made by an anonymous writer, relating the course taken by Lee in constructing his frame. Henson's account coincides generally with this; the differences are such only as would lead to the conclusion, that they came from separate but authentic sources. It is more than probable that Henson had no knowledge of the previous statement, though the writer of it was practically acquainted with the parts and operations of the stocking-frame, as well as conversant with the hosiery trade. He does not say from whence he derived his information.—On the whole, it may be reasonably concluded, that the main facts in Lee's course of invention, have been handed down. The following description embodying them is chiefly drawn from Henson:

"The web of a stocking is knitted by hand, on three or four long pins, of a row of loops, and in a round shape; it seemed to Lee impossible to construct a machine to make a *round* web, having as many needles as loops, in the circumference of the hose. Pondering on the difficulty, he one day saw his mistress knitting the heel, using two needles only; one held the loops while the other was employed in forming a new series. It struck him he could make the web flat, or in a *straight line* of *loops;* and when thus made, *join the selvage* by seaming them together; and thus make it round. He was then led to the idea of throwing a thread across a long elastic hook, the point of which should be pressed down into a hole in the stem of the wire, and thus loop at pleasure. He bored the holes, and tried to insert the point; but though he could make the loop on the wire (since called a needle), it would not slide easily over the inserted point. At length he thought of the groove instead of a hole. But here tools failed him in making the groove. He flattened the wire at that part, heated it, and turned the edges towards each other, and spoiled much wire in the ineffectual attempt. Afterwards, by using a three-edged file, he cut out the groove. After spending a long time in making these hooks of various shapes, he made the long bearded hook or needle, fit for his purpose.

In his first attempt at looping, he inserted firmly into a piece of wood a dozen of these needles, eight to an inch; fixing this piece of wood upon a wooden frame-work, (hence the name *frame*), and

endeavoured to make a succession of loops upon them by hand, which he finally accomplished, knitting on this row of hooks a pair of garters in this manner.

The next point needed, was to form and fix a wooden bar (the presser) to press down at one movement all the barbs of the hooks into the grooves, using the one hand to bring forward the loops, while he put all the beards down into the grooves with the other; and so by passing the row of loops over the beards and needle-heads, he formed row after row of loops to pass upon the previously made rows, till several inches of web were produced.

He now tried so to deal with the single thread with which his web was to be made, as to gain a sufficient length of yarn in each loop; and so to form the succession of loops, across a series of needles, placed in a straight line. All attempts to do this by rows of pins fixed upon levers, acting at the head of the needle, where it is bent back to form the hook or beard, proved abortive; so he was driven to attempt it at the stem, which, after many efforts, was effected in a most ingenious manner by the construction of what are called the 'jack' and 'sinker.'

The jack is a lever working freely on a wire, upon which it is balanced. In Lee's frame these were of wood, one to each needle, and the whole row of jacks were kept in place by working in a comb. In the round head of the jack is a slit from which the sinker hangs, and works perpendicularly. The sinker was made by Lee from a thin plate of tin, and is so shaped, as by passing between the needles to carry down as much thread as to form a loop between each pair, then to carry them forwards under the needle-beards and close to their heads; and after the presser had placed the points of the beards in their grooves, the sinkers brought forward the web of loops already formed, and passed it over the row last formed; then took the work back to the stems of the needles ready for a new course. To devise one instrument shaped so as to perform so many essential operations was a marvellous thing, and was only accomplished after many unsuccessful efforts. Still more wonderful, that it was so perfectly adapted as to continue, without material change, in use to the present time.

The jacks, when the sinkers were attached, were lighter behind than in front, so he placed a row of light springs at their tails to hold them from falling forwards, except when wanted to form a fresh row of loops. Then they, following the thread thrown by the workmen each way, were forced down in rotation by an iron instrument of suitable shape, called a slur cock; which, pulled by a string attached to treddles, runs backwards and forwards on a bar, and by striking against the jack tails in succession, cause the hissing noise heard in frame-work-knitting.

The whole inside of the machine was first made to run on two trucks only; since, on four—a great improvement as to labour and speed. For the entire machine has to be moved forwards by the hands, then made to sink by means of a central spring; then to rise and to retreat to its former position; all to enable the sinkers to do their successive duties. These movements must be seen to be quite understood; and the skill of the workman is shewn in their rapid performance by his hands and feet, governed by his eye."

There were in Lee's frame only jack sinkers, and the half jacks which connected the movements of the jacks, combs, and springs, were fastened to the verge bar, which stopped the heads of the jacks when pressed up by the locker bar, after they had fallen. This locker bar was worked by the foot, as was the frame bar when sinking to bring the thread to the heads of the needles. After three years Lee made the first actual course of loops upon his frame.

He was not long in learning how, by removing loops from time to time on the outer sides of the web to the next needles inward, to gradually narrow it, and by a reverse process to widen it.

But here a great and seemingly insuperable obstacle presented itself, arising from the peculiar shape of the heel and foot of a stocking. He had observed that the hand-knitter on coming to this point of her labours, first knitted the heels alone, and then proceeded to form the remainder of the instep and foot. Misled by this he worked the heels alone, and in order to avoid pressing the instep off the needles, he brought the instep under the needle hooks or beards by hand before pressing in every course. It is said that months elapsed before the method of working them together was devised by him.

Thus at length, by perseverance, his efforts and hopes were crowned with success, and William Lee, the clergyman, became the first frame-work-knitter.

The peculiar shape of the needle with the barb turned back diminishing to a point is shewn at Plate III. with a section of the presser ready to act on it. The needle is made of carefully selected and tempered iron wire, and, though the result of simple operations, requires to be thoroughly well finished by experienced workmen. These form a separate branch of business.

The sinker is seen appended to its jack (Plate III.); as the sinkers have to pass easily and freely between the needles, they are made of sufficiently thin plates of iron cut to exactly the same size and shape in moulds. They are carefully smoothed so as not to injure the thread on which they operate. Making them is also a distinct business.

The frame-smith makes the jacks to an exact size

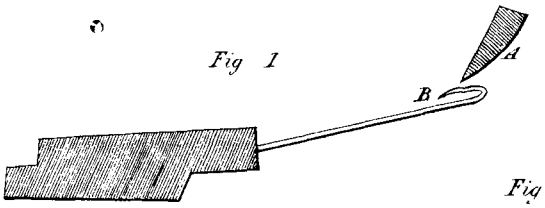
and with great care, as also the combs. To make the jack springs is usually a separate business.

The operations of the stocking-maker when seated in his frame, may be described as consisting of eleven movements, in the formation of one series of loops or a 'course.' These are as follows:

"Throwing the thread from a bobbin over the hooks or 'needles' by hand. Drawing the slur by one of the treddles, to force down the jacks and their sinkers, and so to form loops between every other pair of needles. Sinking the lead sinkers down on the thread, to divide the loops between all the needles; locking up jacks at the same time by the thumbs; and so equalizing all the loops by these cleverly combined movements. Bringing the loops thus formed to the needle-heads. Throwing up the frame, assisted by the strong central spring; leaving the loops at the needle heads, and the work at the stem, to be pressed over, in forming the new course or series of loops. Then, putting down the spring bar or 'presser' by the foot on the middle treddle; and, putting forward the web already made, upon the needle beards, which are now pressed into the grooves of the needles. Then, letting the presser rise, and at the same time, bringing the web over the needle heads. Bringing down the frame to the bottom standard to catch the work with the nebs of the sinkers, which are for that purpose made in the shape of a long arch. Taking back the web by the nebs of the sinkers, holding the frame firmly down. And, finally, letting the frame rise to the catch of the copens, holding the thumbs firmly to the thumb plate; and then quit the thumbs for another course. The slur is moved for one course, to the right; and for the next, back to the left."

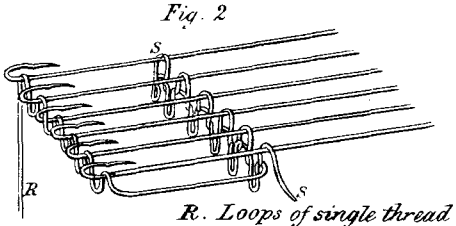
While the hands are thus busy, and the feet moving at the rate of one hundred yards in a minute, the eyes must keep watch over the needles as to their soundness and uniformity, and upon the work, that it be free from blemish, and irregularity in the lines of loops traced down its length. In narrow frames the number of needles is from 150 to 600, according to guage; in wide ones there are sometimes 1500. Fashioned work is favourable to the hand workman, by relieving him during the shaping of the stocking and other operations which require change of labour and position of the body. Wide hand-frames on which usually the unfashioned work is made, which has to be shaped by the scissors, are consequently very trying. Nevertheless, the constancy of muscular motion is favourable to the health of the stocking-maker. If the shop in which he labours is sufficiently warm and well ventilated, this employment is more desirable than many others in this important

Fig 1



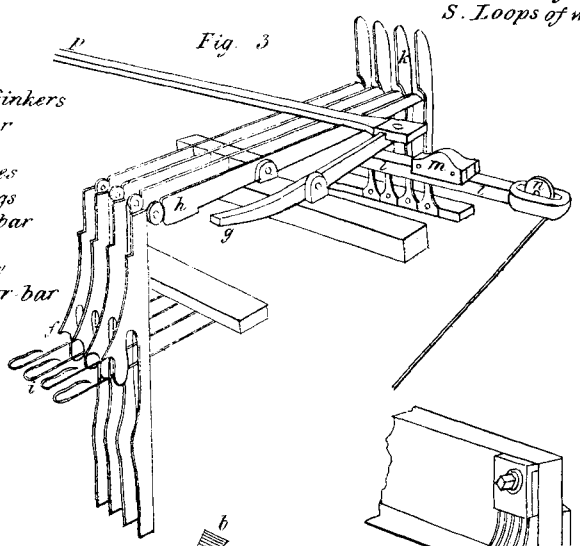
A. Section of Presser-bar to act on B Needle beard.

Fig. 2



R. Loops of single thread
S. Loops of web to pass over beards.

Fig. 3



f. Jack Sinkers
g. Locker
h. Jacks
i. Needles
k. Springs
l. Slur-bar
m. Slur
n. Pulley
p. Locker bar

Fig. 4

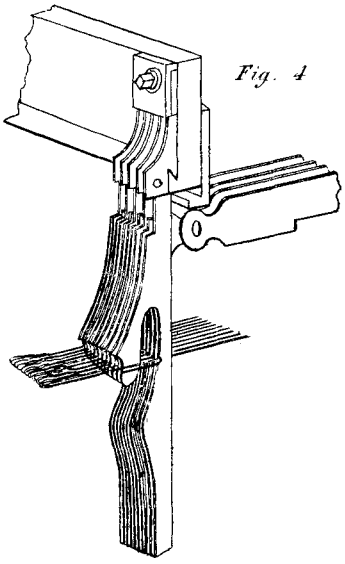
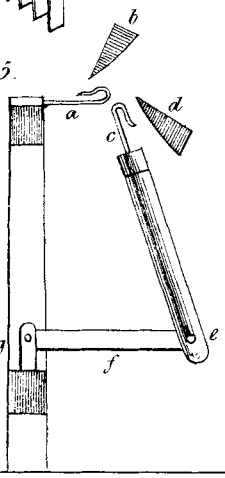


Fig. 5.



SECTION OF LEE'S FRAME.

a. Needles
b. Presser
c. Needles
d. Presser
e. Moveable Joint
f. Vibrating Arm
g. Standard

STRUTT'S MACHINE.

W. Metcalfe, Lithog.

particular. The failure of sight as evidenced by the early use of spectacles, is however very common, especially so in the case of frame-work-knitters occupied in making hosiery of fine qualities.

By this process instead of, as by skilful hand-knitting 100 loops formed in a minute, on Lee's first frame 5 to 600 were made, and upon the frame afterwards adapted by him so as to produce silk hose, 1000 to 1500 loops were produced in the same space of time. It was not long before greater width, fineness, and speed of the machine, were attained. At the time of the first invention and even now, to those who are not accustomed to examine the construction of machinery, the stocking-frame presents the appearance of complication in its swift movements. A youth ten or twelve years old soon learns to work in it. The author at thirteen years of age produced three pairs of fashioned women's twenty-six guage full sized hose between six in the morning and nine in the evening of a summer's day in 1808. There are, in reality, no complicated or difficult movements in the stocking-frame, almost the whole are merely those of levers moving on their respective fulcra, excepting those of the carriage, which gives horizontal motion to the jacks, and a perpendicular one to the sinkers; and the alternate motion of the frame backwards and forwards on its four wheels. But the machine requires care and experience to keep it in good order. This arises chiefly from the small compass in which a number of moving parts must be placed to work. Owing to this, the needles, unless cautiously handled and kept with the utmost nicety in line and equidistant, are frequently bent or broken. The sinkers which must be very thin are easily injured. As they must pass freely, both in a perpendicular and in a horizontal direction between the needles in a very limited space, the slightest deviation from being truly and squarely placed, unavoidably injures other sinkers or the needles next to them. When a workman, ignorant of mechanism and too impatient to wait for a remedy from another, attempts to rectify defects, he often unfits the machine for working at all, until thoroughly repaired. This, together with the necessary wear and tear of machinery,

has caused a class of mechanics to be employed, called smiths or *setters up*, who act as constructors of new frames and repairers of old ones. Inferior workmen often necessitate a *recruit* (a thorough repair) of their frames in three years: many however are so worked as not to require it in less than ten or twelve, and we once knew a steady and clever frame-work-knitter, sell his frame at the end of twenty-five years, never having had a recruit, nor then needing one, a singular instance of care and the efficacy of "the stitch in time." The average is about seven years.

Having formed expectations, proportionate to the profound thought and skill shewn in the conception and completion of his machine, and to the consciousness he seems to have felt, that it was calculated to administer greatly to the comfort and advantage of his countrymen, Lee removed it to London, with the intention of seeking the approval and countenance of his sovereign. His brother and other workmen, his relatives, went thither with him. When the invention of a complicated knitting-frame became known there, it was thought to be an almost miraculous event.

The nation was at that moment nearly delirious with joy, at being delivered from threatened invasion by the Spanish Armada. Lord Hunsdon had commanded a main body of the army raised upon that occasion. He was also a near kinsman of Elizabeth. To him Lee made known his desire to exhibit this wonder-working machine, and shew its method and powers in her presence. The whole court seems to have been filled with curiosity upon the occasion. Elizabeth herself, having heard the news, and received Lord Hunsdon's request on Lee's behalf, was not indisposed to accede to it; and at length attended by Hunsdon and his son, Sir William Carey, she repaired to Lee's lodgings in Bunhill-fields, at which place he had set up the frame. Either himself or his brother James had the honour there of working his machine before their sovereign. The Queen expressed her sense of the ingenuity displayed by the invention, but to Lee's great mortification shewed her marked disappointment, that instead of fine silk hose as she had expected, the production was a

coarse worsted-stocking. Indeed it was only eight needles or wales to the inch in width. Notwithstanding this untoward circumstance, Lord Hunsdon had faith in the ultimate importance of the enterprise, and pressed this conviction upon his mistress, begging that a patent of monopoly might be issued to the inventor. But most probably for other and important state reasons, besides the one she is said to have avowed, the influence of her highly valued relative was, on this occasion and afterwards, unsuccessful. Elizabeth's answer to Lord Hunsdon on his intercession for Lee, is thus related:

"My Lord, I have too much love for my poor people who obtain their bread by the employment of knitting, to give my money to forward an invention, that will tend to their ruin by depriving them of employment, and thus make them beggars. Had Mr. Lee made a machine that would have made *silk* stockings, I should, I think, have been somewhat justified in granting him a patent for that monopoly, which would have affected only a small number of my subjects; but to enjoy the exclusive privilege of making stockings for the whole of my subjects, is too important to be granted to any individual."

After much search of the public records and in other quarters, no patent of Elizabeth to Lee can be found, nor the record of any one granted to him. His followers for ages denied there ever was one. And the account by Henson of many parchments and papers being destroyed on the death of Mr. Seagrave, town clerk of Nottingham, "amongst which was one in a tin box having a large seal, on examining which" (the relator, one Twells a tailor, says) "I found it was a deed of patent, granted to Mr. Wm. Lee, for the use of the stocking-frame," has little air of likelihood about it. How came it there, and after two hundred years enquiry after it, how could it have remained unnoticed and even unknown, in the hands of the public officer of that town, which had become commercially important by the use of this very machine? Henson's supposition is that Seagrave obtained possession of this document, during the disputes respecting the charter of Charles II., in 1753. It is not easy to imagine what motive there could be on the part of any descendant of Lee, and still less on that of the Frame-Work-Knitters' Company, to part with this document; or of the Nottingham town

clerk to conceal it, while in his possession, if it ever were so.

So great was Hunsdon's confidence in the value of this invention, and so high his estimate of the profit to be derived from it, that he bound his son by deed of indenture as an apprentice to Lee, that he might learn the art of frame-work-knitting, and thus made him a guarantee to Lee for the security of his invention, as well as to obtain for himself a claim to share in the large anticipated profits. In this manner, Sir William Carey, a knight, the son of a peer and of the royal blood, became one of the fir. t stocking-maker's apprentices. His father no doubt furnished the greater part, if not the whole of the funds, expended in constructing the next and some subsequent frames.

Lee, though chagrined, was not daunted by the Queen's reply. He determined to fulfil the expectation she had expressed, and at once proceeded to construct a machine, on which silk hose could be made. This was a frame with twenty needles to the inch, requiring a comparative reduction in the thickness of the needle wire; and the substitution of iron for wood jacks, and sinkers so much thinner, that five should work in the space occupied by two in the first machine, with all the other internal parts to correspond. The principle of the machine was unaltered, but its construction in those days was rendered, by this change, so much more difficult, that it was only by his own strong will and the aid of his talented brother James, and their skilful and faithful colleagues, that this notable feat was accomplished.

He now proceeded to make silk hose. Hitherto he had experienced the mortification which was to be the lot of many future inventors. "Because he had not accomplished everything he had done nothing." This silk-hose-frame had been very costly in time, labour, and money. It was not completed till about 1598, which has been taken by some writers, as the date of the invention of the original machine, instead of its successful adaptation to the wishes of this imperious Queen, and the requirements of her expensive courtiers. Lee presented Elizabeth with a pair of silk hose thus

produced, which she accepted with many praises for their elasticity and beauty of texture. But his prospects were not improved thereby; neither patent nor money were forthcoming to do honour or bring profit to the inventor. He discontinued attendance at court, and employed himself sedulously in the construction of more frames, being thenceforth seldom seen any where but in his workshop. Of these he erected nine which were worked by his relatives and apprentices; upon them it is probable he expended all his remaining means.

In 1603, he saw his great but politic and parsimonious sovereign laid in the grave. On the accession of her successor, Lee's hopes of court favour and of a patent revived, especially as it was known that before leaving Edinburgh, James had borrowed a pair of silk hose from the Earl of Mar, saying, "Ye would not have your King appear like a scrub before strangers." But again he was disappointed. In this matter Cecil does not appear to have exercised his usual foresight; or he was thwarted in regard to fostering so promising a manufacture. It is said, but by one writer only, and that a recent one, that Lee worked his frame also in the presence of James: but it is unlikely. After the death of Lord Hunsdon and his son, meeting with continued neglect, he fell into a deep melancholy. Upon which Deering quaintly remarks—

"He shewed an experiment in this kind of workmanship; offering the discovery to his countrymen, who, instead of accepting the offer, despised him, and discouraged his invention. Being thus discountenanced by his native country, and soon after invited over to France, with promises of reward, privileges, and honours, by Henry IV., he embraced the seeming fair opportunity, and went himself, taking his brother and nine workmen, and as many frames, to Roan (Rouen) in Normandy, where he wrought with great applause."

These offers were made by Sully, the celebrated Marquis de Rosny, a special envoy to the English sovereign, who, with the design of assisting to revive the decaying manufactures of France, thus desired to take advantage of the neglect of Cecil. Lee at first hesitated to accept them, because of the tendency to religious persecution in France; but at length he determined to close with the ambassador, and went thither. On arriving and fully establishing his machinery there, he

was called up to Paris, and presented by Sully to Henry, meeting with a gracious reception. This, added to his successful commencement of operations at Rouen, once more raised hopes of good fortune, and he was fast rising into note. While waiting in Paris, expecting a special grant of privilege, and an arrangement by the Minister for the enlargement of the business at Rouen, the assassination of Henry IV. by Ravaillac took place, destroying Lee's position and his hopes at one fell blow. The Minister having resigned his office in disgust, Lee found him retiring from Paris to his estates in the country. The Regent, Mary de Medici, withdrew her protection from Lee; he became suspected at court on account of his Protestantism; his fortitude forsook him; he fell into poverty and distress, and a deeper melancholy than that which had haunted him in London. Finding himself unprotected in a foreign country, and left to bear the pangs of a deeply wounded spirit alone, he sent a message to his brother James to come to him from Rouen. But it was too late: for before the arrival of his brother, the great inventor of the stocking-loom, almost an outcast from his native land, and an alien in France, after nearly twenty-five years of deferred hope, had died in Paris of a broken heart, and was already buried there. This event took place in 1610. If England had the honour to give him birth and education, France, from the just appreciation of his merit by her great sovereign and still wiser statesman, gave him the only royal patronage he ever obtained—and a grave.

It has been stated, that there is absolutely nothing in that which is known of Lee's life, to justify the idea that he had a wife or a child to cheer and animate him through any part of his arduous and eventually saddened career. Had there been such, some trace must surely have been left of the fact in the relations, however brief, of his expatriation, his disappointment, and especially, of his death.

No reminiscences have survived the intervening centuries descriptive of Lee's personal appearance, his manners, his natural disposition, or his general conduct and habits. Born in the middle ranks of life, and

educated as a gentleman with the learning of a studious collegian, he must have been fitted to take a part in the high society amongst which he frequently moved. By the boldness of his claim to the notice of Elizabeth, and his unquestioned success, he became known in the circle of gifted men who surrounded that keen-eyed princess, as the first English mechanician of his own or any preceding age. So far his ambition was gratified. Still more so, when the great merit of his invention was acknowledged in the presence of the court of France. But pecuniary reward depended on the smiles of fortune, of whose fickleness few more striking instances are on record. Riches were not at once superadded to fame; and Lee could not either bide the time for their slow accumulation, or resolve to abandon the hope for them, and rest content with the consciousness of having deserved the prize. In the prosecution of this effort of mechanical genius, all his faculties were engaged to their fullest extent, and entire success seems to have been necessary to their continued and vigorous exercise. In proportion as that success was delayed, his horizon darkened and closed in. He could not look with calm and clear vision beyond or above it. He seems at these times neither to have been aided by the philosophy of the schools, which he had studied, nor to have realized the self-sustaining faith of the Christian, which he had for a time preached. The thoughtful mind cannot but revert with anxious and deep sympathy, to the reflections of that once powerful intellect, in the closing hours of life. They have passed away, leaving no record behind. They would, no doubt, be deeply shaded by a sense of the vanity of courtly applause, and of resting hopes of real happiness on anything external to one's self, except it be Divine. The idea must be indulged, that as the services of twenty years before in that small parish church of Calverton would surely often return to memory, so the lonely gloom of that far off chamber might be lighted up by the rays from heaven, which shone upon those early sacred engagements.

Lee should ever be held in high regard by those who study and practise mechanical science, because in the very commencement of modern practical invention, he

asserted its value while he shewed its results; placing his master mind not merely on a level with, but on a higher platform than, that occupied by nobles and even statesmen, who seem never to have disputed the right or withheld the respect due to so eminent a genius.

It has been found impossible to adorn this volume with a copy of the original likeness of Lee. That painting is not to be found. The figure and face of the clergyman in an engraving of the arms of the Frame-Work-Knitters' Company is supposed to be taken from a picture by Balderston, formerly hanging in their Hall, Redcross Street, London. This contained the portrait of a man in collegiate costume, pointing to an iron stocking-frame, and addressing a woman who is knitting with needles by hand. It bore the following inscription:

"In the year 1589, the ingenious William Lee, A.M., of St. John's College, Cambridge, devised this profitable art for stockings, (but, being despised, went to France,) yet of iron to himself, but to us, and others, of gold, in memory of which this is here painted."

As the original painting by Balderston is so interesting a work of art, in connection with this history, it is to be much regretted that Mr. B. Woodcroft is compelled to state that "desiring to place it in the gallery of eminent men in Kensington Museum, he cannot find it, or any likeness of Lee, after enquiries carried on through a long course of years." The following is an extract permitted to be taken from his notice of this eminent inventor, in the "catalogue of portraits in the Museum at South Kensington." Its contents have an important bearing on the possible restoration of the original painting to some worthy public position, having been parted with by the company at a period of pecuniary embarrassment, and probably now in private hands:

"On the inside of the cover of the second book of the company's record, are two lists, dated 1687, of plate, pictures, &c., then belonging to and in the possession of the company; in one of which lists, is an item—'*Mr. Lee's picture by Balderston.*' In 1708, Hatton's book was published, which, at p. 605, vol. II., mentions this picture. From 1732, the company's books shew no more meetings at their hall, which probably the company let, and removed its plate, pictures, &c. to a tavern. There are no minutes of any court being held from 1732 to 1745; from which date the company appears to have held its

courts at the White Hart Tavern, Bishopsgate Street. In 1755, a bond was entered into by the then landlord of the Dog Tavern, Garlick Hill, for securing '*the plate, &c.*,' belonging to the company, and deposited with him for its use; no copy of the bond or its schedule, however, is made in the books. In 1759, the hall was leased to Mr. Seward, a brewer; if not previously, Mr. Lee's picture must then have been removed. In July, 1761, the company removed its 'plate, colors, furniture, &c.' to the Ship Tavern, Threadneedle Street; where the courts were held with tolerable regularity for about nine years; after which various taverns seem to have been used; and subsequently to 1772 the company met frequently at the New England Coffee-House; and again at the White Hart Tavern; but no further mention is made of 'Mr. Lee's picture by Balderston;' which, it is probable, was included either in the 'plate, &c.' of 1775, or 'the plate, colors, furniture, &c.' of 1761; for there is in the company's possession a copper-plate for court-summonses dated 1777, engraved with a similar heading to the above, and as it is not improbable that the picture was in the company's possession in 1761, it is also most probable that the engraving, which tallies with Hatton's description on the plate, dated 1777, was taken from Mr. Lee's picture. There is no entry subsequent to 1770, by which the existence of the picture can be inferred, or its fate determined. The above engraving seems to be a close imitation of the plate dated 1777."

Mr. Woodcroft records an additional statement, derived also from individuals officially connected with the Frame-Work-Knitters' Almshouses in London:

"I can only add, it is my opinion that the picture was, together with others, taken by 'Mr. Robinson of Threadneedle Street,' about 1773, either to wipe off a debt due to him by the company, or as a security for its repayment. Mr. Robinson was an influential member of the court of Frame-Work-Knitters, and resided in Threadneedle Street; courts were sometimes held at his house; and from time to time, he lent the company money, as appears by their books now extant."

In Cunningham's *Handbook of London*, p. 527, this portrait is said to be at Weaver's Hall. R. Seymour, in *Survey of London*, vol. II., p. 603, gives the inscription. Von Uffenbach, in his *Reisen*, vol. II., p. 571, says, "which picture and inscription, I saw."

George Balderston, one of the first wardens of the company under the charter, was probably a relative of the painter of this portrait. If so, he would be likely to take care that the clergyman in the coat of arms, should bear a strong resemblance to the picture.

Is a monument to the memory of William Lee sought after? Let the enquirer visit Nottingham,

Leicester, Chemnitz, Appolda, Troyes, and Nismes. The teeming populations of those cities, with the districts around them, and the vast manufactures in which they are profitably employed, silently and unintentionally, but eloquently, perpetuate his fame. For the foundations of the trade, which has grown into such magnificent proportions and made them rich and great, were laid by him.

CHAPTER V.

STOCKING-WEAVING AND THE CHARTER—1610 TO 1750.

THE writer in *Bibliotheca Topographia Brittanica* already quoted, says "Mr. Lee, after some years residence in France, received an invitation to return to England, and accepted it. Thus the art of frame-work-knitting became famous in this country." This is altogether a mistake. Upon Mr. James Lee's returning from Paris to his countrymen at Rouen, with the sad news of Lee's decease, after a serious conference amongst them, it was decided by seven of the number to return immediately to England, taking with them all the machines except one, which was allotted to the two workmen who remained behind, hoping to get the privileges and rewards promised to Lee. J. Lee brought these frames to London, where they were set up, in Old Street Square, and worked, and became the foundation of the London hosiery manufacture.

Thus was the business very near being permanently established in France from the time of Lee, and in this manner was it, contrary to all reasonable expectation, brought back again. No sooner was the fact of the return generally known, than, as if to make up for the national neglect of the inventor by posthumous appreciation of his genius, people of all kinds and classes strove to become frame-work-knitters. The owners of the returned machines sold them, intending to construct others. This arose from the circumstance that one Aston, then a miller at Thoroton near Nottingham, but formerly an apprentice to Lee before he went to Rouen, though he declined to accompany him thither, had, during the interval, continued to direct his attention to the machine, with a view to its improvement. Immediately, therefore, upon effecting a sale of his machinery, James

Lee left London and returned to Nottinghamshire, and without loss of time joined Aston, who he found had really devised an important addition to the inside parts of the machine. They at once begun to make frames on this plan about the year 1620. The novelty consisted in the introduction of one fixed sinker, placed between every two moveable jack sinkers; and thus, either allowing half the jacks and their sinkers to be dispensed with, or else by the addition of these fixed lead sinkers (so called because their upper ends were imbedded in lead), and an equal number of needles, to double the gauge of the machine. Either way the cost of the frame was much reduced. But, in applying the invention, they found that the jacks must be raised, in the act of lowering the fixed sinkers, in order to get the thread divided into loops of equal depth, without deranging the horizontal line of the needles. They were thus led to discard the lever, working the locker bar from the front, by placing a long lever in front of the locker axles cut aslant in front, and forcing it up by a plate on each side, worked by the thumbs upon an axle at the top, having an inclined nob, and by driving one slant against the other, raised the jacks in front by pressing behind the bar. Thus were the lead sinkers, thumb plates, and lockers added. Machines were built in great numbers, altered in this way, both in London and in the neighbourhood of Thoroton, Calverton, and Woodborough; the population of which villages increased rapidly within the next fifty years, as is evidenced by an incidental remark of Thoroton, complaining, as to Calverton, of the emptiness of the church, notwithstanding the populousness of the parish. William or James Lee had taken an apprentice in London named Mead, whose time was not yet finished, as an apprenticeship might at that period be legally prolonged to the age of twenty-four. The remainder of his term was purchased from James Lee, together with one frame, for £500, by the Venetian Ambassador, who desired to repeat Sully's effort with better success in favour of that city. Venice was still the most commercial city in the world, though the route to India by the Cape was now open. They were reputed to have the best smiths in Europe. The envoy

transferred Mead and the machine to Venice, where it was worked, and others were attempted to be constructed like it, but without success. For, skilful as some of the mechanics were, they could not make needles, or sinkers, or otherwise repair the one in their hands, much less construct others that could be worked. The necessary inside parts would have been continually required to be sent from London, 800 miles overland or 1600 by sea. So when the stock of needles and sinkers was exhausted, the scheme came to an end. Mead, at the close of his engagement, returned to London, bringing the dilapidated machine and the abortive imitations with him, and they were disposed of for little more than the value of old iron. This was in 1621. Zano says:

"That after Mead's unsuccessful attempt, one Gian Battista Carli, a steel worker at Gerona, drew the plan and constructed an imitation of an English stocking-loom, which he had seen at Venice, and established the manufacture at Udino; where frames continued to be worked for some time. But in consequence of the poverty of the Venetians who were employed there in making hose, no more frames were permitted to be set up; and those already at work were afterwards sent to Gradisca, in Austria, where the Venetian Udino hose had been chiefly sold."

Sir Joshua Child mentions that, in 1670, the Venetians had not got the stocking-loom, but that English hose were exported there at that date.

The number of frames and workmen greatly increased both in London, Godalming, and Nottinghamshire; chiefly, however, in London, because of the facility afforded for the execution of orders for fancy goods, made to suit the colour and fashion of the clothes then worn, and which commissions generally required immediate execution.

The London frame-work-knitters formed themselves, early in the 17th century, into a Trade Association; regulating prices, and opposing non-apprenticed hands working at the business. But the employment was so profitable as to induce people to offer money to be taught. Some in the trade took it, and were thought to have committed a heinous offence.

One Abraham Jones, a master stocking-maker in London, was so harassed by this combination, as to go with other transgressors to Amsterdam, taking with him

frames improved after Aston's method. After a time the plague broke out in that city, and Jones, with his wife, family, and all his men, died. His frames were brought back to London about 1633, and were sold for a trifling sum, his adventure being thought unpatriotic, and its conclusion a judgment on him and his.

The rule of the self-constituted company continued to be set at naught, especially in the matter of apprenticeship. Non-apprenticed catholic workers were driven abroad to Brabant, and protestants into Germany, but after awhile most of them returned home again.

The two men left by James Lee in France made little progress; one at length died, and the survivor at the end of forty years still worked his jack-frame, unimproved by the addition of Aston's lead sinkers.

After James Lee's death, the business of stocking-making in Nottinghamshire had passed through Aston and his family into many hands spread over north Nottinghamshire.

In 1641 there were two master hosiers in Nottingham, and it is probable the owners of frames in the north of the county brought their produce to that town for sale to these manufacturers and dealers. From this time the trade gradually spread through the adjoining counties of Derby and Leicester. The midland district, over which it has been located for ages, extends from Chesterfield in the north to Market Harborough in the south, and from Newark in the east, to Ashby-de-la-Zouch in the west, a space of seventy miles by forty-five in its greatest length and breadth.

From the time when the union of frame-work-knitters arose, the London hosiery trade disputes were constant; and the company's difficulties in enforcing their restrictions were becoming every year more pressing. But the manufacture increased at a distance from the metropolis as the result of its freedom, and there was a voluntary transfer of London hands to the counties. James Lee and Aston had long before begun to work on their improved machines, *worsted* (for which they were specially adapted) an article spun in the neighbourhood of Sherwood Forest, from wool grown there of the longest and finest staple in England, and

equal probably to any in Europe. Articles made from this yarn were strong enough to compete in wear with hand-knitted hose, which were made from extra twisted materials.

The London frame-work-knitters now put into their old twelve guages the additional sinkers and needles; and so making them 24 guage; which machines ever since have (with 26 guage) been called *altered* frames.

A master frame-work-knitter, named Pickard, whose family continued in the business so long as it was carried on to any extent in London, determined to teach the art to any one who would pay him, and so set the Company at defiance. He was also accused of making 'fraudulent' *i.e.* underfashioned goods; his silk hose were declared to be unsound, and his worsted hose deficient in the number of threads, and dyed with log-wood instead of madder. Such were the allegations with other more general reasons on which the company rested the application, which, by petition to Oliver Cromwell, they made to be incorporated by charter like other London trades; especially as he had just granted incorporation to the sewing-needle-makers, in 1656.

This application to Cromwell, together with a subsequent similar one to Charles II., were fraught with such important consequences to the trade as to require special notice.

It has not been ascertained where Deering obtained the copy of this petition, which he has given entire in the appendix to his *History*. He has laid his readers under obligation by inserting it. It is a very interesting document, from the insight it gives into the views our ancestors of that day took of manufactures and trade, as well as on account of the manly, though quaint, language in which it is couched. It is also valuable, because of the corroborative facts it embodies, respecting the origin of the business, whose interests the petitioners desired to serve, and of its usefulness and advantage to the commonwealth.

"*To His Highness the Lord Protector of the Commonwealth of England, Scotland, and Ireland.*

"The humble representation of the promoters and inventors of

the art and mystery or trade of frame-work knitting, or making of silk stockings or other work in a frame or engine,—Petitioners to your Highness, that they may be united and incorporated by Charter under the Great Seal of England—Whereby their just right to the invention may be preserved from foreigners, the trade advanced, abuses therein suppressed, the benefit to the Commonwealth by importation and exportation and otherwise, increased; and hundreds of poor families comfortably relieved by their several employments about the same, who will otherwise be exposed to ruin, having no other calling to live of.

"Their trade is properly stiled frame-work-knitting because it is direct and absolute knitwork in the stitches thereof, nothing different therein from the common way of knitting (not much more anciently for public use practised in this nation than this) but only in the number of needles, at an instant working in this more than in the other by an hundred for one; set in an engine or frame composed of above 2000 pieces of smith's, joiner's, and turner's work; after so artificial and exact a manner, that by the judgment of all beholders, it far excels in the ingenuity, curiosity, and subtilty of the invention and contexture, all other frames or instruments of manufacture in use in any known part of the world.

"And for the skill requisite to the use and manage thereof it well deserves (without usurpation as some others impertinently have) the titles of mystery and art, by reason of the great difficulty of learning and length of time necessary to attain a dextrous habit of right true and exquisite workmanship therein, which has preserved it hitherto (from the hands of foreigners) peculiar to the English nation, from whence it has extraction growth and breeding, unto that perfection it hath now arrived at. Not only able to serve your Highnesses dominions with the commodities it mercantably works, but also the neighboring countries round about, where it has gained so good repute that the vent thereof is now more foreign than domestic; and has drawn covetous eyes upon it, to undermine it here, and to transport it beyond the seas. Of whose swifter working to that pernicious end, these petitioners (as most interested) standing in the nearest fent, think themselves in the common duty of well affected persons to your Highness and their country (besides their own case of necessity) bound to make address unto the wisdom protection and care of your Highness (as their predecessors in former times have done to the rulers of this nation) speedily to restrain and suppress all attempts to bring so great a detriment and inconveniency upon the Commonwealth."

"Now so it is, and may it please your Highness, That the trade of frame-work-knitting was never known or practised here in England or any other place in the world before it was (about 50 years past) invented and found out by one William Lea (Lee) of Calverton in the County of Nottingham, gent., who by himself and such of his kindred and countrymen as he took unto him for servants, practised the same, many years, somewhat imperfectly in comparison of the exactness it is sithence brought into, by the endeavours of some of these petitioners. Yet even in the infancy thereof, it gained sufficient estimation of a business of so extraordinary a national profit and advantage, as to be invited over into France, upon allurements of great rewards

privilege and honor; not long before the sudden murder of the late French King Henry IV., unsuccessfully accepted by the said Mr. Lea (at that time wanting due encouragement at home) and transporting himself with nine workmen (his servants) with some friends into Roan (Rouen) there wrought to the great surprise of the French, so that the trade was in all likelihood to have been settled in that country for ever, had not the decease of the late King disappointed Mr. Lea of his expected grant of privilege, and the succeeding troubles of that kingdom delayed his renewed suit to that purpose, into discontentment and death at Paris, leaving his workmen at Roan to provide for themselves, seven of which returned back again into England with their frames, and here practised and improved their trade; under whom (or the master workmen risen under them) most of these petitioners had their breeding and served their apprenticeships. Of the other two which remained in France only one is yet surviving; but so far short of the perfection of his trade (as it is used here) that of him, or what can be done by him or his means, these petitioners are in no apprehension of fear, nor have not been (since then) endangered in foreign countries, by any that have served out their full time of apprenticeship here.

"But near about that time a Venetian ambassador gave £500 for a remnant of time of one Henry Mead, then an apprentice to this trade, and conveyed him with his frame from London to Venice, where although his work and the manner of it were awhile admired, and endeavoured to be imitated, yet as soon as necessity for reparation of his frame and instruments happened, for want of artificers experienced in such work there, and of ability in him to direct them, the work prospered not in his management; so that (his bought time of service having expired) affection to his native country brought him home again to England. After his departure the Venetians grew disheartened, and impatient of making vain trials, they sent his disordered frame, and some of their own imitation to be sold in London at very low valuation.

"And within very few years afterwards the trade was greatly endangered by one Abraham Jones, who having by underhand courses and insinuations (and not by servitude, &c. as an apprentice) gotten both the skilful mystery and practice thereof, did (contrary to the articles, which the rest of the company that had taken some jealous notice of him) pass himself with some more unto Amsterdam, and there taking unto him some Dutch, as servants, erected frames and wrought for the space of two or three years, until the infliction of the plague seized on him and his whole family and carried them all to the grave. His frames also (as things unprofitable to them, that could not find out their right use without an able teacher) were sent to London for sale at light rates.

"These preservations and escapes of this trade from transplantation into foreign countries, these petitioners do with thankfulness acknowledge and ascribe to have been brought to pass by the Divine Providence, limiting his bounties and administration whither he has been pleased to direct them. For it may well seem marvellous in human judgment how otherwise this trade should remain (notwithstanding all the covetous and envious attempts to the contrary practised for the space of forty years past) an art peculiar to only this our nation; and to the nimble spirits of the French, the fertile wits of the Italian, and

the industrious inclination of the Dutch, a concealed mystery unto this day."

The memorial proceeds to state that the manufacture of silk hose raises the value of the raw material six parts in seven, inverting the old proverb, "the stranger buys of the Englishman the case of the goose for a groat and sells him its tail for a shilling;" it may now be said, "the Englishman buys silk of the stranger for twenty marks, and sells it him again for an hundred pounds." Other paragraphs set forth the hands this trade indirectly employs, and assert the greater ability of the English to supply home demand and foreigners with stockings, *calceons*, waistcoats and many other things than they can be supplied elsewhere, and describe it as "an inexhaustible mine of rich and staple commodities wrought by this manufacture for the service of all the great, honourable, and better sort of the inhabitants of the whole commerciable world." They argue finally, that the objection against a machine which so greatly exceeds in its power of production that of knitting by hand, that it would seriously injure public interests by superseding that employment, is unsound, and they cite the case of pin-making by hand superseded by machinery and printing superseding copying by hand for all public and general purposes.

This petition seems to have accompanied a short written one, a copy of which is preserved in the state paper office, and in one part of it the petitioners pray "that His Highness will graciously cast his eye on the printed representation annexed." But there is no trace of any other representation than the above long petition, given entire by Deering, and a copy of which without names or date is in state paper office F. p. 277. At p. 279 is a copy of the order of reference 27th December, 1655, to the committee for trade; p. 281 to 284, is a report of the Lord Mayor and court of aldermen to the committee for trade as to the justice of the claims, &c. and confirming the statements of the petition of 23rd October, 1655; at p. 285 is the report of the committee for trade recommending (and proposing the scheme of) incorporation: this is signed "W. Wheeler," and dated "13th April, 1656.

Down to a very recent date this petition has been generally supposed to have remained unnoticed by Cromwell, and therefore that no charter was granted by him. Deering expresses this view, "For what reason I cannot tell they did not obtain it at that time." Blackner says Cromwell did not refuse; but Gardner, *Music and Friends* in 1835, says expressly that Cromwell granted them a charter. In this he stated the real fact. On this point the result of the researches of Mr. Woodcroft, made a few years ago, leaves no doubt. A copy of the letters patent of Oliver Cromwell, dated 13th June, 1657, incorporating the company of frame-work-knitters, and the act of the common council in that year regulating the binding of apprentices to members of that company passed in the same year 1657, were found deposited in the office of the town clerk of London. The charter contains the words "it being an English invention." It was enrolled in the city archives 13th July, 1657. Its tenor was referred to in a further petition dated 3rd December, 1658, from the frame-work-knitters of London, which asked for measures to prevent the export of frames. It was accompanied by an affidavit of two citizens, "that thirty to forty frames were about to be exported." An order in council was granted 14th June, 1659, forbidding the exportation of any frames and engines for knit-workers of silk stockings, and a third petition prayed for frames seized to be brought into the custom-house, London. The last has no date.

During the short interval which elapsed after the grant of the letters patent by the Protector, and the accession of Charles II., when all his acts were set aside, the company now established legally does not seem to have exercised any authority over the trade calling for notice; 400 out of the 650 frames then in England (a good many having been exported) were in London, chiefly in St. Luke's, Norton Folgate, and Shoreditch, of which three-fifths were employed on silk work, stockings, waistcoat-pieces in colours, trowser-pieces, striped and of stout ingrain dyed materials. Frames as yet had no sleys to steady the jacks, nor caster backs, but in 1670, Needham, a workman in London, placed two additional trucks on the sole bar. The needles had

before been soldered into brass, but were now cast in lead; the combs were formerly wedged in with counters and were very broad, the jacks long and heavy, and they still used treddles to move the sinkers: these were now all improved. In 1711 the caster back and hanging-bits were added by Hardy, also a London frame-work-knitter. Since then no improvements of the power or speed of the machine have been effected until the present century.

After Cromwell's death, the company lost no time in applying for a new charter, and obtained it. An abstract of the frame-work-knitters' charter, then granted, will shew the powers on which they acted for the next hundred years: it is from G. Henson's unfinished *History of the Trade*, p. 79:—

"1. I, Charles (2d.), by the Grace of God, &c. having taken into consideration the petition of the frame-work-knitters of London, Westminster, England, and Wales, seeing that many deceits and abuses are made, to the ruin of their families by strangers and others, think it necessary to uphold the trade, for the general benefit of my subjects, as well as the frame-work-knitters, and as the frame-work-knitters are dispersed among other trade companies in London, and have not proper government for the management of their own.

"2. Being desirous of encouraging the manufacture, all persons having served seven years apprenticeship, and apprentices who shall hereafter serve seven years, and all others who may be admitted as follows, shall be one fellowship and body corporate and politic, by the name of master, wardens, assistants and society of the art and mystery of Frame-Work-Knitters of the kingdom of England and dominion of Wales; and shall have power to govern the said trade in the said kingdom, as herein directed; and they shall have in that name perpetual succession.

"3. The society shall have full right in that name to hold any property not exceeding £100 yearly.

"4. And shall have power in that name to sue and be sued at law.

"5. The said society shall have a common seal, which they may alter at their pleasure.

"6. The society or company shall consist of one master, two wardens, and fifteen or more assistants.

"7. John Croson shall be the first master, and shall continue in office until the Nativity of St. John the Baptist (24 June) 1664, upon taking the oath before a Master in Chancery, and the master shall be chosen annually from the two wardens.

"8. Jonathan Gramer and George Balderston shall be the first wardens; who shall continue in office till St. John's day, when the wardens shall be chosen annually from the assistants.

"9. John Lee, Thomas Phillips, Joseph Tomlinson, Richard Read, William Rigson, William Gramer, Gabriel Brewer, Samuel Knight, Francis East, J. Pagiter, jun., Samuel Tomon, Owen Lavender, John

Bennett, jun., F. Armstead, Thos. Stevenson, George Massie, Osmond Smith, Wm. Pickerne, and Thomas Ladd, to be assistants for life.

"10. The wardens and assistants shall choose a master on the feast day of St. John the Baptist in room of John Croson, who shall continue one year.

"11. The master, wardens, and assistants shall choose two wardens at the same feast to continue in office one year, but shall remain assistants when out of office.

"12. The master or wardens dying, there shall be a new election within fifteen days.

"13. Upon the death of an assistant, the master, wardens, and assistants shall supply the vacancy from the society.

"14. Any person of the society who shall be so nominated and refuse to serve shall be fined any sum not exceeding ten pounds, to be enforced by distress and sale of his goods.

"15. The society shall appoint a clerk of the company.

"16. John Hennis, gent., shall be clerk for life, all other clerks after his decease may be removed at the pleasure of the company.

"17. The master, wardens, and assistants, may make such laws and regulations as they think proper, for the government of the society, for the reformation of abuses, or preventing fraudulent work; and may inflict and levy fines by distress and sale or otherwise.

"18. Such laws, ordinances, &c. not to be repugnant to the laws of the realm, nor prejudicial to the customs of the City of London.

"19. The master, wardens, and assistants, shall choose a beadle; but Wm. Patrick shall be the first beadle, to serve only during pleasure, under the seal of the company; and shall have power to levy all fines by distress or otherwise.

"20. All mayors, sheriffs, bailiffs, constables, and officers, are commanded to assist the company according to the laws of the realm.

"21. The master, wardens, and assistants, shall from time to time, appoint two deputies from the society, under their common seal, to search in the day time, in the presence of a constable, any place, whether privileged or not, to try and prove whether all stockings or frame-work-knitted goods, be workmen-like wrought, and if found badly made, or of deceitful stuff, to cut the same in pieces; and to fine the parties making them, according to the bye-laws of the company.

"22. The master and wardens shall administer an oath to the deputies, that they will rightfully and faithfully perform their office as searchers.

"23. Such deputies shall be chosen yearly or oftener; and may be removed on just cause.

"24. The invention being purely English (natural born subjects as well as aliens, having by secret means endeavoured to take the art to foreign states, to the discouraging of the industrious subjects) no person, whether freeman or foreigner, denizen or alien, shall presume to carry or cause to be carried, any frames used for making silk stockings, or used in frame-work-knitting, beyond the seas, upon any pretence whatever.

"25. The master, warden, assistants or deputies, or any two of them, may seize such frames going to be exported, and may deposit the

same in the custody of a lawful officer, until due proof be made thereof before a justice of the peace, when it shall be forfeited; such conviction and judgment shall be within forty days, if within twenty miles from London; and six months, if further distant.

"26. One half the value of such forfeiture shall go to the company, the other to the exchequer.

"27. The master, wardens, &c. may search for fraudulent frames, fraudulent machines, and fraudulent goods.

"28. No person shall follow or use the trade of frame-work-knitting, unless they shall have served seven years apprenticeship, according to the custom of London.

"29. Every person using the art of frame-work-knitting within twenty miles of London, must enter the society in three months; and beyond twenty miles in six months; and take the necessary oaths, or forfeit £5 for every week they may neglect.

"30. Persons who are freemen of the City of London, or of any other company, are commanded to bind their children who are frame-work-knitters, to the members of the frame-work-knitters' company.

"31. The Lord Mayor of London is commanded to enrol this charter in the records of the common chamber of London, that they may become freemen.

"32. The master, wardens, and assistants may receive any person they think fit, upon taking the oaths, into their body.

"33. The master shall enforce the statute of the 5th Elizabeth, or any other statute as respects apprentices, and the occupations of the trade.

"34. The master, wardens, and assistants may appoint deputies in the districts where the manufacture is carried on, who shall have the same powers in their districts, as to the enforcing the bye-laws and statutes.

"35. Such deputies shall report under their hand and seal, an account of all their transactions as to money, &c. from time to time, to the company, and must render an account and pay the money yearly.

"36. The society shall pay yearly to the Exchequer four nobles, on the feast of our Lord God (25th December); and if not paid in forty days, shall forfeit 20*s*.

"37. All justices, custom-house officers, &c. are required to assist the company.

"38. This charter shall be taken in all courts of record, and construed most largely.

"39. The master, wardens, &c. must take the oath of allegiance.

"40. If the master, wardens, and assistants do not enrol this said charter before the clerk of the peace within six months, they shall forfeit £10, and so for every six month's default.

"By the King,
"HOWARD.
"Fine twenty marks.

"Signed 19th August (1663)
"in the 15th year of the King."

The body of frame-work-knitters never cordially acquiesced in the provisions of this charter. Nor was this at all surprising. Here twenty-four persons caused

themselves to be appointed for life, with power to name their successors; to make laws and enforce them by fines; to levy fees, and to dispose of fines and fees at their pleasure. And which was the most objectionable clause of all—causing in the end the limitation of their authority and influence within the narrow bounds of a London nominal hosiery trade company—they were empowered to choose their members from the body of citizens, whether frame-work-knitters or not. A corporation so composed, could neither sympathise duly with, nor long exercise authority over bodies of workmen dwelling in distant parts of the kingdom.

An adverse feeling to the company shewed itself in London, and still more in the country. The disputes continued as to the number of apprentices that might be taken. The Act, 5th of Elizabeth, was construed by country masters and magistrates not to include frame-work-knitters as weavers. The number of frames had increased in London, in 1695, to 1500: notwithstanding many having been sent over to Ireland, to which country the charter did not extend; and was, therefore, resorted to by those stocking-makers who were anxious to employ an unlimited number of apprentices. But Tyrconnel, the viceroy under James II., granted, in 1686-7, a charter embodying larger powers than the English one. The application for this was made at the instance of the London company, in order to strengthen their own position.

More than 400 frames had also been exported between 1670 and 1695, in spite of the company's efforts; amongst other places, to Paris, Orleans, Rennes, and Caen; Louvain, Tournay, and Valenciennes; Cordova, Seville, and Cadiz; Rome and Messina. The 7th and 8th of William III. fined persons £10 for removing frames without notice. All were ordered to be numbered; and if missing, or unaccounted for, the parties were exchequered. This legislation immediately caused the practice of exporting frames to cease.

The low price of admission to the freedom of the company, and its indiscriminate character, letting in persons merely desirous of the municipal and parliamentary vote, or of obtaining a position in the Guild,

produced in the first forty years of the operation of the charter, a marked change in the members constituting the Hall. The income was large from registration of apprentices, enrolling freemen, fines levied, and premiums on the sale of freedoms and livery. So, as they could hold only £100 a year, the company fell into expensive pomp and pageantries. A carriage for the master, gold lace liveries for beadles and attendants, a gilded barge, a large band of musicians, flags emblazoned with their arms, and finally, a new Hall erected in Redcross Street, in which to hold their courts and feast sumptuously, absorbed more than their income, and in time brought the company into debt. The fees levied to support this expenditure were enormous; and had the effect of rapidly increasing the business in the midland district, by sending the trade thither.

Of the frames built in Queen Anne's reign the principal parts of many still exist. They attest that the smiths had then arrived at great excellence in their art. Worsted hose were made of three, four, and five thread yarn, and in turned shapes, narrowed clocks and fancies. They produced also worsted breeches-pieces, and webs for waistcoats of varied colours and stripes. Gore clocks were silk hose with heels six or seven inches long; and by which the instep was made an inch narrower than in plain. The labour in making them was much increased; as also in making turned shapes and parti-coloured hose; all which kinds were for a long time fashionable. Very heavy plain and embroidered silk hose were much worn. The workmen gained on plain, 2*s.* 6*d.* to 3*s.* 6*d.* a day; and on embroidered, 3*s.* 6*d.* to 5*s.* a day. The average of the hands only worked about four days a week, as meat was 1½*d.* per pound, and bread 14*d.* a stone. The earnings throughout the trade were computed to average 10*s.* a week in the country, and 15*s.* in London. The number of frames in 1727 was 2,500 in the metropolis, and 5,500 in the provinces. In consequence of the expensive wars in Anne's reign, trade became inactive, and many stocking-makers were, for a time, unemployed. This season of privation naturally caused the journeymen, as well as the masters who adhered to the company's

bye-law of taking not more than three apprentices to one journeyman, to turn their attention to the unlimited number of apprentices now taken—ten or more to one journeyman. The company, upon an application made to them about 1710 to repress this practice, had declined to act; on which occasion, one Nicholson's frames were broken in London. The circumstance will be noticed when Luddist feats are subsequently described. One of the apprentices of that epoch, Hardy, was not only the inventor of the 'caster back' and 'hanging bit' during his apprenticeship, but was the first workman who "met the presser and passed over the arch at the same time." This he did while under age.

Upon this destruction of machines, two masters who infringed, Cartwright and Fellows, took their frames away from London to Nottingham; the former having twenty-three, and the latter forty-nine apprentices.

It was resolved at a general court of the company, held on the 7th of June, 1720, that as the renter warden had at that time £10,000 in his hands; and as it was expedient to remedy the evils arising from underselling of goods made by non-apprenticed hands in the country, a company should be formed to carry on the trade and defy all competition. A capital of two millions sterling was to be raised, in shares of £1000 to £10,000 from each subscriber, 25*s.* to be paid for each £1000 to reimburse charges. "Each of the eighteen assistants was to have his name put down for £1000, for which he was to pay nothing." Shortly after, they resolved that "all the undivided stock should be divided amongst the projectors without their paying deposits; and for which stock they should have receipts given in such names as they should nominate." Of the first £1800 received for shares, Pocklington, who projected the scheme, received two hundred guineas "for his invention and trouble," and warden Austin ten guineas "for his extraordinary trouble." Cash was advanced for goods received from any assistant. The seal of the company was affixed to these proceedings, by which, stocks in the hands of the members of the company were so much lightened, that wages rose in London, and at Godalming, Oldham, &c. For a time

bonds for £1000, on which £12. 10*s*. had been paid, sold for £15. 15*s*. Before long the question of legality was raised; and counsel advised that the chartered company required an Act of Parliament to enable them to trade as a Joint Stock Company. They nevertheless continued to do so for ten years. In 1730 the making of goods was discontinued by them. The accounts were audited, and the affair was ended by resolving "that the two million joint stock fund was attempted to be raised for the good of the chartered company, and that the balance remaining in the hands of the prime warden should, in future, belong to the company."

The £10,000 fund was expended in this manufacturing scheme, and the company became so impoverished, as to be obliged to borrow even the small sum of £50 on bond. Several such transactions are on record, as having occurred during the next half century, in some of which the plate and pictures of the society were transferred, at least for a time, as security.

To replenish their funds was no doubt a very pressing motive for the desire manifested to establish more firmly the power of the company in the country, and for this end, to put in force a duly authorised code of bye-laws.

Another important consideration impelled them to activity. The Chartered Company had for some time perceived that the trade had declined in London, and in consequence had held quarterly courts by their deputies; visiting Nottingham and other places for the purpose of admitting apprentices, levying fines, and admitting to the freedom of the company. At Nottingham, this court sat at the Feathers tavern; and at this time was instructed to put into strict operation the bye-laws and authority of the company; so as to put a stop to this tendency of the business to emigrate from London, if possible, and at all events, keep up the income of the company. The deputies therefore proceeded to levy a fine of £400 on Fellows, and one of £150 on Cartwright. These persons refused to pay any fines, when, as authorised by their bye-laws, their goods and frames were sold by the deputies and beadles of the company.

The justices and gentry generally of the midland

district had observed with disquietude, that the intention was to effect a two-fold and serious evil; to prevent the growth of the country manufacture, and so far as possible restore and confine it to London; and further, to withdraw a very large annual income from these parts. They very unwillingly convicted on these complaints, and were well satisfied when an action was brought for trespass by Cartwright, against the officers of the company, which was tried at Nottingham in 1728. It was then found, that the bye-laws had not received the assent of the chancellor or judges; as, to prevent the abuse by chartered corporations and companies of their powers, their bye-laws were required to be, by the 19th Henry VII. It was moreover urged, that the charter gave the company a legislative power, inconsistent with the constitution. The company said they acted on the 5th Elizabeth. To this it was replied, that frame-work-knitters were neither 'cloth workers,' nor 'weavers.' It was then contended that they were 'hosiers,' which brought them within the statute. To this it was rejoined, that frame-work-knitting was not a trade at the time of passing the 5th Elizabeth. After a long trial, a verdict was given for Cartwright. The effect of this trial was, for a time, to render the operations of the company nugatory outside of the twenty miles round London, and practically to restrict it to the city.

All power of interfering with the operations of the county masters being withdrawn, the number of apprentices became larger than ever. As an instance of the temptation to excess, by parishes offering £5 with each thus taken off their hands, and the under prices at which their work was performed; one man having a shop of frames in Brewhouse-yard, just outside the Borough jurisdiction of Nottingham, always had a staff of twenty-five apprentices, more or less, and never employed a journeyman for more than thirty years.

Another cause for an increase of the business in the country, at the expense of London stocking-makers, was a change in fashion. Gay colours and fancy patterns were gradually disused, and the merchants and hosiers in London began to find that they could obtain good

work at less prices in the country. Therefore they sent their orders for plain articles, more and more to Leicester and Nottingham; so that by 1750, there had been a diminution of frames in London to 1000, and in Surrey to 350; 800 having been sent down to Nottingham, and nearly as many to Leicester, and sold at a low price. The number in the former place had become 1500, 1000 in Leicester, and in Derby 200; elsewhere in the midland counties 7300; in other English and Scotch towns 1850, and in Ireland 800; total, 14,000.

It is to be remarked, that the first pair of cotton hose from yarn spun in India, four threads being used for the legs, and five for the heels, had been made in 1730 from a 20-gauge silk-frame in Nottingham. At first, the yarn spun from cotton wool was not of suitable quality for use in the hosiery frame; it was harsh, and two highly twisted to bend easily in forming loops. In proportion as its use grew to be important, from the greater magnitude of this trade, efforts were put forth with success, to make the exact article required.

The company shewed occasional signs of animation, by endeavouring to retain and exercise control over the operations of the country master stockingers. In 1734, they tried to enforce their claims to authority, and threatened legal proceedings; but the known invalidity of their bye-laws strengthened resistance, and deterred the company, for the present, from further attempts to sustain them; but decided them rather to construct carefully a new code, and to obtain for it the proper legal sanction.

They carried out this determination; and in 1745, the company made a new set of bye-laws, to which the signature of the chancellor was obtained; but which, in 1753, had the effect of entirely upsetting their authority to regulate the trade. They were as follows, viz.:

"1. The court of assistants shall yearly, on Midsummer day, choose out of the assistants, one master and two wardens.

"2. And at the same time choose three persons to audit the master and wardens' accounts.

"3. And may choose others to fill the office of master and wardens on their dying or being displaced within the year.

"4. The master and wardens shall, within one week, be sworn into their offices.

"5. The court shall as often as they think fit, admit such members as are free of the city and of the livery, to be assistants; upon refusing to serve, to forfeit £10.

"6. And may admit into the livery, so many of the members of the company as they may think fit, and every person so admitted refusing to come into the clothing (unless shewing reasonable excuse before the Lord Mayor or one of the aldermen) to forfeit £20.

"7. The court may elect two or more members to be their deputies, to rule and govern all persons exercising the trade of frame-work-knitting, according to the powers of the charter, within such district as may be assigned them apart from their habitations.

"8. The court may elect yearly, on the second Tuesday in April, two members as stewards, within forty miles of London, who shall provide a dinner on Midsummer day, for the master, wardens, and assistants, at their own charge, or forfeit £6; such dinner not to exceed the value of £12.

"9. The court may elect three members to be stewards, on Lord Mayor's day, who shall provide a dinner of the value of £21, according to a bill of fare to be presented to them, or shall pay their share of £7, or be fined £10. No person to be chosen steward who has served the office before.

"10. The court may choose a clerk.

"11. The court may choose a person, being a member, to be their clerk.

"12. The company shall have a chest with three locks for the custody of their treasure; the keys of which shall be kept by the master and two wardens.

"13. Four quarterly courts shall be held every year, for every member that will attend, to hear the ordinances read. The court of assistants shall attend, as often as required by the master and wardens, to transact the business of the company. Every member neglecting to appear, to forfeit for the first offence 1*s*., the second 2*s*., and for every other default 5*s*.

"14. It shall be lawful for the master and wardens, or any two of them, with two or more assistants, and also for their sworn deputies, four times in every year or oftener, in the presence of a constable, to enter into shops, &c. to view, search, and prove all frame-work-knitted goods, *frames*, &c.; and if found defective, to seize the same, and produce them at their hall of meeting on their next court day; to be fined at the discretion of the court, not exceeding 10*s*. Every person obstructing the master, &c. to be fined £5. The master on searching any house may demand 4*d*.; any person refusing to pay, to forfeit 3*s*. 4*d*.

"15. No member to hire frames, but of such as are members, on pain of paying 1*s*. per week for every frame.

"16. No member shall teach and instruct any person in the art of frame-work-knitting, other than his male child, or children, or apprentices, unless bound according to the ordinances of the company, upon forfeiture of £50 for every offence.

"17. No member shall retain an apprentice until, for trial of his skill, he shall have wrought in the presence of the master and wardens,

or some persons appointed by them, a pair of silk stockings, and upon finishing thereof, if approved, he shall be allowed as a work-house keeper, upon pain of forfeiting £5.

"18. No person shall exercise the trade of frame-work-knitting, unless he shall have served seven years' apprenticeship, and shall first be admitted a member of the company; and neglecting to be a member for three months, to forfeit 30*s.* for every neglect.

"19. No person shall employ an alien or foreigner, under penalty of £10 for every offence.

"20. Every member residing within forty miles of London, who shall be minded to take an apprentice, shall present him within one month at the hall; or, if at a greater distance, to the deputies, to be bound by the clerk of the company, on pain of forfeiting 40*s.* Any member, free of the City of London, who shall cause an intended apprentice to be bound to a freeman of any other company, shall forfeit £5.

"21. No member shall turn over his apprentice, without license of the master and wardens, on pain of forfeiting 40*s.* for every offence.

"22. No journeyman shall depart his service, without a month's warning, except for non-payment of wages, or by mutual agreement; and no master shall turn away such journeyman, without the like warning, and paying him what shall be due to him, under a penalty of £5.

"23. No journeyman shall work with any, but such as are members of the company, under a penalty of 20*s.*

"24. No master shall set any person on work but such as are members, except his male children or apprentices, under a penalty of £5.

"25. The master and wardens within forty days after quitting office, to bring in their accounts to the auditors.

"26. The master and wardens, or any person appointed by them, shall receive of every member using the trade as a master, 6*d.* per quarter; and from every journeyman 3*d.* per quarter. Every member refusing to pay the same when demanded, to forfeit 6*s.* 8*d.*

"27. Every member shall contribute proportionably to the necessary expences of the company, upon pain of paying double what he shall be rated at for that purpose.

"28. Every member free of the City of London, who shall neglect to enrol his apprentice before the chamberlain, within one year after the binding, shall pay 20*s.*

"29. Widows, on being admitted members, may exercise the trade during widowhood.

"30. The court of assistants may moderate, or wholly remit, any penalties, provided such persons pay such sum, without suit at law.

"31. All fines and penalties to be sued for in the name of the company, by action of debt, in any of His Majesty's Courts of Record.

"The following are fees paid to the company:

"Admittance 10*s.*, clerk 2*s.*, beadle 1*s.*, stamp 2*s.*, total 15*s.*

"Apprentice bound 3*s.*, stamp 3*s.*, clerk 2*s.*, beadle 1*s.*, total 9*s.*

"Work-house keeper's proof piece 3*s.*, clerk 2*s.*, beadle 1*s.*, total 6*s.*

"Apprentice turned over, 3*s.* 6*d.*"

The new bye-laws being duly legalized, the wardens, clerk, a full court of assistants, and beadle, came to Nottingham, and placed them before a large meeting which they had convened of the trade. After much discussion, a determination was come to, not to submit to them by the masters, and by the court to enforce them by law.

Petitions were in consequence sent to parliament from several parts, complaining of the arbitrary nature of these regulations. That from Nottingham complained:

"That certain of them were against all reason, and contrary to the general liberty of the subject, by the company levying taxes, to assist them in extending their jurisdiction all over the kingdom, with power to search premises of the frame-work-knitters; monopolizing the lending of frames for hire; and thus prejudicially affecting and oppressing the trade."

The petition from Godalming added:

"That if submitted to, the result would be, the decay of the manufacture, and to bring greater burdens on parishes."

These petitions contained the first direct reference to the practice now beginning, of letting out frames for hire, by owners of them not in the trade, and on which the fifteenth bye-law has a pointed bearing. This charge on the men was strenuously resisted for years afterwards, on the ground which has been taken ever since by its opponents, that it encouraged persons out of the trade to purchase frames, or cause them to be built, not because they were needed for the requisite supply of goods, but solely for the income to be derived from them as rent; and thus, by inevitable competition, overload the business with both machinery and hands to work it.

In connection with the extraordinary influx of apprentices into the business, another practice was introduced about this time which, by the mode in which it was carried into effect, has had a most pernicious influence on the character of a large part of the work-people, and as a necessary consequence, upon that of the trade. The apprentice was allowed so long a time to learn to work the stocking-frame, usually three to six months. As he grew in age, and required more sustenance, he had a certain stint, so many pairs of hose to make as his week's work, and all he earned beyond

was his own. This in itself was just and wise, both to himself a stimulus, and a remuneration for his board, &c. to his master. But he has for ages been allowed to work it very much when, and as he pleased, and he became too often the "shacking lounging stockinger."

To return. In consequence of the rigour with which the company did enforce them, the bye-laws being petitioned against, were referred with counter-petition of the company, to a select committee of the house of commons, who having possessed themselves of the books and papers of the company, and heard the complaints of the petitioners and other evidence, as also the replies of the company and their supporters, in defence of their proceedings, resolved, on the 13th of April, 1753, to report as follows:

"1st. That it is the opinion of this Committee, that the several persons employed in frame-work-knitting in the town of Nottingham, who have petitioned against the Company of Frame-Work-Knitters, have fully proved the allegations of their petition.

"2nd. That the petitioners from Surrey have fully proved the allegations in their petition.

"3rd. That it is the opinion of this Committee, that the bye-laws of the Company of Frame-Work-Knitters, incorporated by a charter, bearing date 19th August in the 15th year of the reign of Charles II., are injurious and vexatious to the manufacturers, and tend to the discouragement of industry, and to the decay of the said manufacture.

"4th. That it is the opinion of this Committee, that many of the said bye-laws are illegal, and contrary to the liberty of the subject.

"5th. That it is the opinion of this Committee, that the powers granted by the said charter are hurtful to the trade, and tend to a monopoly.

"6th. That it is the opinion of this Committee, that the carrying on vexatious prosecutions against any person, male or female, for exercising the art and mystery of frame-work-knitting, is hurtful to the manufacturer, and destructive to the trade of the kingdom."

On 19th April, 1753, a committee of the whole house agreed to the third resolution against the bye-laws, as injurious and vexatious to manufacturers, and discouraging industry and trade. The consideration of the fourth was postponed, and the fifth and sixth were agreed to and confirmed by the house. The effect of this vote of the house of commons was to deprive the company of all hope of legally enforcing their authority. They therefore abandoned the suits they had commenced,

and from this time ceased to exercise any real authority over the trade at large, merely existing as a London chartered body.

Throughout all these proceedings, legal and parliamentary, the masters and country gentlemen opposed, while the journeymen supported the company.

Trade corporations were for many ages very useful in fostering manufactures, and securing to those who embarked skill and capital in them, their due reward. They also by combining in large masses the otherwise powerless individuals employed in each kind of labour, gave to such bodies the opportunity for offering a united, and therefore strong expression of opinion, and of presenting to feudal power and despotic governments, a bold front on any question affecting the rights or interests of the manufacturer or the citizen. In these respects they had their useful sphere of operation, becoming as it were standing chambers of commerce. But they did not in process of time confine themselves to this. The natural tendency of exclusive privilege was to inert monopoly and confined efforts. They were as jealous of innovation in their method of manufacture, as of the intrusion of unauthorized labour. Prices for work and goods were maintained at an unnatural height, that heavy imposts might be laid on initiated members, to be expended on extravagance and shew. While, except under permission difficult to be obtained, a non-apprenticed person, one not regularly brought up to the trade, let his genius be ever so brilliant or his discoveries ever so important, might not practice his invention in it. Ingenious foreign inventors would naturally be subjected to still greater difficulties unless introduced under powerful counter protection.

One of the strongest arguments that has been brought forward at various times for the revived exercise of power to regulate the manufacture of hosiery under the privileges granted by this charter, as in 1778 and again in 1849, is that it would enable an effective guard to be maintained against spurious quality, whether in materials or work. But experience shews that almost the only laws which can be practically executed in trade are those directed against positive fraud. Even the rights of the

true inventor are difficult to ascertain, and often too expensive to be enforced. All restrictions, internal or external, upon the freedom of action in trade, must be very limited and exceptional in their operation to be beneficial or safe.

At this epoch, 1740 to 1750, the wages for making the common kinds of worsted hose were reduced very low; and many of the parish apprentices, ill managed, ill taught, and little cared for, were reduced almost to starvation. Idle and dissipated habits were the consequence, and became the precursors of general depreciation in the clothing and dwellings of the country frame-work-knitters. It is related "that there was often only one coat in a shop, which was worn by each in turn as he went out from its precincts; so that one Moss, a Northamptonshire master, refused to employ a man possessed of a good coat, declaring the best workmen were only to be found in ragged ones." This was quickly followed by the production of inferior goods; and to such an extent had the quality and use of English silk goods declined, and those made in France been imported, that Parliament in 1754 prohibited their introduction, avowedly because the balance of trade against us was become so large. For twenty years English workmen put 'PARIS' in the welts, that they might pass in sale for French.

The national rivalry was at length stirred up to such a point on this head, that frames of finer guages were constructed; and specially to meet in a proposed friendly contest between the two countries, a 38-guage silk-frame was constructed; one Joseph Stocks, the best workman in the English trade, being appointed to work it. Frequent examinations and consultations were held, that it might be kept in good working order. But, in the end, the London referees decided in favour of the French wrought hose.

The Spaniards had made gloves at Cordova from the stocking-frame; also mitts were now first made there, and in these articles the English imitated them. The fingers were all made with extra inlaid threads, and had perfect selvages. The thumbs and gussets were formed separately. These articles were ornamented on the backs,

and had eyelet-hole open-work fingers, produced by removing stitches from one needle to another. Rose leaves and other fancy objects were introduced of such elaborate workmanship, that journeymen were often paid 5*s*. or 6*s*. a pair for making them. And some workmen could make two pairs in a day.

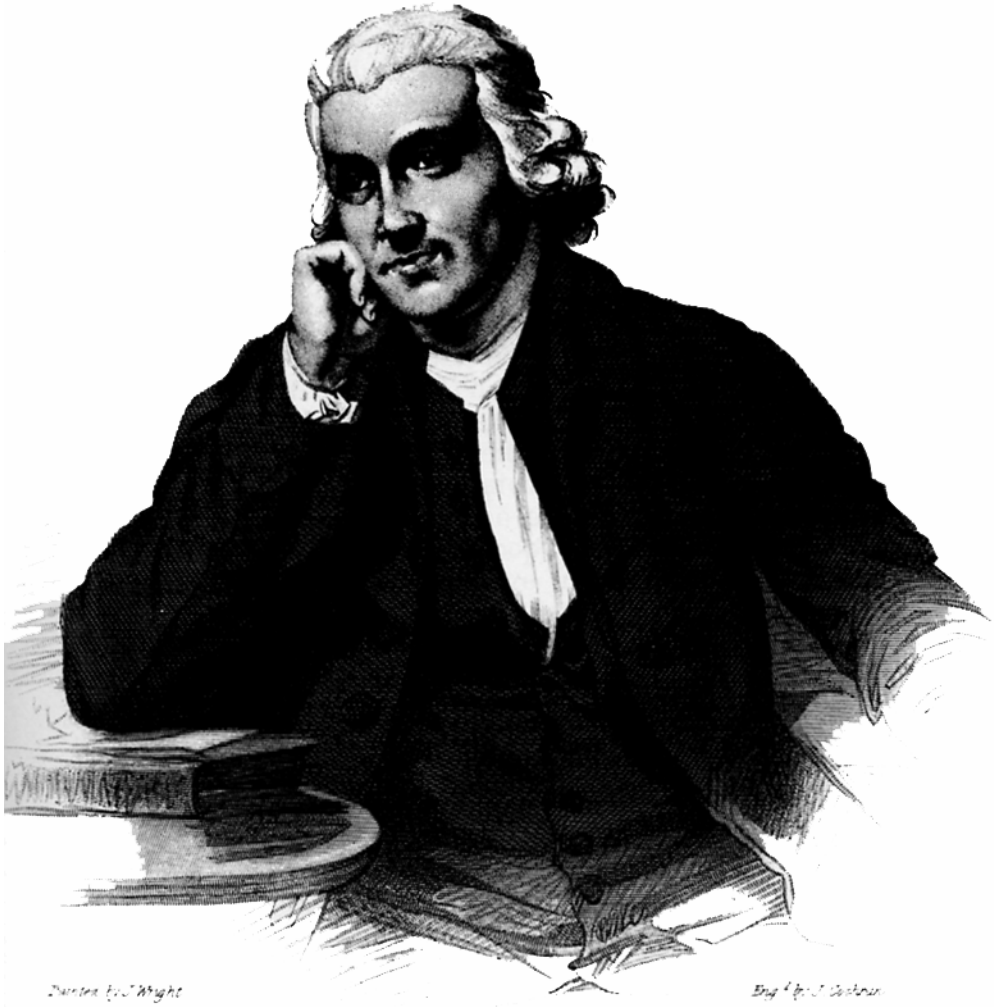
In 1750, there were fifty manufacturers, employers of 1200 frames, called 'putters out,' in Nottingham, all trading directly with London; 1800 frames were also thus employed in Leicestershire on woollen hose.

CHAPTER VI.

THE DERBY RIB HOSIERY-FRAME. MR. JEDEDIAH STRUTT.

THE manufactures of this country were still carried on in the middle of the last century at the homes of the work people usually, and in general on a very limited scale. Though the mercantile marine of England had been gradually extending its visits to distant shores from the time of Elizabeth, and returning with supplies of the products of foreign fields and looms and mines, yet in the main the demand for them was found amongst the upper and middle ranks of society. Very small stocks of wrought articles were kept any where except in cities and towns of note. The bulk of society relied for the supply of necessaries and even of things convenient upon the labour of their own hands in their various crafts, and so getting what they needed by interchange with their neighbours. Travelling even in the busiest parts of England was still slow, along difficult roads, and often not safe ones; therefore internal commerce was as yet advanced but little beyond its infancy.

Whether from the political freedom and security enjoyed during the previous half-century, which always stimulate where they are present the industry of those who by their benign influence enjoy a larger proportion of the results of their labours; or whether from the greater expansion of mind and the direction of its powers to useful purposes amongst the middle classes, arising from the study of the literature of the previous century, added to more extended intercourse with the continent of Europe, there was an undoubted movement upwards in society. Many most important changes were about to be introduced and discoveries and inventions made known, which however accidental some might seem, and none of them perhaps directly traceable to any general



Painted by J. Wright

Engd by J. Jackson

Jed. Strutt

cause, yet could not but have resulted from vigorous thought and well conceived design—themselves the symptoms of an improving age.

Thus new sources of supply of cotton wool, then only recently introduced into our raw materials for clothing, were opened up, and improved methods were adopted in the growth of sheep's wool. New machinery to spin both was at hand. The more general substitution of coal for wood as fuel soon followed. Fresh vigour with improved scientific resources were applied to our mines. Well formed roads managed by local turnpike trusts and canals excavated in every direction, gave new means of ready transit for materials and goods, while stage coaches and mails offered greater facilities for personal communication. When completed by the addition of steam, since become an all pervading agent in aid of labour, the last half century may be truly said to have magnificently inaugurated a new manufacturing system, which has issued in the enlarged capital, commerce, and enjoyment of the people generally.

Symptoms of desire to emerge from the small scale on which all productions beyond those necessary for food were cultivated, and the homely manner in which manufactured articles were wrought and enjoyed, were early manifested in the midland district, and on its northern borders in Lancashire and Yorkshire, where at that time the manufactures of cotton and woollen cloth were even more rudely carried on than that of hosiery in the counties of Leicester, Derby, and Nottingham, and not to a much greater extent. Indeed the latter town co-operated in some important degree in the early arrangements, which issued in the greatest of our textile manufactures—the cotton trade.

This state of things was an introduction to that long train of ingenious efforts which begun now to be made, in order primarily to improve the demand for hosiery, by modifications in the methods and kinds of its productions. The local developement of inventive skill had some relation, there can be little doubt, to the spirit of enterprize rising into activity all around. Here as elsewhere it was without pretension in the beginning, but very marvellous and unlooked for

in its results. The alterations and new constructions in hosiery and lace machinery had become before 1815 so numerous and intricate that Blackner, in his *History*, altogether declined the description of the then later important ones. Fifteen years after, Henson expressed his sense of the difficulty there is in giving numerous mechanical details, so as to be clear without becoming wearisome. Since his publication the duty has become doubly onerous. But the endeavour to compress will, it is hoped, be now so performed as to give the object of each new plan, and the mode of its accomplishment where necessary, with sufficient clearness, yet without drawing too largely upon the patience of the reader.

The first step in this course will be to describe the modification in the use of Lee's frame by the 'tuck-presser,' and the subsequent independent addition to it of Strutt's Derby ribbing machine.

No attempt, so far as is known from any existing record, had been made to add any machinery to the stocking-frame for the purpose of varying the face or appearance of the web it produced, until the earlier part of the eighteenth century. About the year 1740, an apparatus was applied to it for the production of a kind of fancy work in hose. By some this was said to be a French invention, alleging it to have been practised by Paris workmen under the direct inspection of Louis XIV., who they affirmed took great pleasure in the operations of the stocking-frame, and even knew how to work in it. But though not impossible, there does not seem to be any proof of this. Nor is it more certain that it was invented, as others said, in Dublin; though brought by an Irishman to Nottingham between 1740 and 1756. This addition to the stocking-frame was called a 'tuck presser.' A 'tuck' is the technical name for two or three loops accumulated on the same needle, in the process of making as many courses of loops by these not having passed regularly over the heads of the needles. To make such loops in regular lines or ribs down the hose, or in zigzag lozenges and other forms required, a second presser was needful to act in place of the ordinary one at the necessary intervals of courses, and on particular needles.

This tuck presser was a thin bar of iron attached to the frame presser, but so as to admit of its moving sideways to and fro, the space of one or more needles. Grooves were cut in its lower edge to admit the beards of needles under the grooves not receiving pressure, while others were pressed by the teeth, and their loops passed over the needle-heads, the non-pressed remaining behind until pressed over in the usual way. By using parti-coloured threads with this machine, not only would the looping be varied on the external face of the work, but a shaded variegated appearance was given to the stockings produced. This tuck presser has been applied since for other purposes.

It will be observed that by using the bar just described, an alteration was made in the operation of some of the needles at the pleasure of the workman, and a consequent variety in the looped fabric effected. This was a step in the right direction, and might have some effect in stimulating still further the attempts which had been made for some time by Roper, Bowman, and others, under great difficulties, to produce by machinery the ribbed hose, which the hand-knitters had long produced by reversing the formation of the stitches in straight lines and of various widths down the length of the hose. So great was the desire for the *fine ribbed* stockings that, previous to their being mechanically made, some which were made plain on the frame were ribbed by hand, the stitching allowed to run down through the length of the stocking, and then was looped up the reverse way by using a turning hook. One Wright, a frame-work-knitter of Ilkeston, is said to have thus hand-ribbed a pair of machine wrought hose, and sold them to a manufacturer for half-a-guinea—no great remuneration for so much labour.

The attempts to mechanically reverse the loops of the stocking-web, though unsuccessful, were much spoken of in the trade, particularly on the borders of Nottinghamshire and Derbyshire. Probably those of a frame-work-knitter or setter up, named Roper, living at Locko in that district, being somewhat notorious, were most prominently put forwards. He was a vain person, fond of company, amongst whom he was of self-indulgent

habits and apt to speak in high terms of his mechanical doings.

Mr. William Woollett was at that time, 1750, a hosier in Derby. His attention was directed to the question of how these ribbed hose could be made; and he brought it under the special notice of his brother-in-law, Mr. Jedediah Strutt, who, though an agriculturist had, he knew, been from his youth engaged in mechanical pursuits as an occupation of his mind and hands during leisure time. The reference thus made proved to be a most happy and successful one. The important results could not have been at first anticipated, nor even during the lifetime of Mr. Strutt were they fully understood. But they have been such as to have given him a just prominence amongst the inventors of that age, and to require the more extended personal account about to be given. The very simplicity of the plan he devised, and of the mode of its application to the machine of Lee, 170 years after its invention, added to the fact that no historian of the trade wrote during the next fifty years, preclude any minute detail of the obstacles he encountered. Such an account would be very interesting if it had been forthcoming. Great difficulties there must have been; for the constructive powers of mechanics in the stocking trade had not, a hundred years ago, been employed as they have been since; mainly as the effect of this effort of Strutt's genius.

Mr. Jedediah Strutt was the second son of Mr. Wm. Strutt, who, in the early part of the 18th century, was resident at South Normanton, near Alfreton, in Derbyshire; and also in the neighbouring parish of Blackwell, where he occupied lands as his ancestors had done for several generations, and where Jedediah was born in 1729. One branch of the family had occupied Newton Hall; another the old manor house near Blackwell church. He with his elder brother, Joseph, and younger brother William, received such an education as a country school of the better class could supply. Their father was chiefly anxious that they should obtain a sound practical knowledge of agriculture, in which pursuit they were engaged in their youth. Certainly the scholastic studies

of this, the most talented of the three brothers, seem to have been but slight preparatives for the mechanical skill and commercial position Jedediah Strutt eventually attained. Though unthought of by his father, it was through manufactures—by machines to be studied and improved, and by the anxieties and hazards of trade—and not by the more tranquil occupations of tilling and reaping the products of the soil, that his son was to lay the broad foundations on which have rested a superstructure of wealth, and honours, and fame. Jedediah Strutt inherited his father's tenacity of purpose and firmness of resolution. In everything else his mind, receiving but little external aid, took its own direction. He had an insatiable desire for the attainment of knowledge, and acquired for himself the elements of his intellectual character, becoming in thought, memory, and observation, a self-taught man. His thoughts took an eminently practical turn. While employing himself in the cultivation of the farm, his leisure was taken up with mechanical studies. When a boy he had constructed small mills to turn in the adjacent brook. Now he employed himself in improving a plough, or in discovering methods of subjecting the lever and the wheel to any motive power, to effect operations suggested by his fancy, or promising usefulness in their application. He seems to have acquired considerable knowledge of literature and science, though the district in which he lived presented few advantages for these enquiries. Such as there were, he diligently improved. So that Mr. Strutt became early distinguished for his enlightened mind and indefatigable efforts: giving to his inventive genius a new and efficient direction, leading at an early period of his life to the career which was unexpectedly opening before him.

On attaining manhood, the death of his uncle placed him in the farm at Blackwell; and in 1755 he married Miss Woollett of Derby, whose brother has been named above. This lady had a well cultivated mind; and in age, station, and all other respects, was well suited to him. The marriage was a happy one for both parties, and indirectly led to the important invention with which Mr. Strutt's name has been since so honourably associated.

It was now that he, by Mr. Woollett's representations of the difficulty and importance of the matter then occupying the frame-work-knitting world, was induced to make himself practically acquainted with the principles and movements of a stocking-frame; probably the most if not the only very complex machine he had ever seen; and this with the idea, no doubt at first but a remote one, of so dealing with it as to cause it to produce what hitherto had been thought to be beyond its powers. A clergyman had invented it, why should not a farmer increase its capacity for usefulness? After much labour, time, and expense, he succeeded admirably in this; by making an addition to it, or rather placing in front of it so as to work in unison and harmony with it, a distinct apparatus or 'machine'; thus between them to produce the ribbed web of looped fabric: and not, as popularly stated, by finding out the defects of Lee's frame, and devoting himself to its improvement. It is necessary to Lee's fame, as well as to Strutt's, that this should be correctly understood. Strutt left every part and movement of Lee's frame unaltered; so that when a ribbing apparatus is attached, if not put in separate action, Lee's frame may be worked, as it always has been, and produces perfect plain web: put both into co-operative action, and ribbed work is the result. Strutt's invention rests on a new and great principle; that which is at the back of the invention of Dawson's wheels, devised a quarter of a century after, and of Jacquard's apparatus, constructed a quarter of a century later still: the fact of applying external means for mechanically selecting and operating, independently of any or all others, on any individual thread or needle, lever or bar, at work in the machine, formerly only making plain web work; thereby giving power to produce fancy work of either a simple rib or spot, or the highest complexity in pattern of which woven fabrics are capable. The germ of this discovery had been hid in the selection by hand of warp threads in forming patterns on the old weaving-loom; this, its further development, was of inestimable value.

The apparatus added by Mr. Strutt consisted of an iron machine, hung on jointed arms in front of the ordinary frame. In this were

placed needles of like form with those at work already, but while the row in Lee's frame is set horizontally, these were placed nearly perpendicularly, and so as to enter between the horizontal ones. The number of needles fixed in the added machine, and their relative places on the extra bar, would correspond with the width of the ribs and number of loops to be reversed to form them. Thus, in one and one rib, *i.e.* one loop formed as usual and the next to be reversed, and so on across the frame—by which process the two sides or faces of the web appear alike—there will be as many needles in the added machine as there are reversed stitches to be formed, one facing every other loop. When all the old frame needles have had their loops pressed, which all face the usual way, the needles of the new machine are brought by its swinging action to enter between the old ones and penetrating the loop or loops to form the rib, and these loops being passed under their beards, they are in this operation reversed, and being also pressed again, pass over the needle heads with the other loops, but with the visible part of the ribbing loops turned the other way.

Ribbed goods are variously arranged as to width of reversed stripes. For the tops of socks, wristbands on shirts, and ancle bands on pantaloon drawers, the ribs are mostly one and one. In hose from round frames this is also a favourite rib. For many years, when men's stockings were not hidden by trowsers, ribs of wider stripes were fashionable in white cotton hose. Fancy coloured striped hose were long made on these frames.

Articles are now made more extensively every year of ribbed work in wide and narrow stripes of all colours, and of each kind of material, suitable for male and female use.

The principle of Strutt's Derby rib machine remains unaltered; its operation has been simplified, however, by its subordination to automatic movement, as will be at once seen on examination of power hosiery frames lately constructed.

By the close examination of Lee's frame, which Strutt must have made in order to become fully master of its construction, he would no doubt convince himself that there had been left but little to be done in the way of simplifying or shortening the ordinary movements of the frame. The knowledge he could not but obtain during his own investigations into the construction of the machine, of the efforts of others and their ill success, would cause his ideas to take new directions. In this respect it was probably no ground

for regret that he came to the work free from all prejudices of the frame-smith or the stocking-maker. The hints which, in common with all inventors, he might gather from theories and plans floating around him, were negative rather than positive; indicative of what was to be avoided, not shewing what was to be done. He came to the conclusion that it must be something added to that machinery which was already at work in the stocking-frame, and having devised the simple principle on which it must act, by a well ordered combination of parts and motions, accomplished his task. This required great genius and skill on the part of Mr. Strutt, and was followed in due time by an ample reward.

The apparatus applied by Strutt to the front of the machine, was necessarily, when in operation, the most prominent object about the frame. This fact had probably a most important bearing on the future history of the trades. An equivalent mechanical device has been since adapted to ribbed power frames, but so closely allied to them, and as it were hidden in its operations as to almost escape notice, and challenging no investigation on the part of the bystander. Had this been the plan originally adopted by Strutt, the idea of external individual action on the needles, might have long lain dormant. But when some hundreds and at length thousands of ribbed machines were spread over the three midland hosiery counties, shewing the mechanical selection of loops; and when every workman in a plain stocking-frame, by the hand use of a pointed wire, was constantly removing loops, and thus making eyelet holes in his web; the almost necessary result was a further development of the principle. This took place within a short time; for it lies as the basis of Morris's patents of 1763 and 1781. Eyelet hole ancles and insteps were thus made in ladies' hose. Under Crane's patent, 1768, looped nets were made; and Else, in 1770, made the 'pin-machine,'—both by added operations on the needles. This principle of control and selection, variously applied and modified, produced, in succession, the knotted, twilled, stump, mesh, and point net machines. In 1769, R. Frost, by means of a perforated square hollow roller, affecting the

operations of a sliding tickler machine, and thus the working of any hook or needle at pleasure, produced the first useful imitation by machinery of fancy lace. The warp machinery operates on every thread; it being all warp, and looped sideways, each thread with its neighbour; but it is equally subjected to command as to every needle in its wide horizontal range by machinery acting, if need be, on the principle of selection. Thus, in addition to a series of inventions in fancy hosiery which caused great increase in its machinery, the large pin, point and warp lace trades of Nottingham, Lyons, and Vienna, indirectly leading to the still more extensive bobbin net manufacture of this country and the continent, owe their origin to this invention. And it is gratifying to trace here briefly, what will occupy the reader's attention hereafter more at large—the history of a simple discovery pregnant with unlooked for yet immense national benefits.

Though much attached to Blackwell and its quiet pursuits, yet the patents which were taken out in 1758, No. 722, and in 1759, No. 734, to secure the invention just described for making ribs, rendered it more convenient and pleasant for Mr. Strutt to remove to Derby, where he could superintend the carrying out of his plans in conjunction with Mr. Woollett, now become his partner: so he took up his residence there immediately. By this change he was placed in frequent intercourse with minds congenial to his own. The hosiery manufactory carried on by the firm rapidly increased, especially in these patent articles called "Derby ribs" from the town where first made. They possess the peculiarity of great elasticity, and yet tendency to cling to the surface of the limb on which they are worn. From this circumstance, ribbed goods, whether hand or frame-work, have always been much liked. The demand for the hand-knitted ribbed hose was rather increased than otherwise, while that for machine-wrought was such as very soon to bring about infringements. These issued in two trials at Westminster. The first action was against associated hosiers in Derby; the second against a like combination at Nottingham—both ending in verdicts for the plaintiffs.

They afterwards enjoyed their rights in peace until the patents expired.

The partnership received an addition in Mr. Samuel Need of Nottingham; and the business was carried on under the firm of Need, Strutt, and Woollett, until towards the expiration of the patents in 1773.

Morris's patent of 1764, which will be fully described afterwards, was an infringement of Strutt's invention. They took no notice of it; nor of Crane's in 1768, also an infringement; nor of Else's in 1770, which was an infringement of both Strutt's and Morris's patents. Though they defended their rights against combined hosiers, who injured them by making ribbed hose without acknowledgement, they took no serious steps against either Morris or Crane or Else, who though in reality all infringing, were doing so by the use of Strutt's plan, but for making very different classes of goods; and therefore though not benefitting, yet not injuring them. Not so Morris; against his poor, though exceedingly clever co-partner in building the very machine of 1764, he put the law in force on account of Else's further improvement of 1788, ruined him, and then quietly used Else's patented modifications in his own machines.

A poor imitation producing what were called pack thread ribs and soon laid aside, was made by pressing one needle and missing one. This, however, led to the making of 'sankey' and 'bird's-eye' hose.

Mr. Strutt continued in the hosiery manufacture until his death dissolved the partnership with Mr. Woollett. The family finally retired from the trade in 1805, having disposed of their frames to Messrs. Paget and Byng, for £12. each on an average.

A train of circumstances apparently as fortuitous as those which had brought Mr. Jedediah Strutt into the hosiery manufacture, opened before him in 1771, and led him into the business of cotton spinning, which, so far as magnitude of operations and profits was in question, in process of time left those of the stocking manufacture in the back ground. His position as a large consumer of cotton yarn already might dispose his mind to entertain this new matter favourably.

Nottingham very narrowly missed on this occasion

being made the seat of the cotton manufacture, which, had steam power been then available, in all probability it would have become. Coal, iron, skilled artizans, and cheap labour were as abundantly at command there as in Lancashire. If Manchester had the advantage of proximity to Liverpool for its cotton wool, the eastern counties lying so near to Nottingham secured supplies of labourers and food. The demand for cotton yarn increased as rapidly for the manufacture of hosiery as for that of the weft in calicoes, the warps of which were for a long time of linen yarn. Nottingham and Derby therefore became large markets for cotton yarn, a circumstance that no doubt led Hargreaves and Arkwright to bring their immature spinning inventions to Nottingham for protection and pecuniary support. The latter, Arkwright obtained from Messrs. Wright the bankers of that place, who, not only on this but on several other occasions, have liberally shewn the interest they take in the progress of local manufactures, by rendering assistance to rising talent and merit. But the machinery not being perfected so soon as expected—and which, if successful, would evidently render the aid and supervision of capitalists and practical men of business necessary—they recommended Arkwright to apply to Messrs. Need and Strutt. After visiting his works already in operation in Nottingham and making a sufficient investigation, these gentlemen were satisfied that the invention itself was of extraordinary importance, and in 1771 entered into partnership with Arkwright, furnishing the capital necessary for its satisfactory development from the ample means afforded by profits in their hosiery trade. Need did not remain very long a partner in the cotton spinning business.

This patent for spinning yarn by the use of rollers was obtained in 1769, and was taken out in the name of "Richard Arkwright of Nottingham, clock-maker." This was also the year in which Watt secured a patent for his steam-engine.

The first cotton mill was erected at Nottingham, and was driven by horses. Up to this time things had not progressed satisfactorily in the practical working out of the invention. Arkwright met with unexpected diffi-

culties when enlarging his scale of operations, and it was fortunate for him that Strutt brought skill as well as money in aid of the affair at this its incipient stage. One such impediment had baffled and annoyed Arkwright for a time. The fibres of the cotton wool in being drawn through the rollers were very apt to "lick," *i.e.* stick to the upper roller and wrap round it, instead of the roving going forward to the spindle clear and uniform in size. On this being made known to Mr. Strutt, he at once had the top rollers rubbed with chalk and thus cured the evil. After his entering the business, which was soon transferred to near Cromford, the difficulties both pecuniary and mechanical quickly disappeared.

In 1775 the first of four splendid mills was erected at Belper on the Derwent, that stream furnishing an ample supply of power. The construction of this large building and its water-wheel, together with the machinery with which it was filled, called the mechanical science and inventive powers of Mr. Jedediah Strutt again into exercise. The building was destined to be the precursor of other factories; by means of which Belper, then a mere hamlet, has become the second town of the county. It has been well said, "that the record of Mr. Strutt's life, as of that of many other remarkable men and public benefactors, is to be found written in his works." This eminently successful partnership continued, though after several trials to sustain the patent rights, its ever enlarging affairs until 1781, when Arkwright retained Cromford, and Strutt the works at Belper and Milford.

Meantime, although yarn of excellent quality was spun by the patentees, the Lancashire calico weavers combined against its use; a course adopted partly from prejudice in favour of hand-spinners and their yarns; and partly by some supposed adverse interests of their own. No event in the history of manufactures ever transpired of wider influence, nor has any question arisen in regard to them, on the right solution of which have hung more weighty consequences. The cotton trade of the empire was then in the balance. Happily it found its natural and just settlement by the breaking up of the confederacy. Mr. Strutt suggested to Mr. Need,

still his partner at Derby, the possibility and advantage of weaving calicoes *all of cotton,* instead of using, as hitherto practised in Lancashire, linen warps. The attempt was successfully made in 1773, the warps receiving the necessary twist and preparation to resist the friction of weaving; and thus an article was produced less costly and for many purposes more suitable than the one the use of which it rapidly replaced. The jealous fears of the bulk of the manufacturers were excited; and they soon pointed out that by law the new article was subject to a *double* duty of 6*d.* per yard and to prohibition when printed, and in regard to either class they strenuously insisted on its being rigidly enforced. Strutt and Need had made a large quantity of the unmixed calicoes, and found it necessary to encounter the odium and expense of an application to the legislature for relief. This was granted, after a severe opposition, by an Act passed in 1774, specially applicable to this manufacture, repealing the prohibition and the discriminating duty, and declaring it to be "a lawful and laudable manufacture."

The machinery for weaving the calicoes was placed and worked at Derby, in the first fire-proof mill ever erected, having brick floors laid on brick arches. The building remains, but it is now used for other purposes. Derby long remained the chief centre of the commercial business of Mr. Strutt, Belper and Milford continuing the places of the yarn production, and in consequence of the relatively increasing importance of the latter in his affairs generally, he took up his abode at Milford house near Belper, a mansion of his own construction. He gave close personal superintendence to the business. The number of hands employed was great; systematic attention was paid to their health and comfort; and their education, intelligence, and morals were objects of Mr. Strutt's earnest solicitude.

In consequence of illness which supervened about 1795, Mr. Strutt returned to Derby; where, at Exeter house, he died in 1797, in his sixty-ninth year.

An outline of the more marked lineaments of Mr. Strutt's character, may be traced with considerable accuracy from the account above given of the principal

occurrences in his business life. An intellect singularly clear and cool, was combined in him with the faculty of devising inventions and improvements, which he carried into effect with unwearied energy of mind and purpose; impressing themselves on the entire conduct of his establishments as they increased in magnitude. His tenacity of principle and moral fortitude resulted from his confidence that his determinations were founded upon truth. His convictions in regard to general views of society were equally strong. His political and religious opinions were liberal, and adopted because he thought them sound and conducive to the happiness of mankind. Mr. Strutt had the satisfaction, denied to his great prototype Lee, of realizing a large reward for his ingenuity. He had the qualities of being a good mechanic, a clever man of business, and a patron of ingenuity in those around him. He saw with great satisfaction, while building up a princely income for his family, his own interests as a manufacture were directly contributive to the national advantage. Mr. Strutt seems to have been singularly devoid of ambition for worldly distinction; he was only ambitious of the blessing that follows duty done. To promote the welfare of his family, to encourage the trade of which he had been the founder, and to fill with honour the station to which his talents, energy, and integrity had raised him, were the objects at which he aimed. These he attained in an eminent degree.

The true estimate of Mr. Strutt as an inventor is that he fixed the starting point leading the way to an immense field of invention. This is thus expressed by Blackner:

> "Common justice demands of me to say that next to Mr. Lee himself, the country owes more to Mr. Strutt, than to any other man that ever engaged in the frame-work-knitting business; as from the application of his machine, the invention of every other which has been appended to the stocking-frame, has progressively emanated. From this slender but fortunate beginning of one industrious and ingenious man, have several most extensive fortunes been realized. What is still more honourable, the names of the Strutts, as patriots, stand second to none in the kingdom."

Some idea of the magnitude of the concerns of this family may be gathered from the circumstance, stated

by a respectable writer after visiting Milford and Belper, that on wishing to retire from the business about 1820, they proposed to any one who would purchase their works at a valuation, that they would allow the parties a bonus of £150,000. The extensive area over which the yarns of this, one of the two first great cotton spinning-houses, are sold and consumed, may be gathered from the fact, that from Moscow, amongst other merchandize on the road, lines of two-wheel carts each laden with its bales marked with the well-known brand of this firm, may be seen on their way to Novgorod fair; and from thence may be again passed on the route to Kiackta, the Russian frontier mart for the Chinese north-west provinces. Everywhere these marks on bale and bundle are accepted as the unfailing pledges of the integrity of the article in every respect. Equal, perhaps superior confidence is thus placed in the honour of the English makers and vendors of the goods, to the assurance given of their having been unrifled and unchanged in transit, by the imperial seals of Russia and China attached to them. When will the sentiments of honour and truth of an over competitive age be aroused to feel that the forgery of a trade mark is a flagrant robbery from the maker and imposition upon the buyer?

After the death of Mr. Jedediah Strutt, the business was carried on by his three sons, William, George, and Joseph. Some of the remarkable characteristics of the father have been perpetuated in his descendants. Having all of them been associated with Mr. Strutt in the conduct of the concern, they continued to manage it with progressive enterprise, intelligence, and success. They were also alike distinguished for literary taste and liberality of feeling.

Mr. William Strutt, the eldest son, inherited much of his father's mechanical genius. His self-acting mule was not, from some unknown cause, entirely successful. The first fire-proof building already named was built by him. He devised a system for thoroughly warming and ventilating large buildings: with improved methods of cooking, washing, and drying. Indeed he appears to have been devoted to scientific and literary pursuits.

His mansion was richly adorned by paintings and works of art. He was pre-eminent for zeal and liberality in promoting public improvements at Derby. Its institutions, especially the Infirmary, owe much of their excellence and usefulness to him. To these objects he devoted much time and money; and he was equally exemplary in private life. He died in 1830, aged 74, universally regretted, leaving an only son Edward, the present Lord Belper, who was born at Derby in 1801.

Mr. Joseph Strutt, the third son of Jedediah, resided at St. Peter's, Derby. This amiable man was a patron of literature and art. His urbanity of manners won the regard of every one who came in contact with him. His princely liberality endowed the town with the beautiful Arboretum, and helped to establish the Institute. His name is introduced here, that the noble words with which he concluded his opening address of the Arboretum, in 1840, may adorn these pages:

"If we wish to obtain the affections of others, we must manifest kindness and regard towards them. If we seek to wean them from debasing pursuits and brutalizing pleasures, we can only hope to do so by opening to them new sources of rational enjoyment. It is under this conviction that I dedicate these gardens to the public. As the sun has shone brightly on me through life, it would be ungrateful in me not to employ a portion of the fortune I possess in promoting the welfare of those amongst whom I live, and by whose industry I have been aided in its acquisition."

On Mr. George Strutt devolved much of the management of the business at Belper; and evidently imbued with his brother's sentiments, by his conduct he acquired in a remarkable degree the confidence of his workpeople. His son John seems to have inherited the like principles, judging from the following account—very characteristic of the considerate liberality of the successive members of the Strutt family, in their unwearied endeavours to secure the comforts and enjoyments of their workpeople. It is given by Gardiner, *Music and Friends*, vol. II., p. 512, after personal examination of the matter he describes. Being himself an enthusiastic lover of the Divine art, he gives it with his warmest approval, in the hope of its proving a stimulating example to other employers:

"John, the son of Mr. George Strutt, possessed refined musical taste, and rendered his neighbourhood as famous in that science, as any district in Germany. He formed a musical society of forty or more selected persons out of his mills and workshops, making a band of vocal and instrumental performers. They were regularly taught by masters; and whatever time was consumed in these studies, was reckoned in their working hours. When mustered, five or six forgemen in their leather aprons might be seen sending forth terrific notes on trombones or ophicleides. Soon after this music school was commenced, it was found the proficients were enticed away to commence as teachers of music. To remedy this, the members of the orchestra were bound to remain at the works seven years. The orchestral instruments and books, packed and placed on a pair of wheels formed a carriage, with an omnibus for performers, which could be moved to Derby or elsewhere, on public or charitable occasions. As an incentive to excellence, Mr. Strutt took occasionally half-a-dozen of the cleverest with him to London, to hear the finest singers and performers of the age. Solicitude for the happiness of their work-people and the population around, and for their social and moral advancement, has marked the conduct of the successive members of this family. They have become very wealthy; but people do not so much speak of the amount of their property, as of churches and institutes, chapels and schools, to the erection of which it is liberally devoted."

In closing an account of the second great inventor in the stocking manufacture, it seems almost impossible to avoid the thought, how strange are the contrasted events of human life; when one reflects on the melancholy fate of Lee; of Elizabeth's coldness; and his sad exile and lonely death: and then turning to the bright and usefully happy days; the long and tranquil career of Jedediah Strutt; to whom, in only the third generation, there follows in the person of Edward, Mr. Strutt's grandson, the member of the House of Commons, the minister, and at length the peer. It was in 1856 that Queen Victoria, as a mark of the interest she took in the manufacturing industry of the country, and having observed that "this important element of national wealth had not been suitably represented in the Upper House," expressed, through Lord Palmerston, her intention of conferring on Edward Strutt, Esq., of Kingston Hall, Nottinghamshire, the honour of the peerage. He paid a graceful compliment to the town of Belper, as the scene of the commercial enterprise and prosperity of his family, by adopting its name for his title. Few modern peerages have been better earned, or the bestowal of which have been more generally acceptable to the country.

CHAPTER VII.

MODIFICATIONS OF THE HOSIERY-MACHINE.—1760 TO 1800.

LEE'S stocking-frames had now been known and used in Spain for many years, and silk hose made upon them had been imported into France and England. About the year 1700 open work mitts and gloves, and hose ornamented with eyelet holes made by using the work needle or hand ticklers, and which had also been embroidered by hand, were imported into England. These were quickly imitated here, but still by hand. The introduction of Strutt's added machine led to many attempts to make these eyelet ornaments by machinery applied on the like principle. These efforts were generally carried on with much mystery, for the profit anticipated from success was very great, as the wages obtained by hands making such work were 5*s.* to 7*s.* a-day if diligent, at a time when meat was only 1½*d.* per lb. and bread in porportion.

Amongst those who were thus engaged was one Butterworth, a stocking-maker, living near Mansfield, who devised a plan which he was obliged to confide to Betts, a smith working in his neighbourhood, in order to carry it into effect by the construction of the necessary machinery. This was in fact a union of the principal parts and movements of the tuck presser and Derby rib to be added to the stocking-frame. By it the tuck presser brought the stitches which were to be shifted to the needle heads. These were removed to make the eyelet holes by short flat and pointed ticklers or points cast in leads and fastened to the tickler bar. They had two eyes at first and were brought in a parallel direction to the needle heads; and then when the stitches were on the ticklers, they had a side or shogging movement given to all of them, by which these stitches were placed

on the needles intended to receive them. From the history of this and several after inventions of this period, it will be seen how difficult it is sometimes to allot with perfect certainty the meed of credit and praise due to each respectively, who laboured in this field of constructive operations often for years in the nearest proximity to each other, and not unfrequently with the like end in view. To supply the money to complete this invention, was beyond Butterworth's means; through Betts it was obtained of Ferdinando Shaw also of Mansfield, and probably on the responsibility of Betts. The latter being fully possessed of the plan, and having an insight into its importance and value, threw Butterworth aside apparently without remuneration; and as Shaw became either unable or unwilling to furnish the further funds necessary to obtaining a patent for the invention, Betts made overtures to Mr. John Morris, a hosier of Nottingham, who accepted them; and with Betts and Shaw proceeded to London, where the patent was taken out in 1764, No. 807, in the names of Thomas and John Morris and of John and William Betts:

"For making by a machine to be fixed to a stocking-frame eyelet holes or *net work*, having an additional row of frame tickler needles."

In Shaw's absence, but while the three remained in London, it is related that Betts sold the entire interest in the patent to Morris. This information with what follows relating to Shaw was received by G. Henson from Roland, the inventor of the *double lap warp* method of making hosiery, who was born about 1750 and died in 1838. This person said he had worked for Shaw, and knew Betts and Morris well. Shaw having been promised his share of the profits to be realized under the patent, was so chagrined by the transfer to Morris without any remuneration to himself, that he proceeded to the Netherlands to set up the manufacture there. He visited the chief places where hosiery and lace manufactures were carried on—Brussels, Lisle, Tournay, and Valenciennes, but met with no encouragement. At the latter city he saw a widow making mitts and handkerchiefs in imitation of Spanish open work, by, to him, a

new method. A warp was framed in an upright position, the threads of which were made fast at the bottom. They were platted by hand and kept from unplatting by the insertion of pieces of thin wood whilst a new series were similarly platting. After about twenty-four of such layers had been made, the bottom end of the frame was withdrawn and the platted work fastened. Each layer produced a row of eyelet holes in the web. She was then making silk mitts with comparative ease and rapidity, and he found that they could be thus produced at a lower cost than the tickler mitts, the machinery for making which he was wishing to introduce. He brought the widow and her plan to Mansfield, and as the apparatus cost little, he soon made great progress in its use. But Morris, upon this, having the help of Else's inventive genius in improving his machinery, ruined Shaw by lowering the prices for his tickler-machine wrought goods; and in consequence part of these Netherlands wooden frames were sold to Mr. Fellows, of Nottingham, and part to Mr. White, of Chesterfield.

It is true that this statement about Shaw's wooden frames coming into Fellows' hands is altogether contradicted by another account, which is to the effect that two Swiss mechanics, after seeking in vain to dispose of such machines elsewhere, brought them to Nottingham and sold them to Mr. Fellows, who worked them near Weekday Cross, and is said to have obtained a patent for the plan, but this has not been ascertained. The peculiar mode of placing and using the warp threads here described, was so frequently adopted by those who many years after sought to find out methods for making platted lace by machinery with rapidity and at a moderate cost, as to lead to the saying that this machine opened the way in a more especial manner to the construction of lace machinery. But the course of invention which has yet to be described, as it is that most generally accepted, is also most natural and probable. The eyelet hole machine, by the facility with which the covering tickler could be used, was the first step really taken after Strutt towards making lace from the stocking-frame. A. Else, by getting rid of one eye in the form and use of these

ticklers, so improved them that this class of machinery has in consequence spread over every country where hosiery-frames are employed.

About the year 1770, Else and Harvey took the "pin" machine which they had constructed, from London to Nottingham. Haynes allowed Harvey £50. a-year, during Haynes' "point" patent, not to work Else and Harvey's invention.

It was extensively used in the latter place for some years afterwards for making lace, but from some unknown cause it ceased to be employed. Excepting that it is said to have had one crank pin to each needle, its construction, mode of operation, and the kind of article it then produced, have long been forgotten in England. But this machine was soon introduced into France, where, after a series of modifications, it became the prolific source of employment and wealth. The Convention gave a large sum to Rhambolt for getting this English frame; and it is from machines made on the principle of this, but considerably improved, that at Lyons the large production of the single and double silk net is obtained; as also the like articles now extensively manufactured in or near Vienna. These goods are known and used wherever lace is consumed. Harvey, when asked in 1812 to describe the pin-machine, could not; he had forgotten his own invention. Had there been a museum for the reception and conservation as well as public exhibition of machinery and its products in Nottingham—and such there ought to be in every seat of manufacturing industry—this and other now unused and forgotten ingenious combinations would be rendered available, not to gratify an idle curiosity, but for useful examination and reference. This has long been desired by the more considerate and fore-seeing amongst both inventors and experienced manufacturers. It would become an explanatory pendant of the best kind, to that increasingly useful institution in Nottingham—the local corporation patent office, should both ever become placed where the machines can be examined easily with the specifications and explanatory maps.

A patent was taken out by John Morris in 1781,

No. 1282, for an improvement on the patent of 1764; whereby the sinker loop was put across two needles making *point net;* these may be taken together as an invention almost equal to any brought out between 1760 and 1800 in these trades. Attempts were made to avoid the rights of the patentees. Some worked with hooks instead of points. Some placed them differently. The following case was curious as to the facts, and is often referred to as an important judicial statement of the law:

Upon the trial of a cause, Morris *v.* Branson, in 1778, before Lord Mansfield, for infringement of this 'tickler' patent, evidence was given that by the use of a telescope in the early morning from the upper hill of Nottingham Park, opposite to Branson's open shop-windows, the machine was seen at work. Upon proof being given of this fact, the wife of one Mayo swore *she* had invented the machine, and used it before the date of the patent; which statement was supported by her husband. It was also pleaded that the patent must be for, substantially and essentially, a new invention; whereas this was only for an addition. A juror pointed out that this objection would destroy every patent right. The jury found for the patentee, with £500 damages—a verdict in which Lord Mansfield acquiesced. The court held, that "to effect by machinery in any mode the working of a whole course or row of loops at once, that which, before Morris's patent was done loop by loop singly by hand, was an infringement of it." Branson took his frames out of the country, but was overtaken when in sight of the French coast. On submission and giving up the machines, the fine was remitted. Morris agreed that he would employ him on a rent for the machinery. Mayo on his way also to France was taken by a press gang, sent to sea, and not heard of again.

Now that modifications of the stocking-frame had begun, they were vigorously carried on. Else, assisted by a stocking-maker, Hammond, discarding the tuck presser, devised an apparatus regulating the tickler's operation on a sliding needle bar, and giving a side motion to remove the stitch by the tickler alone. This nearly doubled the speed over Morris's plan. It was on the use of this plan that the latter brought his action for infringement, which it certainly was, of Betts' (or Butterworth's) tickler. Why Morris bore so hard on Else is not known, as the former had the reputation of generosity in paying high wages for the making of his goods under the patent. It is worthy of notice that Morris took out his patent *for the work, as well as the machine.*

A figured lace-web was first made in 1769 by

Mr. Robert Frost, on a frame arranged by Thomas Taylor, of Nottingham.

A slide lever tickler was used to every needle, and those which are desired to operate, being pushed forward by a carved roller, on the principle of an organ or chime-barrel. This roller had projecting points on the surface, adjusted according to the requirements of the pattern; these pressed on pins at the ends of those tickler slides which were required, leaving those not wanted to remain at rest. There being one of these ticklers to each needle, any stitch in the course or row could be moved at pleasure, and any pattern produced."

In 1767 velvet pile web was made on the stocking-frame, under a patent taken out by Ross and Donetti, who produced the article chiefly in London and Edmonton.

The mode of procedure was to add a slack course to a stiff one; and a wire being passed through every second loop taken off by a tuck presser in the process of forming the row or course of loops across the frame, left long loops on the face of the work, which before the wire was drawn out were cut, and left a loose pile.

It was unsound, in consequence of the velvet pile drawing out, and its use was soon discontinued. Nevertheless Ross had a great sale for it at first; paid his workmen a shilling an hour wages, and retired with a competency, dying in London in 1786.

Josias Crane and J. P. Porter patented, in 1769, No. 940, "a machine in which is fixed a set of slides added to a stocking-frame." It was for shading, brocading, and flowering in gold, silver, &c. mitts, gloves, hoods, aprons, &c. in all shades of colour. It was a beautiful article, but required more than an ordinary share of ingenuity in the workman.

The needles were not cast into leads, but had small bits of iron affixed to them, and were placed in grooves on the needle bar, with a string fastened to each. There was a cylinder roller put into operation from behind the frame. A *drawboy* brought back the needles necessary to produce any given pattern, while the workman placed coloured or other threads of silk, &c. on those needles that remained.

Inlaid or shot brocade was afterwards made by means of added thread carriers and ticklers operating on different needles. (These thread carriers were destined to become most important additions to all looping frames). Thus most rich waistcoat-pieces were produced. But the cost, added to a change of fashion, laid them

aside. Crane gained little benefit from his invention, and died a poor man.

Having described this machine, Blackner, with the true prescience of an ingenious man, enquires, "might not the *drawboy* have been dispensed with, by pricking patterns on a cylinder like a tune on an organ-barrel to be turned by the foot?"

A person named Broadhurst, of Nottingham, reversed Frost's plan above described, by the following method:

The cylinder was placed in front of the frame, and had iron pins driven in upon its surface to form the pattern, with spring ticklers to press into the eyes of the needles, and the stitches were removed without touching the needles.

The fabrics made on this class of machines were of two kinds: one an opaque stocking web, and eyelet hole pattern; the other an eyelet hole ground, and figures of stocking fine looped web.

Not being of fast mesh and liable to break into large holes, the article went out of use here. Rhambolt took this machine also to France in 1785, where it continued in work for more than thirty years.

In 1771 Richard March and William Horton took out the patent, No. 991, for machine knitted or knotted hosiery; and in 1776, No. 1120, a patent was granted to W. Horton for knotted and double looped work. Under these patents most excellent and durable articles were made.

This was effected by replacing the long covering ticklers, using a short shouldered *point* to every needle. These points are passed into the loops, and by a clever side movement raise and place each loop on the next needle to that on which it was wrought. It thus becomes *knotted*. By turning the rack one way a given number of courses, and then turning it back a like number, a ribbed lustrous article is made; or if the rack is alternated every course, shaded work is produced.

The use of this kind of hosiery has varied greatly at different epochs. In 1795 the demand was supplied with difficulty by 1000 frames; ten years later not more than fifty were employed. They have since more than once become fashionable both at home and abroad. The great defect of knotted work is their coarse appearance, though made from thirty to thirty-four guage three-needle silk frames. The finest in the world was

a forty-six guage built by consul Le Brun (colleague with Napoleon Buonaparte) who established a manufactory for frame-work-knitting at Dordogne in France.

Mr. Wm. Horton was a native of Hinckley. On account of some youthful indiscretion, he removed to Chacomb, in Northamptonshire. He began life probably as a stocking-frame repairer and setter-up. It is certain that he very early acquired an intimate knowledge of the principle and working of the machine. The former he conceived to be perfect: but devising means of modifying the latter became the ruling passion of his long and useful life. Seeing a workman making the diamond in the hand of a glove by tucking or knotting it, the plan was suggested of making stockings wholly of knotted work. This task he accomplished ultimately, using John Lindley's tickler machine, in which every other loop was knotted; also imitating Else's plan, with a novel combination of other parts. Horton aimed at and succeeded in knotting every loop; thus making an elastic as well as sound fabric; it was knotted so fast that it would not run on the thread being broken.

His finances were low while constructing his frame, and he fell into an additional difficulty by the serious injury of a new ordinary stocking-frame, while taking it to its destination on the back of a pack horse. A friend assisted him with money: but his resources becoming exhausted, he went to live in London; and there finishing his newly invented frame, succeeded in gaining the confidence and co-operation of Mr. March, a hosier; it was patented as above stated.

Difficulties occurred in the perfect working of the frame. The patentees offered a reward of £20 for the remedy of a defect in the points. Peet, a master stocking-maker, devised a shoulder or elevation in their shape. When shewn to Horton, or to March, he exclaimed, "that is what I wanted"; applied the improvement, but merely gave Peet as his recompense employment on liberal terms. Betts, another workman of Horton's, was fortunate enough to still further improve the working of the points, and is said to have received £50 for his skill. Nevertheless the then well-known

Centlivre Stevenson, a Nottingham workman, also claimed the merit in this matter.

An impediment to safety in having to move the points half a needle in knotting, was removed by placing horns on each side the machine, so as to prevent it at that moment from moving at all. This was a masterly arrangement; but by whom devised is not known.

Horton built his machines in great part thirty inches wide; but two he constructed fifty-four inches in width. His workmen at Godalming were greatly excited at their size; called them Gog and Magog, and refused to work a web upon them of more than thirty-six inches in width. At length a giant in strength, one Whitehorn, worked Magog in its full width for twenty years; making fleecy great coats upon it, and driving it faster than ordinary hands could work frames of the usual width.

Mr. Hooley of Nottingham infringed upon this patent. When legal proceedings were threatened, he removed to Scotland and there established a rival manufacture.

Mr. Horton was a man of indefatigable industry; and though he had realised a handsome fortune, yet, at an advanced age, was still to be seen repairing or improving his frames, with all the assiduity of his younger days. He was as remarkable for the simplicity of his tastes and habits as venerable for his years. He lived to see the dawn of the day when the hosiery manufacture, by singularly unexpected developments in its machinery, was relieved from the deplorable dearth of employment and consequent miserable rate of wages, which during the latter half of his life, had so grievously reduced the condition of the greater portion of the hand-loom-workers in this trade.

An imitation of knotted work was made by William Brockley, a poor working man of Nottingham, in 1776. If made by one kind of operations they were called *twilled*, if by another *plated* goods.

He applied to his machine as many ticklers as there were needles. He used them in a new method, simple and ingenious, and when once seen, very obvious. He placed projecting arms or 'dogs' to cover the tickler or horizontal sliding bars, modifying the use of these latter instruments; he then made two or three courses of thread, one of them to be shogged one or two needles sideways according to the desired pattern.

By this method the web lost its looped appearance

and assumed a *twilled* face. By removing the twilled stitches to the right or left, a kind of stripe might be obtained. The article being non-elastic was after a time abandoned.

These twilled goods could be made with a silk face outside and a cotton one inside, by carrying a cotton thread at the back and the front thread of silk. They were then called *plated* hose, were of brilliant appearance, and came at a moderate price. So long as the back was made of a *double* cotton yarn, they would wear well; but when single yarn was introduced, the credit of plated goods rapidly declined, and the production became extinct.

This adaptation of hosiery machinery was the means of giving for years a large amount of employment to workmen, and by its use several manufacturers gained fortunes. It led also to several other important and useful modifications. But the genius of Brockley met with no corresponding reward. No generous remembrance of his past services to the trade reached his poverty-stricken dwelling; and he died at Nottingham in very humble circumstances.

Another of these ill-requited ingenious men was Mr. Robert Ash, a mechanic of Nottingham; who, in conjunction with Dalby of Leicester, about the year 1781, devised and patented, No. 1300, a method for making "a new kind of fastened platted work." This was a machine to produce a twilled fabric that should be properly elastic, and have the exact appearance of the knotted hose, by the use of Brockley's twilling machinery, to which he added a long and knobbed wire. This divided the work by a double tickler. The loops were twilled in a very complicated but ingenious manner, the discovery of which presented points of great difficulty. The complexity of the machine may have prevented its extensive use; thus rendering Ash one of the unfortunate inventors; yet its merits were such as to justify his claim to high credit as a mechanician.

The article made from it was plated as well as elastic; it was a close imitation of knotted twills, yet at less cost. But it was coarse in appearance, and was

in consequence chiefly exported to the West Indies and South America.

An improvement upon this plan of Ash's, was made by Samuel Hague, who, in 1790, was enabled to take out a patent, No. 1777, for it, "as a machine added to the stocking-frame."

It was for making elastic double knit goods, by placing an apparatus containing instead of the former wires others called stumps, cast into leads so that they operated over and parallel to each needle, and thus did away with the presser.

This was called stump work, &c., an elastic and eventually a *plated* fabric, known as the product of the "mesh" machine of Eaton, Green, and Hague. Hague appears to have sold his invention to Messrs. Watson's, of Nottingham, on condition of receiving over and above his charges for applying the necessary apparatus, two guineas as a bonus for each stump machine they should employ through him. On some disagreement, the frames were placed in other workmen's hands, and Hague lost his reward, which he asserted had previously been ill paid. This was not to be easily credited, considering the respectable position of the house in question, the smallness of the royalty, and beyond all, the peculiar characteristics and habits of the inventor, as narrated by G. Henson:

"There was living in Nottingham at this time" (1770 to 1790) "Mr. Samuel Hague, one of the ablest yet most improvident of men. He had received an excellent education; was by original trade a baker; but followed several other occupations, chiefly that of a schoolmaster, in which he has scarcely ever been equalled, notwithstanding his irregular habits. It is said, he could write at the same time with both hands; could solve problems in Arithmetic and Algebra without figures by mere rumination; even in his cups could rhyme extemporaneously, not in mere doggerel but in genuine poetry. He knew music and sung well; turning out in dark nights 'to raise the wind' by singing his own songs, and selling his auditors slips of old newspapers cut to resemble them put into print. But Hague was a great mechanic, and surpassed the greater part of his able contemporaries. By mere dint of genius he enabled himself to adjust the parts of machines and combine them, following the employment of a setter up for a considerable time. It was by the enlightened skill and perseverance of this versatile genius, that this elastic twilling machine was perfected."

Hague had attempted so early as 1777 to solve the problem of making twist bobbin net, but without success.

He used a horizontal warp, winding every other of its threads on a long wire, which wires and threads were made to pass over and under the remaining threads. But he could not pass them more than half round, and abandoned the attempt, never after renewing it.

He agreed, in connection with John Eaton, to take out a patent for the *mesh* machine, and having, amidst the vicissitudes of his changeful career, acquired some money, advanced it to Eaton for patent purposes. Eaton expended it in a most improper way, and returned from London without the patent. This so straitened Hague's circumstances that he never recovered from the loss, and died extremely poor.

These wire, stump, and mesh stockings were more elastic than the original twilled ones, and so acquired the name of *elastics*. On all these kinds and their imitations the hose are made *sideways*, *i.e.* the width of the frame gives the length of the stocking; the frame is therefore twenty-eight to thirty-four inches wide. At one time 300 frames were employed on elastic work; in 1830 they had dwindled down to fifty. For many years after these goods were first produced, they were much admired at home, and were also largely exported, especially to the West Indies. At length over-competition caused the hose to be reduced in size much below what they were called and sent out for; the markets rejected such attempts at deception, and finally the articles ceased to be ordered, and the manufacture was ruined.

In 1784 John Webbe, of Birmingham, with Captain Whittle, of the Oxford Blues, took out a patent, No. 1417, for a simplification of the Derby rib with a more easy and perfect division. There were at one time 300 of these machines worked at Banff, in Scotland, with great advantage. About 1790 Rhambolt took them to France, and many were constructed at Paris, being employed in the increasing hosiery trade of that city and elsewhere.

Articles fitted to the size and shape of the upper part of the body, and to be used next to the skin for vests, drawers, &c., whether hand-knitted or machine-wrought, have always been found conducive to the com-

fort and pleasure of the wearer. These have been made of animal wool on account of warmth, and cotton for economy in cost, and silk because of its useful electrical affinities. Bandaging of elastic hosiery web for surgical purposes has long been used. Such articles of hosiery to be made warm with fleecy insides in order to secure the ease and health of those who used them, and even to assist in the cure of some painful diseases, began to occupy the serious attention of Mr. George Holland, a hosier in London, some time before the year 1788. In that year he obtained a patent, No. 1670, for the manufacture of this class of goods, under the names of "Fleecy and Segovia hosiery, made from superior prepared wool for under-clothing. It is specially adapted for use by warmth, lightness, elasticity, and absorption—qualities which it possesses in an eminent degree, to prevent, or at least operate beneficially in many chronic complaints." He took out in 1790, No. 1738, and in 1782, No. 1901, patents for further improvements. By these Mr. Holland derived large pecuniary advantage.

This house long retained under his successors the celebrity justly earned by their skill and attention to the peculiar processes, necessary to insure the confidence of the medical profession and of consumers, in the hyginenic qualities of this manufacture. The fibres of wool are laid on the stems of the needles of the stocking-frame in front of the web, and of the loops before they are pressed over the needle-heads. They are by this means sufficiently incorporated with the inside of the web; and yet will allow of being combed out into the soft fleecy covering required.

In 1799 John Eaton patented, No. 2325, "a machine to be added to the hosiery-frame for producing elastic and stitch and plated hosiery." This seems to have been an unimportant change of the apparatus used for these purposes, combined with the common frame.

In 1800 Thomas Penn patented, No. 2427, an improved mode of sinking, locking, pressing, drawing back the needle-bar and keeping up the jacks in the stocking-frame. As the object professed to be sought in this invention could only be obtained by the entire modification of the working parts of the stocking-frame,

its not having been generally, if at all, adopted, shews that it was not approved. Nothing can now be known, except from the specification of its intrinsic value.

The above closes the list of patents for inventions up to its date used in the manufacture of hosiery by machinery. Many others were obtained during the last half of the 18th century for the production of lace, upon the stocking-frame modified. These will form the subject of the next chapter. The present one will be concluded by a brief description of the occurrences transpiring during that interval, amongst those who were engaged in the trade.

Notwithstanding the inventions by which the use of the stocking-frame was modified, the wages and profits realized upon the great bulk of the machinery in the trade from 1750 to 1780, were very slowly, partially, and indirectly benefitted by them. The trade still laboured under the constant influx of too many apprenticed boys and girls and non-freed workmen. This led in 1776-7, to the formation in the midland counties of a Stocking-makers' Association for Mutual Protection. This body became so powerful in Nottingham, as to influence, if not control, the return of members to Parliament in favour of their trade. Mr. Abel Smith was thus returned without opposition in 1778, when the members of this association marched in procession before his chair, which was gaily ornamented with the then newly invented white silk lace. Flags inscribed with mottoes indicating strength and unity were borne aloft, accompanied by two assistants, Mr. Reynolds, their clerk, and other deputies of the London Frame-Work-Knitters' incorporated Company. These had come down with Pilkington their counsel, who brought with him a pamphlet written to aid specially upon the occasion. This formerly authoritative body had another opportunity thus given them, of retreating from their coercive and unreasonable exactions, and by wise and timely measures, to have rendered themselves useful between the master hosiers and their discontented workmen. The novelty of high rents exacted for frames, with other charges, had not yet settled into a legalized custom; the best of the journeymen and wisest of the

masters might have been conciliated, and the operation of the charter revived; but the time was wasted in squabbles about fees, and the company lost almost its last hold on the trade.

Petitions were presented to Parliament by Daniel Parker Coke, Esq., M.P. for Derby, during the Session 1777-8, from the frame-work-knitters of London, and of the counties of Middlesex, Surrey, Nottingham, Leicester, Derby, Northampton, and Gloucester stating that—

> "The petitioners had served a regular apprenticeship to their business, but were unable with their utmost industry to obtain by their labour the common necessaries of life, by reason of low wages, frame rent, and other charges made upon them, incident to the working their frames and keeping them in repair—"

and asking for a Bill to settle and regulate their wages. This petition was referred to a select committee of the House of Commons, who reported in favour of a Bill to fix the rate of wages for each guage, size, and quality then made, being brought in. But this was refused upon a division, by fifty-two against twenty-seven. This Bill, if passed, would have been ineffectual, as it did not specify exact fineness in the kinds of work to be paid for.

The employers in the silk branch of the trade soon after sought to reduce the prices paid for work, 25 per cent., or 6*d.* to 10*d.* a pair; and great excitement was the immediate result. This induced other classes in Nottingham to subscribe in aid of resisting this reduction. Mr. Meadows, one of the members for Nottinghamshire, introduced another Bill in 1779, having the same objects as that of the previous year. This was strenuously supported by Mr. Robert Smith, (afterwards Lord Carrington), who said "the measure was moistened and saturated by the tears of the poor distressed families of frame-work-knitters." Leave was given to bring in the Bill with only one dissentient voice; it was so introduced, therefore, at once; and read a first time. The second reading was carried by twenty-four against twenty-three. But it was thrown out upon the third reading by a majority of fifty-seven to eighteen. Upon this great disappointment, riotous proceedings took place on the part of the workmen at Nottingham. Three

hundred of Need's frames were broken, houses sacked, the riot act read, and soldiers called out before quiet was restored.

The hosiers had formed a union of their own; and issued an address after the ferment had subsided, stating that they would oppose all regulations, whether by charter or acts of Parliament, as tending to drive the manufacture to France, where workmen were contented with low wages. These results were repeated in 1783, and again in 1787 and 1790.

Trade seems to have revived somewhat at the close of the war with our American colonies; and wages in the hosiery business were improved. The hands employed in making the usual plain cotton and worsted articles earned 10*s.* to 12*s.*; in silk, 10*s.* to 14*s.*; and those who were engaged in producing the goods from newly modified machines, as knots, twills, and elastics, could earn from 18*s.* to 30*s.* a week. Hose with long or eyelet hole clocks, increased the wages one-third above plain.

By an enumeration of the stocking-frames in 1782, they amounted, in the three kingdoms, to about 20,000. There were only 500 in London, 200 in Surrey, 650 in Tewkesbury, 300 in Northamptonshire, a few in Scotland, 700 in Dublin, and 300 in Cork. In the three midland counties there were found to be 17,350; and the business became from this epoch concentrated in Leicester, chiefly for woollen; Derby, for silk; and Nottingham, for cotton hosiery. The manufacture of hosiery in London was sustained on the very limited scale above indicated by theatrical and other bizarre orders for another half century. The last noticeable act of the London Company of Frame-Work-Knitters seems as strange as disrespectful to civic authority. In 1835 the corporation of London desired a sight of their letters patent, charter, and other records: but the requisition was peremptorily declined by the court of assistants.

From 1780, in consequence of the system of rent-charge for the use of stocking-frames having become fully established, the construction of new machinery proceeded very rapidly for the next thirty years. The

cost bore so small a proportion to the rent, as to induce many persons not in the trade to purchase them.

Mr. Gardiner, in *Music and Friends*, vol. II. p. 810, gives a few interesting notes in regard to the early history of the manufacture of hosiery in Leicester, derived from his uncle Coltman, who was engaged in it in 1768. He states that:

"One Allsop took a frame in 1670 to North Gate Street, Leicester, but from prejudice against *woven* stockings, he found difficulty in vending his own work. However he took J. Parker of Leicester as his apprentice; and in due time Parker took Samuel Wright a quaker for his apprentice. These are said to have been the only stocking-weavers in Leicester for some years. About 1700 the making worsted hose became a trade in Leicester. In 1750, when there were about 1000 frames in the town, the principal manufacturers were Mr. Lewin, Messrs. Barns, Chamberlain and Burgess, Messrs. Cradock and Burney, Mr. Thomas Pougher, Mr. Richard Garle, Sir Arthur Hazelrig, Mr. Joseph Cradock, Mr. John Williams, and Mr. William Miles. The chief articles made were white and brown thread hose; the white thread was imported from Silesia; the brown thread was obtained from Scotland. About 1000 dozen of worsted hose were made weekly for home consumption. The greater part of the dyeing and trimming of Leicester goods was done at Nottingham, where Elliott charged for dyeing hose black 3*s.* 6*d.* a dozen. The hose for the lower orders were at that time mostly of a pink colour; those for the higher ranks were pearl-coloured with scarlet ancle clocks, made long enough to reach to the top of the thigh and to turn down towards the leg."

The clever writer of this interesting work was a descendant of Thomas Gardiner, a Leicester bleacher, who first introduced the plan of whitening worsted hose by the fumes of sulphur. Thomas Gardiner, his son, born in 1743, was placed when young with Chamberlain and Burgess, then the greatest hosiers in Leicester.

"This house, and their fellow manufacturers, distributed their productions all over England, sending them on the backs of pack horses. William Gardiner, the author, was born in 1770; was apprenticed to, and afterwards in partnership with, Thomas, who died in 1837, aged ninety-four. They related, that in their earlier years every village had its wake; the lower orders lived in comparative ease and plenty, having right of common for pig and poultry and sometimes for a cow. The stocking-makers each had a garden, a barrel of home-brewed ale, a workday suit of clothes and one for Sundays, and plenty of leisure, seldom working more than three days a week. Moreover, music" (of which Mr. Gardiner was an enthusiastic and well-versed amateur, he says) "was much cultivated by some of them. Even so late as 1800 the larger part of all the frames in Leicestershire were the property of the master frame-work-knitters, not of the hosiers."

Although the statement that the Rev. Mr. Robinson, an inhabitant of Leicestershire, was the inventor of the stocking-frame, was not founded in fact, yet it was introduced very early into that county. It was taken in 1640 to Hinckley by one William Iliff; 150 years afterwards there were about 1000 frames at work there. It had become the centre of production for the coarser qualities of cotton and woollen hose, chiefly the former. Such it has remained through many vicissitudes to the present time. In 1844 there were 1750 frames, chiefly 20 and 22-guages earning the miserable pittance of 5*s.* 3*d.* a week. At the present time there are more frames than hands to work them, and the hands are receiving adequate wages.

The use of cotton yarn as a material for machine-wrought hosiery, was at first necessarily very limited from its high price, being imported from India, where it was spun into fine numbers of single thread, and if destined to be made into stockings it was doubled, trebled, and even made into four and five-fold yarn. This duplication of the number of threads caused the hose to be so costly that to shew the fact, the custom was established of putting as many eyelet holes in the welt as there were threads in the yarn, and the plan became universal whatever the materials might be. But after a time, when two threads only were used in cotton yarn, and at length one thread carefully twisted was found to be workable, the hands were directed still to make the greater number of eyelet holes, and thus so far to deceive the purchaser as to the quality of the hose in regard to their wear. A petition to parliament in 1765, from the masters and work people of Tewkesbury, where there were about 600 frames, set forth this fraud as a grievance requiring legislative redress. An act was in consequence passed for that purpose, but it was so worded as not to be of any effect. Hose made of two threads and of single yarn have ever since been made and marked with as many eyelet holes as the hosier has pleased. But stockings made of the two-thread yarn, now produced of far superior regularity and consequent strength, having three-thread heels and toes, have so much greater durability than those made from single yarn,

that as the cost of making them is alike, it is much to be regretted they cannot be more easily and with certainty discriminated by the buyer. The outcry of careful housewives when repairing fractures in their texture would be mitigated and the character of the hosiery trade better established.

It has been found by long observation and experience that the softness and pliability necessary to easy and safe working of cotton yarns in hosiery frames, by reason of the liability of harshness and irregularities to break the needles as well as to produce unsound work, is best secured by the use of South American (Pernambucca) cotton. Even with this as the raw material, hosiery yarn is the most difficult class to spin well. A long course of improvements have issued in fixing at Staley Bridge and Ashton-under-Lyne the larger part of this now very extensive and important business. From thence, Belper, and Cromford, hosiery yarn has long been distributed to all parts of the world where the manufacture of hosiery is carried on. Mr. J. R. Allen, hosier, of Nottingham, placed in the London Exhibition 1862, an interesting series of hose manufactured by his father and himself. Amongst them were stockings made in 1790, from five-thread cotton yarn spun by Arkwright, in the first cotton mill which was erected in Nottingham, and from two threads produced in Cromford Mill, spun successively in 1804, 1810, 1812, 1815, 1826. The advance towards excellence of quality in the materials, was clearly perceptible throughout. There were goods from "Lisle" thread made in the years 1848 to 1858, shewing great improvement also in the quality of the yarn. This "Lisle" or "Scotch" thread, as it is sometimes called, is higher twisted and prepared with special care for gloves and hose of a fine texture, the looping being clear and of great regularity.

CHAPTER VIII.

HAND MADE LACE.

It was by various modifications of the stocking-frame that lace was first made upon machinery. These changes were continued through the years intervening between 1760 and 1800. The business was established, and, as respects the hosiery manufacture, for the most part separately carried on from the former date; and this included a course of mechanical improvements down to the present time. It will be desirable at this point of separation, and for the better comprehension of the subject of lace, to state briefly the nature and previous history of that fabric itself; the latter, so far as can be gathered from the notices which have come down to us in ancient writings, and in the monumental representations of this kind of ornament, which have survived the ravages of time.

Dr. Johnson defines net-work to be "anything reticulated or decussated at equal distances with interstices between the intersections." This is a very correct, though not a popular explanation; happily the thing itself is sufficiently known so as not to require more than a description of the principal modes in which the work is performed. The varieties of net-work are almost infinite; the methods of production must be equally diversified.

Nature herself was the first to exemplify, and that in the most beautiful and perfect form, the learned Doctor's definition. Whether the first thought of lace as an ornament was derived from a plant cannot be known; but its most perfect forms have ever been obtained from leaves and flowers.

Mr. Ellis, in his work on Madagascar, thus describes that singularly interesting plant, the "Ouvirandra

Fenistralis," or "lace leaf," introduced by him into England. It may be seen at Kew Gardens and elsewhere:

"This is not only a very curious, but to the natives, a very valuable plant as an article of food. It is singularly beautiful both in structure and colour. From the several crowns of the branching root, growing often a foot or more deep in the water, a number of graceful leaves nine or ten inches long and two or three inches wide, spread out horizontally just beneath the surface of the water. The flower stalks rise from the centre of the leaves, and the branching forked flower is curious, but the structure of the leaf is peculiarly so, and seems like a living fibrous skeleton, rather than an entire leaf. The longitudinal fibres extend in curved lines along its entire length, and are united by thread-like fibres or veins, crossing them at right angles from side to side at a short distance from each other. The whole leaf looks as if composed of fine tendrils, wrought after a most regular pattern, so as to resemble a piece of bright green lace or open needlework. Each leaf rises from the crown on the root, like a short delicate looking fibre, pale green or yellow, gradually unfolding its feathery looking sides, and increasing its size as it spreads beneath the water. The leaves in the several stages of growth pass through almost every gradation of colour from a pale yellow to a dark olive green; becoming brown or even black before they finally decay; air bubbles of considerable size frequently appear under full formed and healthy leaves. It is scarcely possible to imagine any object of the kind more attractive and beautiful than a full-grown specimen of this plant, with its dark green leaves forming the limit of a circle two or three feet in diameter; and in the transparent water within that circle, presenting leaves in every stage of development both as to colour and size. Nor is it the least curious to notice, that these slender and fragile structures, apparently not more substantial than gossamer and flexible as a feather, still possess a tenacity and wiryness, which allows the delicate leaf to be raised by the hand to the surface without injury."

Natural objects of such graceful forms as those here described, and which abound in tropical regions, were the subjects of imitation in Eastern embroidery from the most ancient times; and needlework, if not the sister, must have been the mother of some of those kinds of fine net-work which were used as ornaments in female dress. In more modern times, and in Europe, this is known to have been the course of events; needlework lace preceded that made on the pillow.

But for many ornamental purposes the more simple method of making nets, such as were used in their every day life, would be employed in producing fringes and other large objects. The idea was so natural as to occur to any mind, above all a female one.

Making nets by the hand for fowling, hunting, and fishing, had been without doubt practised from the most ancient times. Such nets are represented on the monuments of Babylon, Nineveh, and Egypt. So universal was their use, that, literally or metaphorically, they are found as illustrations in the most ancient writings of every nation. The pages of the Old Testament furnish examples. Job says—"he is cast into a net by his own feet," "God hath compassed me with His net." There does not seem to have been any material alteration in the instrument used to produce these common articles, during the long intervening series of ages; or in the way in which the mesh was formed, knotted, and fastened.

The needle or shuttle, upon or in which the net-maker placed his supply of corded string or line, was passed just as it ever has been through the loop he had opened, and the thread was tied into a firm knot, incapable of slipping, at the exactly measured distance from the last formed one.

Almost as soon as these nets are named by any of these old authors, lace is mentioned; not only as a cord, but also as an ornamental part of dress. Lace may be described as plain or ornamented net-work, consisting of a thread or threads of flax, cotton, silk, gold, or silver; interwoven, drawn, platted, looped, or twisted so as to form a beautiful texture. Articles of female attire, depicted in paintings on the walls of Egyptian and Nubian temples and tombs, are believed to represent such net-works in looped or darned crochet, on patterned hems of garments. On one of the Egyptian pictures in the great temple of Ombos, the goddess Athos wears a head-dress resembling lace. Rosselini, in plate 41 of his great work on Egypt, shews two figures who appear to be twisting two threads, and forming what seems to be a reticulated open work. At p. 79, neck coverings are seen, but whether of twisted or drawn open net-work cannot be ascertained. But at p. 96 the ends of musical instruments are ornamented with netted tassels, each mesh having a nob or knot suspended from it. At pp. 98 and 99 are figured transparent dresses of females, ornamented seemingly

with beads, but whether on needle-work lace is uncertain. At p. 133 is a female figure whose shoulders are covered by a worked tippet of handsome appearance, the pattern of which might have been of drawn needle-work. Fringed borders were certainly applied to Egyptian articles of dress.

A lace of blue is thrice mentioned in Exodus, and was probably a fringed narrow lace or braid. Fringes are expressly named in Numbers and Deuteronomy; and *knotted* fringes became amongst that people through many ages of significant religious import. But whether the early Israelites made them of drawn needle-work for ornament, it is impossible to say with certainty. Beckman thinks these laces spoken of by Moses were merely cords or fringes of twined texture.

Needle-work and lace are much mixed up together in historic relations and descriptions. This is not surprising, seeing that all the lace produced before the middle of the 16th century, was either made by drawing the threads of fine cloth in various directions by the needle, and securing them so as to form meshes and figures composed of interstices and cloth-work, to which might be added embroidery; or by cutting the cloth ground and inserting braids of narrow breadths, woven or platted, to be used in forming figures, by being joined together at the points required by the pattern. It is possible also that the lace fringes might be made in those early times, as they have been extensively in the middle ages, by taking away the weft from the ends of cloth pieces or leaving the warp threads unwoven, and then platting them by hand into various meshes and geometric figures, leaving the loose unplatted ends of thread to form the fringe. Threads might be loosely inserted on the sides of any article, and netted and knotted in a similar way. In all this kind of work the needle and hook would be principally used.

The Greeks, in Homer's time, employed themselves not only in embroidery, for which they were famous, both as to their designs and colours, but also in fine needle-work for veils and head-dresses, and in net works. There is a marble statue of Diana at Portici, and

the goddess is represented as dressed in a purple garment edged with lace, an inch and a half broad, exactly resembling 'point' lace. The nearest approach to reticulated lace in Hope's *Costumes of the Ancients*, seems to be those figured on the borders of the dresses of Grecian females at pp. 103, 105, and 129, of vol. II.; most probably they are needle-wrought open works; and many of the patterns are so artistic and beautiful as to be worthy of study by our modern designers for manufactures. Phrygian embroidery was of surpassing excellence.

Writers who believe that reticulated lace was well known to the Greeks, assert that the custom of wearing it was introduced with other Hellenic fashions into Rome, that it soon spread over Italy as an article of female luxury, and that it became, in consequence, an important branch of Italian manufactures in the age of the Antonines.

It was customary for the earlier Christian females to wear veils during divine worship. But after the time of Titus, some Christian writers complain of the rule being evaded by ladies, vain of their charms, wearing a kind of net-work embroidered by the needle. This may probably be the origin of the modern lace veils. The Latin term 'Lacinia' dignifying a guard hem or fringes of a garment, from which our name 'lace' is derived, affords presumptive evidence that the Romans had articles of somewhat similar construction; yet netted-work like that in our military sashes was not known by them; they had no word for it. Their meshes were called 'maculae' and 'nodi.'

The practice of making the kinds of lace just described, spread over every part of Greece and Italy; the islands of the Ægean sea, Cyprus, Malta, and Sicily. It entered into Spain from the Mediterranean, and into France from Genoa, and into Germany from Venice. These two Italian cities were for many ages famous for the manufacture and exportation of their needle-work lace. Soon after the art reached the Flemings, and through them, it is thought, England. During the long middle ages of European feudalism, there was scarcely a castle where this needlework was not the

recreation of the ladies of the household; or a convent where the greater part of the inmates did not make it their lifelong and most assiduous employment. Almost all articles of dress for males and females, and especially the vestments of priests and coverings of altars, were adorned with lace of appropriate texture and designs. Sheets and pillow-cases were bordered with lace; and not seldom coverlits were themselves covered with networks of magnificent patterns and execution. Monks eagerly engaged in designing patterns for their sister recluses; in which pious recreation even Dunstan condescended to join. When the art of printing was discovered in Europe, such books of patterns were printed with the requisite instructions for lady workers in their fabrication of lace. English needle-work lace was preferred for a long time to that of the continent. A specimen of it still preserved, being the embroidered cope and manciple of St. Cuthbert in the chapter-house at Durham, is said to be beautiful beyond description. For the protection of this native industry, which was much cultivated under the Plantagenets—much fine work for the court and for tournaments being then made—acts were passed prohibiting the importation into England of laces of thread, and laces of gold, and of silk and gold, in 1483, 1 Richard III., c. 10; and again 19 Henry VII., c. 21, and 5 Elizabeth, c. 7. The importation of laces of each of these kinds, whether from Flanders, Spain, or England, into France, had become so large, that it became there also a ground of royal interference and prohibition.

Another class of needle-work lace was added to those already described. This was called *cut-work*, because the larger interstices were cut out with scissors from the muslin, and the edges secured by the darning-needle or crochet-stitch.

These various kinds of needle-work lace had reached a high degree of perfection in most European countries, when the art of making *pillow* lace was invented, about the middle of the 16th century. Some early writers asserted that it was discovered in Flanders, but by whom, and when, is not stated. After much laborious investigation bestowed by inquirers in after ages, it has

been almost universally attributed to Barbara, the wife of Christopher Uttmann; she was dwelling with her husband at the castle of St. Annaberg, on the borders of Saxony, and there invented the art in 1561.

"This is the unanimous affirmation of all annalists in that part of Saxony. And from the castle where she had taught it to the peasantry, as in a school, it soon spread amongst all the wives and daughters of the miners in that district, who found making this lace more productive than their former employment of embroidering veils according to the Italian practice, and soon supplanted them as an article of commerce." (See the *History of Annaberg*, by Paul Jenisco. Dresden, 1605.)

No traces of this mode of netting, twisting, or platting threads, drawn from spools or bobbins into lace, by passing them round pins upon a cushion, can be found used before this time, nor any terms appropriate to it; furnishing strong presumption that this was the time and place of the invention. Barbara Uttmann saw sixty-four of her children and grandchildren, and died in 1575, aged 60. That she was the true inventress is recorded on her tomb.

As an introduction to the more intricate and difficult operations necessary to the manufacture of ornamented hand lace; the art of making plain pillow lace may be thus described:

A number of threads are attached to a round pillow, each hanging down in front of the cushion, and being attached to a bobbin supplying it with thread and serving for a weight. Each pair of adjacent threads is then twisted three half turns, by throwing the bobbins over each other. The twisted threads are then severally separated, and crossed over pins stuck into the face of the cushion in a row. The like twist is then made by every pair of adjacent threads not before twisted, whence the threads become united sideways in meshes or loops. Lastly, by repeating the separation and twisting, and proceeding onwards, the plain net fabric is made of any required length.

This course of dealing with the threads on the part of the pillow lace worker in making plain reticulations or meshes, being carefully considered and well understood, will much assist the reader in comprehending the subsequent elaborate processes by which ornamented lace is produced.

To mechanise the fabrication of the plain meshes, constructing them as above described, was a wonderful effort of genius. To introduce mechanical ornamenta-

tion, has tasked to the utmost other and perhaps not less able minds. Every one of the crowd of inventors and modifiers of lace machinery have studied, with more or less assiduity, the additional methods of procedure about to be described. This cannot be more accurately done than by following the course explained in the *Encyclopœdia Francaise*, article "Dentelle":

"This is a work in gold, silver, silk, or linen; made upon a cushion by the use of a great number of small bobbins, a design traced upon paper, and two sorts of pins, and which may be looked upon as a composition of gauze, weaving, and embroidery. Of embroidery, because there are many 'points' and thick threads introduced; of weaving, for there are parts where there are proper warp and weft, and where the tissue is the same as that of the weaver; of gauze, because patterns are executed upon it, and the threads which might have been considered as being warp and weft, are often withdrawn from each other by crossings. Of three things, one is necessary, in making lace on the cushion. Either to compose or make it from one's own ideas, which supposes imagination, design, taste, knowledge of many 'points,' facility of employing them, and even invention of other meshes; or, to be able to work out a pattern given on paper; or, to copy a lace already made, given for the purpose, which supposes less talent, but a perfect knowledge of the art. It is then usually necessary to copy from designs pricked carefully on vellum. The art of the 'piquer' is to discern exactly the points where the pins must be placed, in order to keep out the threads in the proper position to form the designed meshes, &c.; to ascertain by careful examination all the 'points' needful to carry out the course of working; composed as it is, of sometimes intermingled points, and sometimes points succeeding each other. If a mesh be triangular, three pins would be necessary; if quadrangular, four; and one pin must also be placed in the centre to produce the opening required.

"The work-woman by counting the threads that need to be supplied, knows exactly the number of bobbins (fuseaux), 60, 80, 100, 150, 200, &c. which will be required; and each is filled sufficiently with thread. Placing a large pin on the cushion, and having fastened the threads of as many bobbins as she can attach to this pin, so that there shall not be any thread given off unnecessarily, she places and fills a second, third, fourth, &c. in a horizontal line with the first, till all are fixed that are necessary. The pattern is then placed behind the pins. It is not difficult to learn the mode of making any sort of mesh or point, if the threads, of which it is found to be composed, be each numbered as 1, 2, 3, 4, 5, 6, 7, 8, &c., if so many are used in it. Let these numbers be invariably considered as attached to the same threads and bobbins. Think of the first that goes from left to right or right to left as No. 1, the second as No. 2, and so on. Whenever a bobbin is displaced, consider it a new arrangement of the whole. Have paper at hand and write the positions down, in order to become perfectly acquainted with them; as 4 and 4, or 8 and 8, &c. until they are well arranged in the mind and understood. Thus a knowledge of the 'points' may be quickly obtained, and the habit of

plain meshes only was produced, and used as a ground for the application of ornamental work by the needle or hook, with which work many around were practically acquainted. But it is certain that before long cloth work, open work, thick threading, and other things necessary to give effect to a pattern, were introduced in the manner now universally employed in making pillow goods. This new mode of making lace speedily became known over the north of Europe; and the articles thus made came into so large a demand as to require many women to be taught the art. In Flanders the manufacture soon becoming thoroughly established, very large schools for children to learn lace making were set up; and in these, excellent goods both in design and execution have ever since been made in large quantities. Brussels Malines, Antwerp, Bruges, Valenciennes, and Ghent have been, and continue to be, justly celebrated for the variety and beauty of their respective kinds of lace. From some of these places articles were shewn in the recent International Exhibitions of almost priceless value.

The French applied themselves early to this manufacture; and Colbert in 1666 obtained the royal sanction to measures for its thorough settlement in Paris and the provinces. The Count de Nassau brought his nurse Dumont from Brussels; and as she perfectly understood lace making upon the pillow, he obtained for her the sole privilege of manufacturing the article. She taught more than 200 young women, many of them of good families, who soon made lace equal in quality to that imported. From thence the business spread almost throughout France. Of its variety, extent, and importance in value of products and numbers employed, an admirable account was given by M. Aubry, in his report to the International Jury, in 1851, upon the lace trade of France.

It is said this manufacture came to England from Flanders by the instrumentality of refugees who settled at Chalfont in Bedfordshire. This is uncertain; but not so, that we owe much to the endeavours made here to imitate the excellences of Flemish lace—the superiority of which still remains incontestible. In this, as in other

countries, it was thought necessary to teach children at too early an age. A school was set up for this purpose at Great Marlow in 1626; and about 1650 the cushion lace trade was flourishing in Buckinghamshire, from whence it extended into Northamptonshire. At Honiton there was early established the production of flowers and sprigs, in imitation of the bouquets and floral ornamentation common in one class of rich Brussels lace, and which were usually sewn upon a plain net of three-twist or platted ground. Shawls of this kind were sold for from twenty to one hundred guineas. These sprigs whether of Brussels or Honiton make are now ordinarily applied to a three-twist net wrought on the machine.

The earliest pillow lace made in this country, as shewn in the portraits painted by Vandyke, Lely, and Kneller, was Brussels 'point,' the net-work made of thread drawn off *bone* bobbins (the origin of the English name bone lace) upon the pillow; the pattern and sprigs embroidered by the needle. This was superseded about 1730 by the *Old Mechlin* ground and wire ground, both of which were very durable and of rich artistic designs. The *Trolly* ground came into fashion about 1750, wrought in coarse angular and ugly figures of the most vulgar taste possible. The re-introduction of the *Old French* ground, nearly the most ancient known, was a happy change; and it remained in partial use for about seventy years.

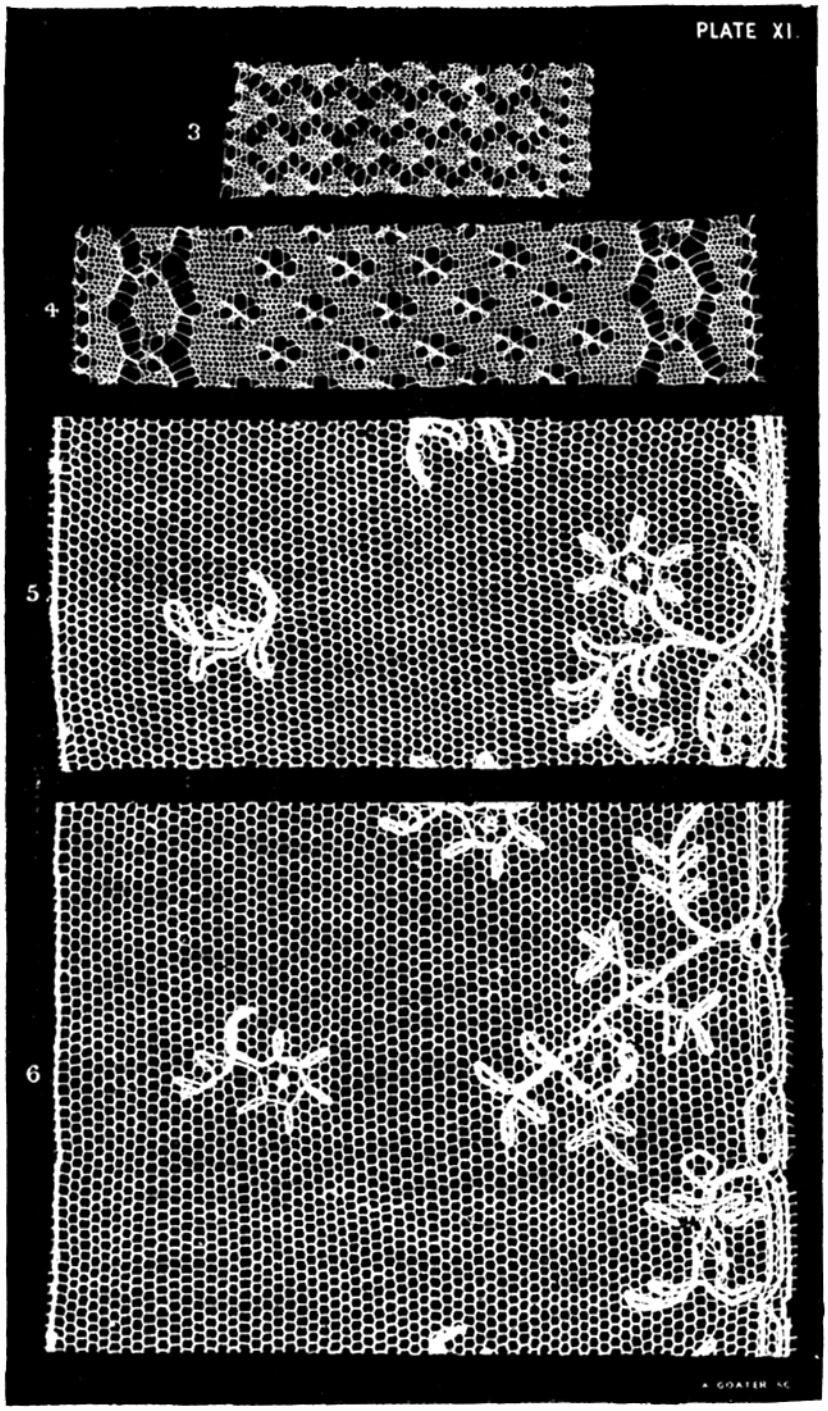
In 1777-8 a new article in the 'point' ground was brought from the Netherlands. From its first appearance may be dated the origin of the modern English pillow lace trade. The peculiar construction of the ground renders the article light and elegant. For the first twenty-five years the patterns of the English 'point' goods were poor and spiritless. Between 1800 and 1812 a change to a freer and bolder style took place, and the improvement and increase of the manufacture was unprecedented. The entire English cushion lace trade had so far extended in 1800 as to employ at least 150,000 hands. In 1830 it was stated by petition to Queen Adelaide that 120,000 persons were dependent upon the business. The numbers employed in France and Belgium, in making cushion lace, had been very

greatly reduced by revolution and war; in England by change of fashion, and in some degree by competition with machine made 'point' and 'warp' goods. But both here and on the continent a reaction has steadily set in; so that there are at present more persons employed in making pillow lace than at any former period of its history. With this increasing demand for the best hand made lace generally, special search has been carried on for *old* hand made lace of every kind. Thus a curious practice has arisen latterly. It had been the custom in some places on the coasts and in the islands of the Mediterranean in past ages, for the rich bridal lace robes and veils never to be re-worn, until the corpse of her who once before was adorned by them was re-clothed in them preparatory to her interment. Vaults have been rifled, and these precious and often magnificent articles, so eagerly sought after in the markets of Brussels, Paris, and London, have been brought into the hands of dealers, who know how to appreciate their worth, and, through them, add for ages to the charms of living beauty.

Whether regard be paid to the intricacy and delicacy of the work, the numbers employed upon it, its varied and extraordinary excellence, and ultimate commercial value, the subject of hand wrought lace is of great interest. A perusal of Mrs. Bury Palliser's splendid and exhaustive volume is conclusive upon this. The illustrative plates given by her are invaluable.

It has been thought necessary to enter thus far into the history of the manufacture of lace by hand, inasmuch as it is to imitate the productions of its fullest and last developement by the cushion, both in its meshes and ornamentation of the ground, that the thoughts and efforts of mechanical lace makers have been directed for the past half century.

PLATE XI.



CHAPTER IX.

LACE MAKING ON THE STOCKING-FRAME.

It is now necessary to trace the course whereby the productions of the intricate manual art described in the last chapter have been successfully imitated. Nearly every known mesh, certainly every useful one, has been mechanically produced, and into most of them elaborate and tasteful designs have been introduced, so that the articles made on the machine are often distinguished with difficulty from those made by hand. This has been necessarily a slow process and a very costly one. It was exactly a century ago, 1760 to 1770, that Crane, Else, and Harvey in London, Hammond, John Lindley, sen., Holmes, Robert Frost, in Nottingham, were engaged in efforts to make lace net upon the stocking-frame, as well as the fancy hosiery already described. These attempts were for a long time confined to this machine, seeking by alteration of its arrangements and suitable additions to it, to obtain the desired results. So far as plain nets were in question, they were in due time successful in producing *looped* articles of perfect regularity, and so highly appreciated as to lay the foundation for the present machine wrought lace manufacture, whether domestic or foreign. It was reserved for a much later epoch to witness the production by machinery of a net composed of twisted meshes like that from the pillow.

The twilling machine before named was amongst the first which were subjected to modifications for the purpose of obtaining different meshes and kinds of net. The interval between 1770 and 1780 was distinguished for experiments in the leisure hours of workmen at the fancy stocking-frame, in forming meshes by hand, which led eventually to many discoveries in the mode of

making them mechanically. Some of these newly invented kinds of lace at once took a position in the market, and for several years gave considerable employment to hands and machinery. In these the tickler-machine was made the chief instrument for the removal of loops and consequent formation of meshes. The '*spoon* tickler,' covering two needles and delivering the stitch on both, was probably invented by John Lindley, sen., and introduced by Thomas Taylor, a framesmith of Nottingham.

Hammond, who had added 'dogs' to this machine, was one of these workmen conversant with the meshing art, but who had so little application and self-government, as to render his knowledge of very uncertain practical use. Both himself and his wife were of intemperate habits. On one occasion in 1768, being together at a public-house in Nottingham without money, credit, or regular employment, Hammond cast his eye on the broad lace border of his wife's cap and a lace caul, and thought he could imitate the fabric. Having borrowed some silk, he went to work upon his frame at his home in the Rookery, and produced a net which with the assistance of his wife was made into caps having somewhat the appearance of lace, which he sold quickly. He called the article, though without any actual resemblance, '*Valenciennes* Lace.'

This net was produced by using a tickler to every other needle, and removing every other loop to the next needle but one; and the remaining loop to the second needle the other way in the next course. This was technically called 'cross stitch,' or 'wire ground *Brussels*.' He afterwards removed both stitches to the left two needles, and next course both stitches two needles to the right, thus forming what he termed 'double cross-stitch Valenciennes.'

On this mode of operating by the added machine, nets suitable for mitts, gloves, and purses were made. But it is difficult if not impossible to understand how anything beyond a net web of interstices formed with four irregular sides could be thus produced. It is certain that this was a step towards making looped lace net. But equally so, that to ascribe to Hammond, as is popularly done, the honour of producing by machine an imitation of cushion lace and of making Bobbin net, is

incorrect. His net was without a single characteristic of these articles. He was probably the first to make a net from the stocking-frame, though that is not quite certain.

His production was however very saleable, and he obtained by making it a precarious income, only labouring at irregular intervals, to supply the most pressing necessities, "working by day, and drinking by night; thus passed several years of the life of this original machine wrought lace manufacturer."

This year 1768 was also remarkable for the application of a kind of warp frame to the stocking-machine by Crane of Edmonton, where may be traced the origin of the warp machine, to which a subsequent chapter will be devoted. Also for the construction by Else and Harvey of the pin-machine, elsewhere referred to, upon the transmission of which to Nottingham in about 1770, a further important advance was made in the manufacture of lace net, and consequent employment of capital and labour there.

Each of these kinds of net it must be borne in mind were made by the looping of one continuous thread formed into meshes across the machine, and therefore liable on being broken to unrove, moreover at first the size of the mesh was irregular.

The meshes of cushion lace have three to six *equal* sides, usually the latter, and to exactly imitate such nets by machinery, was the object of much thought and effort.

An article called '*two plain* net' was made, by using one tickler for every third needle, leaving two needles plain in every course. Of the three stitches, one was removed to the second needle on the left, and of the two stitches remaining unmoved, in the next course the stitch was taken from the right-hand needle and delivered two needles to the right, upon the needle on which the former stitch had been placed. Thus a kind of hexagon mesh was produced. By moving a rack handle the loops could be removed at will, and patterns would be the result.

Shortly after some unknown person devised a great improvement by so removing some of the stitches as to leave large interstices like the open works in real lace. These have acquired the name of 'bullet holes'; and inasmuch as 'eyelet hole' hose had been subjected to embroidery, that obvious improvement was soon added by surrounding these large interstices with needlework.

This was the humble beginning of the vast business of lace *running*, in which, through subsequent lengthened periods, 150,000 females were employed in ornamenting lace net of various kinds as they successively appeared and flourished.

A stocking-maker, named Holmes, with the assistance of Mr. Robert Frost, invented this 'two plain' plan. The former was evidently an ingenious man, but died poor. The method was used from 1777; in 1790 there were more than 200 frames on with it; in 1817 one Wightman was the only person making it. It was carried into France, Spain, Italy, and Germany, and many frames were employed upon it abroad. Some have believed that *this* was the first lace-making-frame that was ever arranged.

The Robert Frost above spoken of, obtained in 1777 a patent for making an article called 'square net,' upon a machine whose arrangements and principal movements are founded on the Derby rib frame.

The net is formed by the use of the tuck presser and knotted points. In its first operation, the web was made having one needle looped and one not looped. The loop was knotted by being placed on the next needle on each side. In the next course the looping and knotting were reversed; the tuck being on the needle before looped. There was a further bar fixed to the added knotting-machine, having only a point to every other needle. It had an additional bar also to which horns were affixed. The point bar moved to and fro, so that the points might be applied to this or that needle without affecting the horns. The pressed stitches were then knotted on the unpressed ones both ways, the machine being used twice every course for that purpose. Thus by varying the presser and points one needle every course, square fast meshes were produced.

This net was very lustrous and durable; so that it was well adapted for mitts, gloves, purses, shawls, &c. Indeed it was strong enough to be used for the foundation of wigs. But it was costly in proportion. Not more than forty machines were employed in making it, and it is now almost forgotten. Attempts to make square net on knotted frames did not succeed till 1798.

According to Henson, the last person who made work on one of these frames was a frame-work-knitter in Spitalfields, who about 1834 produced square net for Mr. Thompson, of Phœnix street, London. The latter was called the father of all stocking-makers; for his

ancestor had been a journeyman to Mr. Lee, the inventor of the frame.

It may here be mentioned, that long after in 1808, a great improvement was made in the tuck presser by casting stumps with grooved ends into broad leads screwed on a moving slide on the presser. They acted as teeth in the pressing slide, and thus worked more safely.

'Flowered net' was obtained by leaving some parts plain in the shape of flowers, &c.

The ticklers were not cast into leads: but were made from thick wire beaten out broad at the bottom end, where, through a hole a wire was passed lengthwise like a spindle on to the tickler bar, and they were acted upon by a lever motion. Where the patterns required plain work, the ticklers which would have there acted were turned upwards by a roller, on which the patterns were set like tunes on an organ barrel.

This was said to be also the invention of Mr. Robert Frost.

'Spider net' was of a very slight texture, in which the figure of that insect or any other figure might be wrought. It continued in use but a few years, and no description of the machine on which it was made has survived it.

From the specific character, which may be easily traced through the various modifications applied to the machine added to the stocking-frame, and its modes of operation, it was almost inevitable that ingenuity applied by many minds should, even without concert, be successfully directed to some plan, whereby not only a perfectly regular six-sided mesh should be produced, but one so constructed as to be sound and durable as well as beautiful. This was accomplished by the construction of what became known as the 'point net' machine.

In this invention both Strutt's machine and Betts' modification of it were used: the top arms were moved from side to side; instead of machine needles perpendicularly acting between the frame needles, a new series of instruments were placed on the machine needle-bar, equal in number to the needles in the frame-bar. Each was in the form of a barleycorn, with its long blade (or point); the underside was made flat, and had two eyes to fit on the heads of two needles. The blades of these points or ticklers were thin enough to pass between the needles. The work was performed principally by two

operations. By the first, the thread passing round two loops made a series of arches; by the second, on the thread being removed from the base of these arches, another higher series of arches was made; and when the work quitted the needles, both series of arches took a straight line, and regular six-sided meshes were formed, which, when the net was stiffened, were equal in beauty to the meshes of *real* plain net. When wet or even damp, this net, however, as first made, shrunk into a fabric looking like crape.

The manner in which this mesh was first made, not constituting it a sound article, but one that, if the thread were broken, would cause the net to unloop and run into a hole, a *fast* stitch was effected by pressing the loops and forcing them over the needle-heads repeatedly through several intricate movements too difficult for description.

The manufacture of point net contributed more than any other to the prosperity of the trade of Nottingham up to 1815, when it gave place to the then lately established twist bobbin-net manufacture. There were various competitors for the honour of its discovery; it is probable all who are most frequently mentioned as experimenting at that time, may have contributed their share towards it. One Flint, a Nottingham journeyman stocking-maker, conceived the idea how this net could be made. His necessities so pressed upon him, that he sold the invention to Thomas Taylor the framesmith, his neighbour, for £20, who, with his son, was a good workman, and perfectly able to work out Flint's instructions, and add ideas of their own. Still they seem not to have been in a position to perfect the machine, and called in Morris, who completed the movements so as to turn off from the machine the single press article. His only reward, Blackner says, "was the satisfaction of an honourable mind, of having added to the stock of human benefits." Though some have asserted that Flint obtained the plan from John Lindley, his contemporaries generally agree that Flint was the real inventor; and his subsequent misfortunes and death in the poor house of St. Mary in Nottingham were the more deplored, seeing that he had so greatly benefitted the trade and town by the important invention of the 'point net' machine.

Taylor took out a patent in 1778, No. 1192, for this

invention; and sold it to Morris, the patentee of the eyelet-hole machine. The reason was assigned, but in error, that Taylor was afraid of infringing Strutt's patent. It is more likely that though the net was of unexampled regularity and beauty, its light texture and unsound make of mesh retarded its use. At length in 1786, John Rogers, of Mansfield, produced the double pressed fast point net of solid texture.

This Mr. Morris, to whom Taylor had sold his patent, soon after disposed of his entire manufacturing business to Messrs. John, Wm. and Thos. Hayne, of Ashbourne and Nottingham; and attached so little importance to the invention under notice, as to make a present of it to his successors. They, on looking into it, saw that it gave them a perfect mesh as to shape, and only needed the additional operations of Rogers just referred to, and a fast net would be secured, which might be cut in any direction without deranging or setting the loops at liberty. This was at once an ample reward for the perseverance and talent bestowed in perfecting the modification, as there was only entailed a loss by using it of one-third in the amount of the production, with a far larger addition to its value. Up to this time there were not more than 50 point frames, and those only twenty inches wide, in existence. The demand doubled yearly, until, in 1810, there were at least 1500 to 1800 employed in Nottingham, many of them thirty inches in width. These gave employment on the spot to 15,000 men, women, and children; besides some tens of thousands throughout the neighbouring counties, who were engaged in needle running and tambouring this net. Mr. Wm. Hayne first introduced the *splitting* of the *stitch*, instead of carrying the needle over and under the threads of the web. This gentleman had considerable abilities, of which he was vain. He often said, holding up his hands, "remember these fingers first run lace"; that is, first *rightly* embroidered it. His plan gave it a flattened smooth surface and increased effect.

These embroidered goods were from one inch to thirty inches in width of edgings, insertions, borderings, flouncings; also veils, scarfs, and every description of

articles suited to the varying fashions of the time. The principal point net manufacturers were W. and T. Hayne; Maltby and Brewitt; Wilson, Burnside, and Watson; and Robert and Thomas Frost.

Mr. Robert Frost sought to make point net by using a double row of pins, in place of Flint or Taylor's barleycorn points. The Messrs. Haynes proceeded to a trial against him at Nottingham, and gained a verdict. But from Frost still expressing a determination to get the patent set aside, on the ground that it had been improperly obtained, a compromise was entered into.

Mr. Thomas Frost, a brother of Robert, devised an ingenious but complex machine for making figured net of various kinds: partly formed of stocking loops, and partly of six-sided point net. He used his brother's cylinder tickler machine for looping and making lace when required, with additional length of thread. It produced a loose fabric, and therefore was little used.

Messrs. Haynes afterwards brought an action against Mr. Thomas Maltby. This person, who was of a respectable family at Hoveringham, near Nottingham, had for some time wrought in the stocking-frame; and his family furnished him with money to pursue the point net manufacture on a respectable scale. Upon Haynes attacking him as an infringer, it was found that Taylor had never enrolled his specification. Maltby therefore obtained a verdict setting aside the patent.

In consequence of the falling off of demand and to cheapen the article, it was made again of single press in 1811; and still further to lessen the cost of cotton point-net, single yarn was used. This completed the ruin of the manufacture in England. By 1815 the demand had entirely ceased here. Some machines had been wilfully destroyed on which the slight goods were made. Many others were taken from time to time to Leicester, where worsted webs of fine quality were made upon them. The last twenty-eight point lace frames ceased working and were sold in 1828. Six only of the workmen are now living; so that were there not a series still existing of patterns produced in this, for a long period, most important branch of the trade of Nottingham, the machines and their products with those

who employed and worked them, would very soon be all passed away. A point-net frame could not now be found, if one were desired, to be placed in a local museum of extinct machinery.

The author has had the opportunity of lately inspecting four such large pattern books filled with examples of white cotton, white silk, and black silk run and tambour worked lace, in about equal proportions. They are supposed to be of the manufacture carried on by the Haynes, and contain 11,930 specimens dating from 1797, presenting curious and very striking contrasts in regard to style and taste with the designs of the present day, though the net ground is as regular and perfect as machinery or hand has ever produced. There are rose trees with stems as straight and bare as a hop-pole, flowers without a curved line in them, perfect triangles; masses of cloth work with hideous Hindoo or Chinese configurations, without the slightest approach to a flowing line in leaf or bud or stalk. In a word, they prove the absence of all knowledge of the art of design in the machine lace trade of that time, although the amount of work put in never was greater, nor on the whole more conscientiously performed. On the side of taste the present lace manufacturers of Nottingham immeasurably surpass their predecessors of fifty years ago. Another later set of patterns worked on the same grounds, are of gradually improving forms and taste. They are believed to have been Maltby's, consisting of 5000 specimens; one volume of 2000 patterns, supposed to be Wilson's, contains some which are better still. These volumes, containing altogether about 22000 patterns, are preserved for reference at the School of Art, People's Hall, and Mechanic's Institute. Large and useful additions may be expected to be made to this collection from time to time.

In the *Society of Arts Transactions*, 1796, vol. XIV. p. 273, is a drawing with a minute description of a fishing-net machine constructed by Mr. J. W. Boswell, for which he received the Society's award of fifty guineas. The inventor knew the stocking-frame, and March's attempt to improve it. He uses beam, comb, sley, jacks and hooks, and produced by the use of a single thread

placed on a netting needle passing from side to side of the machine, a web of sixty-eight meshes across and eight feet wide, when stretched out. The piece presented to the Society was thirty yards long.

Loops were made after the manner of those on a stocking-frame; these being much enlarged, a thread was drawn through them by a hooked long wire, and thus formed a fast square net. The corners of each mesh consisted of the true fisherman's knot. The selvages also were perfect.

The mechanical construction of the machine is ingenious, though, judging from the description, complicated. It is creditable to the inventor's talent. It is said that there are some of these frames still at work in Scotland, but owing to the fishermen making their nets in their leisure time, the use of these machine wrought nets seems never to have become general. In his letter to the Society, 7th December, 1795, Boswell says, "I hope soon to present a sample of exceedingly fine net in imitation of lace, made on a finer machine which I have now nearly ready for working. The invention is equally curious and novel, and may be of great utility to this country in diminishing the large sums that annually leave it for the importation of lace."

No further reference to this fine net lace machine appears in the subsequent volumes of the Society's Transactions. The Author had a lengthened intercourse with Boswell while they were travelling together on the continent in 1824-5, and if such a machine had been perfected, the fact would certainly have transpired, when references were made by him to the one above first described. Mr. Boswell complained with bitterness of the neglect with which the world treated his inventive talents.

This was the last important modification of the stocking-frame made in the eighteenth century, and one of those in which a near approach was made to the manufacture by machinery of a sound net-work. On this account, as well as because its parts and construction have since been referred to in several important patent discussions, it is worthy of the notice of studious mechanics.

CHAPTER X.

THE WARP HOSIERY AND LACE MACHINE.

A VERY important step in developing the hosiery and lace manufactures took place about 1775, by the construction of what is known as the "warp" machine, from the addition of the warp threads of the old weaving loom, for the purpose of forming upon them the looped stitches of the stocking-frame. The competitors for the honour of this invention were Tarratt of Nottingham; March, one of the knotted patentees; Crane of Edmonton; Morris of Nottingham, according to Blackner; together with, Henson says, Vandyke a Dutchman. Morris told Blackner that Crane was the inventor, and not being overburdened with money, imparted the discovery to March, who gave him one hundred guineas for the privilege of using it as his own. March, at the instance of Horton, visiting Nottingham to obtain superior workmen, Morris got from him some insight into the plan, and being an expert mechanic, began to construct a warp-frame. The credit of March was by this put at stake with Horton, and a doubt arose whether a patent could be obtained. At an interview between Horton, March, and Morris, the former, after hearing the statement of the others, came to the conclusion that neither had any claim to the invention, but that it belonged to Crane. This account Morris was candid enough to give to Blackner many years afterwards.

Crane had constructed his warp-frame in 1775. A thread was given in it to every needle. On it silk hose having blue and white zig-zag stripes were made. Some have asserted that the name by which these party-coloured hose with their peculiar shaped stripes were known, "Vandyke warps," arose from fancied resemblance to the pointed angular ruffs in the pictures

of the celebrated painter of portraits. But Henson says:

"The London stocking-makers give a far different account of the invention of the warp-frame, and which most probably led Mr. Farey the engineer, in his evidence to the Commons on the patent laws, to fall into the error of stating that the stocking-frame itself was originally a foreign invention. They assert that the discovery was made in Holland, by Vandyke, a Dutch gentleman. He despairing of remuneration at home, came to London and applied to the knotted patentees, Horton and March, who closed with his proposals and entered into partnership with him. March had certainly a partner of that name in his business at Moorfields, and the articles were known as Vandyke warps."

This machine, whose powers of varied production far exceed those of the old weaving-loom, the stocking-frame, the bobbin net machine, or any other tissue making machinery hitherto constructed, was exceedingly simple in its first arrangement as an appendage to the stocking-frame. Henson believed that he was shewn the first warp stocking-frame in the pigeon-loft of Mr. Hardy in Twister's Alley, London, and thus describes it:

"The star boxes and falling bar were taken away from the common stocking-frame, and the lockers were fastened to prevent the jacks from falling. A series of guides, of the same number and guage as the needles of the frame, with holes in their ends, were fixed on a bar near the heads of the needles. At the top was a warp beam furnished with as many threads as there were needles, and a machine to guide these warp threads to the needles, each passing through its guide. A part of the machine was adapted to make each thread to form a loop like that which school boys make on a string. This alone would have produced only a series of looped strings. But by other movements a spring was applied, and the guides were removed one needle to the right or left at pleasure; and by the same movements being repeated in looping, the two next and every next loop was conjoined to its fellow loop. By removing the guides two or more needles to the right, and then working the same number of courses to the left, a knitted web was produced of zig-zag angular texture, and varied coloured stripes could be made."

The web was non-elastic, was cut by scissors, and sown up into the shape of hose; and being put on and taken off the leg with difficulty, the unsightly seam was liable to break. These stockings did not retain hold of the English market. Made of cotton yarn, they were in considerable demand for Germany, so that three hundred frames were employed. The pieces replaced much of the knotted work.

There is considerable probability that the origin of this ingenious machine is due, in point of fact, to the versatile mechanical genius of Mr. James Tarratt, then well known to the constructive world of Nottingham and the hosiers of London. This idea has always prevailed to a large extent, but the facts cannot be ascertained. It is rendered the more likely, from Tarratt having in 1785 applied treddles to the frame to effect its various additional movements; also building the machines forty-four instead of sixteen inches in width, thus trebling the width and doubling the speed by his improvements.

In 1792, Roland, of Nottingham, produced a modification of, and addition to, the stocking-frame which was patented by Mr. Robert Barber, of Bilborough, No. 1923, as "a method of making it capable of using hard materials in double looped frame-work." In 1797 he took out No. 2175 for a further improvement; and in 1805, No. 2858, for making "stocking stitch warp work." The articles made under these patents were as heavy as blankets, and large contracts were entered into from time to time with the government, for the supply of woollen jackets and trowsers. Our sailors fought for years clothed in Nottingham manufactures, for the supply of which 500 machines were employed, made from fine frames and of good materials; this webbing formed an excellent article for gentlemen's pantaloons.

In 1796 Brown and Pindar arranged a warp hosiery frame, in which the needles were placed upright instead of in the usual horizontal position. One hundred and twenty such frames were employed, and afforded the extraordinary wages of 50*s.* a week to the workmen.

The Berlin or Buonaparte warp piece web was introduced in 1799 by Roland. Copestake also claimed the invention. A large amount of these goods was made, but not being a sound article, they went entirely out of use in a few years.

Thus the warp frame was found capable of competing in the woollen and cotton cloth markets with the common loom, and with a variety in its productions beyond its rival at that and even up to the present time. Indeed it is impossible to describe all the methods and

uses of this frame; no other machine is so universally applicable. Every kind of thread may be used: silk, cotton, linen, and animal wool. Its speed is also unequalled, as it loses no time in passing weft threads; only one gait or thread to the next is required, each thread being looped through a steel guide to its neighbour; all the series thus operating together across the loom. The cloth when made will not tear out, it must be cut. Velvet has been made on warp machines 150 inches wide, without using wires for raising the pile.

The number of warp machines making cloth in the early part of this century was very large in England. Its great usefulness and rapid power of varied production caused it to be used abroad extensively, it having found its way into France, Spain, Italy, and Germany.

But the substitution of a warp thread to every needle, instead of confining the whole set of needles to successive loopings upon one thread, it was soon discovered had introduced great facilities for varying the meshes which might be made on the warp machine. Accordingly, attempts to get an open work article of lacy appearance from it were made about 1795. These were attended with considerable success. At the beginning of the present century, improvements were brought forward in the use of the machine, by which it was adapted for the manufacture of not only plain, but figured lace. Further modifications have simplified the mechanical arrangements so much as to greatly facilitate changes in the articles produced by it. To the heaviest cloths for warmth was rapidly added the fabrication of the lightest gossamer silk net lace; silk blonds and edgings; cotton tattings and pearls; antimacassars and d'oyleys of durable qualities and effective designs, thick threaded, pearled, and finished in the loom: these all now form classes of goods of very large home consumption, and enter equally into our export trade. The low prices at which they can be sold, combined with the durability of the heavier kinds of cotton warp articles, have made them the sure pioneers of our trade for more expensive lace goods in parts of the world where otherwise but little lace would go.

In 1810 the number of warp lace frames at work

was 435, according to the workmen's books. They were employed in making so-called *Mechlin* net, but it was of inferior quality. Nevertheless it was made of cotton yarn specially prepared for this purpose, costing fifteen guineas per lb.; and the workmen engaged in making the net obtained weekly wages of four guineas for a time. The use of this article assisted in the downfall of the point net trade. The persons who devised this modification were Copestake, of Ilkiston, and Brown, of Nottingham.

In 1804 an upright warp machine was set to work, in which no sinkers were used. The invention was claimed respectively by Robert Brown, of Nottingham; James Ewing, travelling with a waxwork exhibition; and James Tarratt, whose name so often appears in these annals of inventive ingenuity, and who, after many years of active employment of his talents upon every kind of hosiery and lace frames, finished his useful life in honourable retirement at the Charterhouse in London.

Hitherto the varied movements required in the warp machine had been made by hand. The way in which rotary power could be applied, requires a notice of the talented inventor. This was Wm. Dawson, who, though a Leicester frame-work-knitter only, made a great discovery in mechanics.

This was by his devising a wheel irregularly notched on its edge, and which, when revolving, operates upon horizontal bolts or bars that are pressed by springs on their edges. As the bars are pushed from it, or allowed to approach, a figure is wrought by this lateral motion in the stuff which is being made.

This plan is used in nearly every kind of weaving machinery; its useful qualities are continually developing themselves, and being everywhere known as "Dawson's wheels," serve to perpetuate the name of the unhappy inventor.

In 1791 Dawson patented (No. 1820) "a machine for making all kinds of hosiery," but it was more especially adapted for military sashes (which from the then existing war were in great demand) of crimson silk for the commissioned, and worsted for the non-commissioned officers. Unexpectedly to the inventor, he

found the machine could be altered to plait stay laces with great rapidity. Being a general mechanic, he planned means for tagging them, cutting the tin and closing it in one operation. Two Leicester manufacturers assisted with means, allowing him a guinea a-week; but not completing his design in the time expected, they withdrew their support. He then found a friend in Mr. Gregory, an architect of Nottingham, and obtained the patent, working a number of his machines in Turncalf Alley, Nottingham. Like many geniuses, he squandered away his money; and at the expiration of his patent, he besought Lord Chancellor Eldon to have it renewed. He removed his machinery and business to Islington, London, and there made a small and beautiful model, which his lordship inspected and worked. But the privilege was not extended, and the unhappy applicant destroyed himself in consequence.

It will be observed that these elevations and depressions upon the outer surface of a wheel, thereby becoming eccentric in its revolving operations upon bars, would be the same in principle as those of the catches of the barrel of an organ for the opening and closing of its pipes; and, of the Jacquard apparatus, by its perforated cards on the threads of a weaving-loom, or on the bars and threads of a lace machine.

In subsequent descriptions of various machines it will be seen that, according to the more simple or complex character of the meshes and ornamental character of the fabric to be produced, one or other and sometimes two of these systems combined, have been brought into play in lace manufactures. The organ barrel had been in use twenty years, and Dawson's wheels ten years, in several kinds of Nottingham machinery, before the Jacquard apparatus had been introduced into notice at Paris and Lyons in 1801.

Dawson's unequal surface wheels were applied to the warp lace frame in 1807, and have been ever since used. Mr. Simon Orgill, of Castle Donington, was mainly instrumental in effecting this great improvement. The same year, 1807, the spotting bar and wheels were applied by Vickers and Gray, both of Nottingham. And in 1809, Kirkland, of Beeston, by adding

other wheels and a further alteration of the frame, produced 'two-course' silk net.

At this point the warp lace trade came under the direct, and afterwards frequently recurring, influence of close competition with bobbin twist net, for the manufacture of which Heathcoat's patent was taken out in 1809. In some respects it would seem preferable to relate their respective alternations in the same narrative, and as they occurred; but clearness and brevity seem to require that the account of the warp manufacture should be a continuous one. To resume, therefore,—Daycock and George Morrison in 1811 put wheels and dividing bars into the warp frame, so as to make upon it *silk blonde*. This article became a considerable branch of the lace manufacture, at intervals, for the next forty years; and, in making the net, workmen gained for some time £10 a-week wages. Mr. Robert Frost assisted in developing this improvement.

In 1816 warp pearling was introduced by Wm. Fowkes, of Leicester, and Kirkman, of Nottingham. This article is much used, and is of great importance to the trade.

In 1819 warp Mechlin had disappeared; and not long after the two-course and blonde declined till about 1830, in consequence mainly of the superiority of the French mode of dressing their light silk nets.

The *plain* warp nets, which had been largely made for ten or fifteen years, were thus rapidly driven out of use by the superior texture in soundness and appearance of 'twist' net. This caused many of the oldest amongst the warp frames to be broken up and sold as scrap iron. But it had the immediate effect also of directing the attention of mechanicians to devise the means for ornamenting the lace in process of manufacture.

After an effort to rival bobbin net by a new net, called *mock-twist*, bullet hole and spotted warp nets were the first additions made to the plain articles, and these were produced by Copestake, Boot, Roberts, and Herbert.

There sprung from these, *warp-tattings* in 1822, the wheels for producing which were devised by Copestake, of Stapleford, and Read, of Radford. These articles are now consumed to a larger amount than formerly.

At their first introduction the demand was such as to greatly raise the value of the existing machinery and to cause new ones to be built.

William Hardy, of Nottingham, devised a machine, in 1824, for spotting and figuring the imitation twist net above named.

In 1831 the warp production, under the patronage of the court, became very large, and the trade attained a state of great prosperity. Queen Adelaide appeared at one of her balls in a dress of white silk lace of Nottingham manufacture.

Many rotary machines, of 100 to 150 inches in width, were built to meet the increased demand, which lasted till 1835, when, in consequence of the bobbin net machinery being further adapted to make ornamented lace of a superior character, cotton warp tattings were much depressed for a time, as was also warp silk blonde, for Heathcoat's white silk twist net took its place.

In 1833 William Herbert took out patent, No. 6399, for tattings in imitation of bobbin net; in 1835, Streets and Whitely, No. 6748, and the same year Dunnington and Copestake, No. 6833, both for improvements in warp frames.

The warp machinery was turned upon gimps, lace mitts, and gloves, from 1836 to 1846; articles which have gone nearly out of use.

In 1838 the commercial panic seriously affected the warp trade, and the narrow tatting-frame workmen were reduced thirty per cent. in their wages, affecting 650 hands. Those employed by Mr. William Herbert, turned out for an advance, which was not obtained. The wide machine hands were then earning 40*s.* a-week generally. Draper applied the Jacquard to the warp frame in 1839. By this means articles of elaborate design, as shawls, scarfs, falls, laces, &c. were brought out, to be supplanted again in due time by their rivals from the bobbin net machine.

An impression from a cotton warp lace selling in country shops at 1*d.* per yard, is given as a specimen of combined excellence and cheapness. It will be found in Plate XIV.

Since 1839, other kinds of webbing have been produced from the warp looms.

Mr. Henry Dunington made elastic woollen cloth for gloves, and for some time the best of its kind. This mechanician had patented in 1836, No. 7132; and in 1838, No. 7801; and again in 1838, No. 7828; in 1839, No. 8035, and No. 8292—all for improvements in warp hosiery machinery and fabrics.

In 1849 he took out No. 12561 for his still further improved method of making hat-bands and gloves. To this manufacturer the trade owes an important advance in the fabrication and use of warp articles, on which he has bestowed much time and money.

In 1845, Dunnicliff and Dexter took out a patent, No. 11020, for making velvet pile ornamentation wrought in warp lace.

In 1849, Ball and Dunnicliff, and also Haimes and Hancock, each produced piece velvet from the warp frame, suitable for gloves. The former house made velvet in combination with lace, the one fabric being the ground, the other forming the pattern introduced into it. An impression of one of these velvet laces is given in Plate XVII.

As a striking example of the progress of this class of machinery, it may be stated, that the average width of warp blonde machines was 54 inches in 1830, and the production 80 racks, or 50 square yards per week. But Messrs. Ball, of Ilkeston and Nottingham, placed in the Exhibition of 1851, a *power* warp machine, which if worked twelve hours a day would produce 800 racks, equal to 1200 square yards in a week, or 60,000 square yards in a year. A square yard of silk blonde sold in 1830 for 2*s.* and in 1851 had become reduced to 6*d.*

The warp frame has amply rewarded those who have thoroughly understood and judiciously employed its diversified capacity for production. Amongst these no one was more conspicuous than Mr. William Herbert, who was the son of a frame-work-knitter, and himself worked as a youth in the stocking-frame. Enlisting into the army, he served in the Netherlands, and was one of the foremost at the storming of Bergen-op-Zoom. He escaped without harm, and quitted the service at

the close of the war in 1815. On returning to New Basford, he learnt to work a warp machine. The savings he then realized from high wages enabled him to get an interest in a machine, on which he made tattings, laying very soon the foundation for a business which he carried on eventually at Tottenham. The profits that he then made were large, but adverse times supervened, and they were dissipated. Mr. Herbert then produced cords and braidings from the warp frames, and gained £50 a week from a single one of 120 breadths. These were disposed of at Coventry, where the demand for a time was so great as to exceed his power of supply. He again accumulated a large sum of money, and increased his machinery so as to overpass demand, and stocked the articles extensively; for his plan was never to do things by halves. A source of great happiness to him consisted in contributing largely to religious and benevolent objects, and during this season of prosperity he was heard to say publicly, "My friends, do not be afraid that I am giving more than I can afford; God gives me my money by skipfuls, I am only distributing it by handfuls." A reverse quickly came, and the blow was so sudden that, using his own peculiar diction, "it was as if an angel from heaven had come down and proclaimed, 'that cords and braidings should be used no more.'" His immense stock was comparatively valueless, and he again lost all.

For the third time he went to work with his constitutional vigour and enthusiasm, saying, "Turn me into Nottingham park without money or clothes, and I shall die a rich man." Hitherto his profits had been made chiefly in warp goods. This time he turned to the twist bobbin net branch, and entered into the manufacture of black laces with success. He concluded his extraordinary career by carving out a business, which for a time he kept almost to himself by producing an imitation of Saxony lace. As he had predicted, he died possessed of considerable property two or three years ago.

Mr. Herbert had not only a good knowledge of the capacity for adaptation of the classes of machines he used, but he employed them appropriately and with characteristic confidence. He devised an ingenious

machine, in which he used pins and plates instead of a chain wheel. This was afterwards perfected and patented by Crofts. Several who were his fellow-workmen in the warp frame became in like manner conversant with its wonderful powers; guided and subordinated them to the production of new and beautiful articles, built up large and profitable businesses, and are enjoying well earned reputation and property.

Messrs. Whiteley and Co. in 1839 took out a patent, No. 8262, for the manufacture on the warp machine, of a tissue, called 'Taffeta.' On their plan the warp threads were to traverse in some measure. The principle of traversing on this machine is in this patent, and the merit of the discovery belongs to them, as to how it was to be effected on the *wide* warp frame from selvage to selvage across the machine. They disposed of this patent right to Messrs. J. and R. Morley. Messrs. Hemsley and Co. worked machinery by license under this patent.

In 1851 the Hemsley's took out a patent, No. 13635, for an improvement upon Whiteley's plan, by carrying the diagonal traverse from selvage to selvage by the operation of longitudinal bars on this wide frame; and in 1854, another patent, No. 981, for an improved manner of carrying the thread and making the selvage, thus perfecting the traverse system on the wide warp frame. Whiteley took out patents in 1853, Nos. 1107 and 1963, for making ornamented warp fabrics.

Messrs. Ball and Co. exhibited in the Paris Exhibition in 1855 a *double* looped taffeta made on a *circular* machine; therefore entirely different in its principle, mode of working, and resulting tissue, from Whiteley's and Hemsley's. This frame possesses the requisites of simplicity in construction, together with speed, quantity, and consequently, lessened cost of production. For the beautiful articles exhibited in the shape of silk gloves made up from this tissue, the jury awarded a gold medal to Ball and Co. This house gave notice for an English patent, but did not proceed to specification.

In 1864 Messrs. Gamble and Ellis obtained a patent, No. 689, which they described as being "for improvements in warp fabrics, and in machinery for making them," and explain as follows:

Instead of the warp fabrics consisting of pillars, each produced by looping continually a single thread, so as to make a chain resembling tambour work; which pillars were connected together into a fabric by other threads which do not loop on themselves, but which catch or link first with one pillar and then with another, and which may pass only from one pillar to the next, or may traverse a greater distance—this improved fabric differs from them, in that the connecting thread or threads heretofore caught one only of the three thicknesses of which such looped pillar is composed, while we cause them in each course to catch two of these thicknesses. The advantage of this is, that whereas on the former plan, in close work with a satin-like face, where in each course the connecting threads were carried sideways over two or more pillars, and on the face of the work float over the pillars intermediate to those which they catch, the back of the fabric has exhibited the pillars as heavy ribs, because the connecting threads only caught one of the three thicknesses of each pillar, and left the other two pillars on the back of the work. On our plan, by catching two of the three thicknesses of each pillar, this ribbed appearance is to a great extent got rid of, the back and front resembling each other, save that at the back the connecting threads do not float entirely clear of the pillars intermediate to those which they catch; but the connecting threads are held down to the intermediate threads by a single thickness of the pillar passing over them. In the open works also, catching with or twisting round two thicknesses of the pillars instead of only one, gives the pillar much more nearly the appearance of a true twisted pillar.

In this machine there is a needle-bar having needles with eyes, applicable to other warp-machines, each having a channel leading up to the eye in which the thread lies, not disturbed by loops of work passing over it.

Also there are in front of the work, points which catch the thread, rise or pass between it and the needle, and so leave a loop upon the points of which there are two to each needle. These points pass the loops sideways, and deliver them on the needles; which process by repetition forms the pillars.

This machine is more rapid than the ordinary warp-loom, because the connecting threads can be carried to and fro at each ordinary course, while in common warp-frames they can make one such motion only. The motions are also shorter.

Extra threads and guides may be used, to lay on or to work their threads into the fabric for ornamental purposes. And threads may be laid in from side to side; and these threads may form the sole connection between the pillars, and so form open net-work with rectangular holes; or these may be filled up by traversing the connecting threads.

Or the needle-bar, by a shogging movement, may pass the new loop through the next old loop needle thread. The machine thus arranged, the needle threads will produce a ground fabric without connecting threads; this may be ornamented by threads, laid into it by means of guides.

Warp-machines arranged according to the plans here patented are said to be suitable for the cheap production of strong curtains.

Plain Mechlin had given place to plain blonde, and blonde at length having become obsolete, a new and lighter article, *Zephyr Aerophane*, or *Paris* net, was largely made from the same machines. But, after maintaining with varied success competition with bobbin net, under the name of *Queen's*, made with a traversed mesh, and *Mechlin*, a straight down article, both of very light materials, and produced at low cost, about 1860 the warp Paris net succumbed; and the machines on which it was wont to be made have been unemployed and become almost valueless. Warp cotton laces and tattings have had to submit to a somewhat similar process. But a very light and inexpensive class of silk fancy nets have come into use. The old machines have in many cases been replaced by new wider ones, to which the Jacquard apparatus has been applied, greatly to their advantage in making heavy fancy goods. The rapid way in which these almost twin manufactures of warp and twist lace act and react on each other is very striking and important. Many of the articles may be said, if not to be common to both kinds of machines, to be so nearly allied as by the slightest difference in price or in the fashion favouring either of them to replace each other. They are always ready to supply their respective quotas to the general mass of the Nottingham lace trade. The machines are gradually assimilating in width, cost, time of working, wages, and vast power of production. They both require great skill and nicety of construction; and each must be worked by hands of a superior class, who, if put on short time, or their labour is suspended but for a brief season, are difficult to be retained, and can seldom be replaced. In both these departments of the lace trade, the machines are worked in factories eighteen hours a day, by two relays of four and five hours shifts. The quantity that can be made is therefore so large as, in times of difficulty, to issue in over production, and prices in both trades suffer accordingly.

CHAPTER XI.

BROWN'S FISHING NET MACHINE.

ROBERT BROWN, who describes himself as a lace manufacturer, of New Radford, Nottinghamshire, took out in 1802 a patent, No. 2571, for the invention of—

"A machine for the purpose of manufacturing by this more speedy, simple, and neat method, fishing nets, horse nets, garden nets, furniture nets, nets for wearing apparel, and all other articles of net-work, having the same common diamond mesh and knot hitherto tied by the hand with the netting needle, in fishing nets; and also for manufacturing divers other figured meshes, with any thread, twist, twine, cord, jersey, or yarn produced from animal, vegetable, or mineral substances."

This machine was never made practically useful or profitable, for it has not being ascertained after much and careful inquiry that any net produced by it was ever sold. But questions of great interest and importance were raised within ten years subsequent to the date of the patent, respecting one or more of its parts and combinations, which will require attention, and render a full description of the invention necessary.

Robert Brown was a frame-work-knitter, and one of a number of clever artizans who were most of them more or less known to each other, and whose great object it was to construct machinery to make lace. This had been accomplished to some extent. Point net and warp net were being made in large quantities, but a *fast meshed* lace was not as yet achieved. This must either be a firmly *knotted* mesh, or a *platted* one, or a *twisted and traversed* one, or one *compounded* of two of these, as for instance *platted and traversed net.*

Now to accomplish by machinery any one of these ends was, by the outside world, considered as likely as to find the philosopher's stone; but by the mechanics themselves it was sought after with all the eagerness of

digging for gold: at any rate to attain to it was to gain the blue riband for invention in this class of machinery. Boswell, as we have seen, had made a *knotted* net of one thread by a machine. Robert Brown adopted the exactly opposite method of using his materials.

On his machine there were twice as many threads as meshes; these were divided into two equal parts, half of them were wound on the usual shaped wooden bobbins, and placed on pins upon a board behind the frame, from which they were carried separately, but in one row, to the front. The other half were wound on bobbins separately, each bobbin of about one-fourth of an inch in thickness, more or less according to the guage, between its sides; and these bobbins were placed in 'sinkers' on a pivot by springing the sinker open. The thread is held tight by passing through a spring. The spring is fastened to one of the inner sides of the sinkers, and likewise the catch by which the sinkers are drawn off and pushed on the bar as on a shelf. Plate IX. fig. 1. This bar moves on axles at the ends, and has a ledge on the front that enters the notches of the sinkers and supports them. These sinkers were doubtless so called from their working up and down perpendicularly like the sinkers of a stocking-frame. In operation the sinker or carriage and its bobbin were equivalent to a weaver's or hand fishing net maker's shuttle. There was another bar in front, about the width of the machine. This bar can be applied and removed at pleasure; it holds wire pins horizontally, and when applied presents these pins exactly to the hollow sheaths at the top of the carriages. The carriages are moved by hooks; these are the same hooks which operate on the threads to form the nooses; and the motion given to the carriages by the hooks draws them forward off the shelf, and then they are received on the wires of the other bar, or are put backwards again from the wires to return upon the shelf. The loops of threads through which the bobbins and carriages must pass are first made by the hooks and other parts of the machine, and are then drawn out or lengthened to obtain sufficient thread; they are afterwards expanded into a triangular form, so as to admit the points of the carriages into them, and the expanded parts of the nooses are thrown by the hooks over the top of the sinkers. Then the moveable bar with the wires is applied opposite to the hollow of the carriages, and seizing the carriages by the hooks, they are drawn off from the shelf and received in the wires; this brings the bobbins, with all the threads they contain, through the loops, which are afterwards drawn up to inclose and form a knot round the thread from the bobbin. The work is then thrown off the pins and the entire course of meshes is finished.

This process, and the machine by which it is accomplished, are very ingenious. It takes and uses as component parts a work beam, shuttle, and other well-known instruments, but some of them in new forms and subjected to new processes. Though at first sight it seems intricate, yet it would be comprehended without difficulty by those

accustomed to the stocking-frame and warp lace machine. The knotted fishing mesh it produces is perfectly sound in quality, and would come very low in price.

The parts of this machine and their modes of operation having been described, the first of the questions raised may be now considered, though they did not begin to occupy the attention of Nottingham mechanics and the lace trade until after the publication of Heathcoat's specification of his second bobbin net patent; to find flaws in which every effort was put forth by those who either envied the patentee's success, or desired to participate in the profits which would evidently arise from the newly-invented machine. The first question was raised by Robert Brown himself, who declared that Heathcoat's bobbin and carriage were only modifications of his 'sinker' and bobbin. In an interview with Lewis Allsopp, esq., a solicitor enquiring into these matters, he said, "Heathcoat and John Brown" (the traverse warp patentee in 1811) "have used me ill in borrowing my bobbin and case." And in a document of later date his son, Alfred Brown, says "my father's frame was the first that worked a bobbin and carriage. If Heathcoat can make a twist net without the bobbin and carriage, let him take the merit of it, otherwise I claim the merit for Robert Brown." And in 1843, in conversation with the author, he remarked:

"The invention of the bobbin and carriage is comparatively as good an one as the wood needle blocks of Lee, the inventor of the stocking-frame; the wood types of Faust or Guttenburg; or the spinning mule of Arkwright, the assumed inventor of the spinning apparatus. Robert Brown's patent had the advantage of some years priority. He fell into poverty and received parish relief; became insane, and attempted self-destruction; had he retained his faculties he would have claimed his right by an injunction on Heathcoat. Things would have been much better for his family after the last trial between Heathcoat and the trade, had there been no collusion or fraud; but they were fearful that, in their contention, R. Brown's claim would be established, and therefore compromised."

Alfred Brown denied all merit to Whittaker in regard to the bobbin and carriage, or that he ever put together a machine on which bobbin twist lace could be produced. It was stated by G. Henson, that—

"Whitemore, an apprentice or workman of R. Brown's, seeing a boy play with a thread wound round a very flat bobbin and being

let down towards the end of the string and suddenly checked, it rose and wound up again; he was led to think that if he could use such an instrument in another implement, he might by that means get a thread to pass round a warp thread: a thing tried for during fifty years, and not then accomplished."

It is further said that when Whitemore had imbibed the idea of a spring regulating a bobbin, he became so excited that his shopmates thought him insane. This is intended to account for Robert Brown's devising his sinker and bobbin in 1802; and it was expected in 1815, that Whitemore would have verified it on oath. He was not, however, called upon to do so. The idea that, by his sinker and bobbin, Robert Brown originated this important part of the twist lace machine became prevalent, and was a good deal relied on by infringers of the patent—the heads of the Nottingham trade, masters, and their journeymen, who for a time shewed him personal attentions, which were, however, soon discontinued; though for some years, in consideration of his misfortunes, he was paid 12*s.* weekly out of a trade fund. A patent, No. 2760, which he had taken out in 1804 for a machine to be affixed to an upright warp or Vandyke knitting-frame without sinkers, had unhappily proved also a failure, being superseded by a horizontal one. Though it is stated that he sold his fishing net machine for £600 to a gentleman at Gloucester (in whose hands it did not succeed), the prosecution of his inventions swallowed up his resources. It is greatly to be regretted that a mechanician of such undoubted ingenuity, and who, under more favourable circumstances, might have achieved success and fortune, should have been left to pine away into a moody melancholy.

Every part of Robert Brown's machine had in some form or other been used before; the 'sinker' and its bobbin amongst the rest. It is a shuttle in a different form, and used for a different purpose to that of the ordinary weaving-loom. The same motive and necessity, though in each case for an entirely different purpose, induced R. Brown and Heathcoat respectively, to reduce their bobbin and carriage into as thin a shape and compass as they could get it to occupy; each performed the real purpose of a shuttle, but in ways,

in the two machines, having no relation to each other. Heathcoat had seen Brown's specification, though not his machine; and may have had his thoughts directed to the practicability and use of a thin bobbin, spring, and carriage by it. He gave credit, as will be shortly related, to G. Brown for his shuttle. But Brown's fame as an inventor does not in reality stand upon this bobbin and carriage, or on any other part or parts of his machine separately, but upon the ingenuity and novelty of his combination of them. For this he deserves very great credit. The result was a perfect article, which, but for special reasons in relation to the use that could be made of the net he produced, must have been the source of much profit to him. Like Boswell's, his frame remained unused, because fishermen's nets cost them merely the sum paid for materials, their leisure time only being occupied in manufacturing them. That this is the just view of Mr. Robert Brown's shuttle, is fortified by the following statement made after examining it, and given in evidence by Donkin, Sylvester, Farey, Millington, Brunel, Hawkins, and Ostell:

"That it is no more like Heathcoat's carriage than it is to the old shuttle of the weaving-loom; that they had no affinity in use or effect, being intended and used for entirely different purposes, and were each detached parts of complicated machines."

Claims to this invention were put forward on behalf of John Lindley, Edward Whittaker, B. Thompson, and C. Hood, which will be noticed when the inventions of John Heathcoat are described.

The second question which has been raised, in reference to this patent of Robert Brown's, is a far more interesting one, and shall be given in substance from the words of Dr. Ure, in his *History of Cotton Manufactures*, vol. II., p. 342:

"Without impugning the merit of Mr. Heathcoat, it may be stated that the principle of his patent has been embodied since the year 1803 in a machine for making fishing nets, the invention of Robert Brown or his partner George Whitemore, both of Nottingham. Mr. Morley, the very eminent bobbin net manufacturer, of the great firm of Boden and Morley, of Derby, pronounces the judgment 'that this machine possesses all the essential principles and properties of Heathcoat's patent bobbin net machine (of 1809 or seven years subsequently to Brown's), and is to all intents and purposes a bobbin net machine.'"

Dr. Ure goes on to say:

"To this machine must be traced the origin of the curious invention of the bobbin and carriage; to it must be referred the method of using two divisions of threads, warp and bobbin; and to it alone must be attributed the beautiful idea of passing, or as it is generally termed, twisting two divisions of threads with order and regularity and without entanglement round each other."

After referring, for proof of the above, to the specification which it is almost incredible that he or Mr. Morley could have examined, he further says:

"The idea of reducing the thickness of the bobbin and carriage to a scale fit for the fine meshes of bobbin lace, seems to have originated with Edward Whittaker, of Radford, who, knowing Robert Brown, had knowledge of his fishing net machine."

These statements, coming from such an authority, go to withdraw from Mr. Heathcoat his title to the invention of the bobbin net machine, and will be most appropriately considered when an account of the origin and a description of that invention has been given. Till then the reader will probably preserve his mind unbiassed by them.

Robert Brown died about the year 1818. His son, Alfred Brown, has shewn proof of hereditary mechanical skill in the construction of a machine capable of producing some of the most intricate combinations of threads hitherto made. Specimens of these meshes indicate the complex character of the mechanism by which they must have been produced. This and his want of means has hitherto prevented its being brought into use. He is a small newsvendor, of respectable demeanour, and is possessed of much intelligence. It is to be regretted that his abilities have not been exercised under more favourable circumstances.

CHAPTER XII.

HORIZONTAL LACE PLATTING MACHINES.

Mr. John Moore, a native of Leicester, was a small hosier, and his sons were there taught frame-work-knitting. Of these, John was living at Croydon about the year 1800. He was previously to that time employed in experiments in making lace machines, while his brothers, Benjamin and Olive Moore, were engaged making 'point net' lace. John Moore turned his attention at first to the production of twisted net, and then in 1810 of platted net by machinery. He had by mechanical means obtained a twist on both sides, carrying threads over each other and then back again; and having constructed this horizontal frame, worked it for some time, making a twisted but untraversed net. At length he found means whereby he platted some of his threads also; they were still untraversed, and the net meshes straight down ones.

According to the account of his brother and nephew, the *pillar* or longitudinal sides of his perfect hexagon mesh were platted, being composed of four threads, two of which had been twisted twice round each other diagonally and other two the same, forming the two upper sides of the mesh, and having all passed together the platting process twice, were separated, and each thread of each pair was again twisted twice round its fellow, to form the two lower sides of the mesh, preparatory to all four entering into the platting combination again. By this method a sound and beautiful straight down real Mechlin mesh may be produced, and which it is presumed John Moore effected. It is uncertain whether he ever arrived at traversing the threads after platting.

As there was no patent, there was no specification; the machine has disappeared and none of the net can now be found. Two of those who worked in these frames, Mr. Olive Moore and his nephew Stephen, are still living. The former with Benjamin Moore helped John Moore, in putting up several to make first twisted breadths, and then platted wide net at Croydon. Yet

neither of them has a perfect recollection of the mechanism or mode of working of either of the machines, but describe the arrangements and processes of the latter thus:

"It was a horizontal machine in two distinct parts, only connected by the threads used in the construction of the net. These parts at the beginning of making a piece were placed distant from each other the length of the room. The place in which the last of John Moore's platting frames was worked, on its being brought by him to Nottingham, and sold to his brother Benjamin, is in Parliament Street, and is thirty-three feet long. Allowing three feet at each end for the machinery, the full length of the extended threads would be twenty-seven feet. The pieces, while making, drew up the machine from the lower end, it moving on trucks, towards the upper end; and they would be so much the shorter than nine yards as the thread would be taken up by plat and twist. At the upper end was the work roller and the under point bar, which held up the work already made, while the top point bar came forwards to bring with it the plat or twist as it was formed. There was no division of threads, all being carried in one line from the machine at the upper end of the room; and at the lower end each thread was tied into a loose needle having in it a catch or notch. Each needle dropped into a slaie. Below this slaie and the threads was a bar with points, which moved such of the threads as were necessary to form the plat by means of the notches or catches to an upper slaie made like the lower one, and on receiving these threads carried them by a movement of the whole of this upper part of the machine to a position where by the side (shogging) movement it placed the threads so as to help to effect the plat, when the remaining threads had performed a similar movement. As the platted or twisted sides were formed, a roller the width of the net (about forty inches) was placed so as to pass from between the top and bottom catch bars, at that end where the platting or twisting had just been effected, and then slide up to the other end machine, whose upper point bar was waiting to take and deliver them to the under point bar, to be added and held to the work already made."

The expence of constructing this machine was large. Only about two yards in length of plain net could be made in a week from No. 300 yarn, costing 16 guineas per lb. The whole of the net produced was sold to Mr. James Fisher at five guineas a yard in length and forty inches in width, until from its high price it was superseded by twist and traversed bobbin net. This machine and the first *traverse warp* machine made by Benjamin Moore were long kept as curiosities, but for want of a public museum they were at length broken up as of no further use. Mr. Stephen Moore says, in conclusion, "the durability combined with the beauty of this platted pillar net was beyond any other machine wrought net hitherto produced."

John Moore, finding that platted nets were too expensive for general use, turned to the traverse warp machine, in the discovery and adaptation of which his brother Benjamin enacted so prominent a part.

This early effort to make so perfect an article as a *true* Mechlin net is very interesting; for it shews after what the indefatigable mechanics of Nottingham were in search, and to what they aspired—a perfect imitation of the best foreign cushion lace. An extract from G. Henson's MS. on this subject is therefore given:

"Tarratt went about 1780 into Northamptonshire to observe how *bone* (cushion) lace is made. On his return he tried (for Morris) to make twist net by the use of all warp, *fastened at both ends*, and by employing six distinct point bars. In this effort he was followed by others—as by John Moore, Croydon, for Frost, of Nottingham, in 1799, and in 1809 by the same machinery improved; by Hill, for Nimmo, of Nottingham, 1805 to 1816; by Widdowson, for Messrs. Woodward and Urlings, of London, 1816 to 1824. During this period the *fast warp* plat machine sometimes made three twist Brussels net, having four threads to a pillar. This machine was the swiftest of all modes of putting in twist, but lost time in securing it, the point bars being drawn by a windlass. Tarratt and Moore fastened the threads at both ends, thus making lace at both ends at once, using two point bars. Moore found out a plan of putting the threads on (loose) pins at one end, thus unlapping them and making a single piece only of net at once. On this plan the Croydon workmen made three racks of two hundred and forty meshes each a day. There were about twenty machines at work at Croydon, London, Nottingham, and Basford."

In the foregoing extract, G. Henson seems to intimate that John Moore's plan of making plat pillared net was identical with one in work from 1816 to 1824, at Basford, for Miss Woodward, (connected as embroidress with Urlings, of London) by Widdowson. These machines were said to have been constructed by or for one Mr. Thomas Hill. This invention has also been attributed to Jeremiah Brandreth, who was executed at Derby for treason; nothing is known to justify the statement. The machines were carefully withheld from public inspection. Some time before 1824 Mr. Thomas Robinson had also an interest in them. They were at one time removed to rooms on the premises of Mr. Samuel Hall, and worked there. His connection with Urlings may probably account for this. Mr. John Sisling is possibly the only one remaining of those who made this plat net

at Basford. A costly and beautiful veil of the finest net made on this ground and ornamented with real Brussels flowers, is the only specimen now known to remain of the kind. The mesh has two pillars of four threads thrice platted and two twists on each of two sides and three twists on each of the other two sides completing each mesh. This square was one of a large number sold in 1822, for the then price of fine three-twist bobbin net, viz. £1. 5*s*. per lineal yard, 54 in. wide. It must have entailed a serious loss on the maker, and though the most excellent machine wrought article ever seen, scarcely distinguishable from *pillow* work in the mesh, its cost was beyond the consumption of that day. So it soon disappeared from the market. It has been replaced ever since, as ground net for the application of Brussels pillow sprigs, by extra fine three-twist nets. Henson (MS.) remarks:

"There has not been better lace either in Buckingham or Brussels ground than some of these fast warp Brussels machine *breadths*. They had for a time a ready sale at £1. 11*s*. 6*d*. a-yard for sixty holes in width. Flemish pillow lace of the same width sold for £2. 5*s*. 0*d*. the yard at the same time."

Thomas Frost, in 1794, made a net by using—

A square bobbin sliding in grooves, the warp shogging (shifting) sideways right and left; the work beam with the work and point bars were lowered to the bobbins as the thread was shortened by making the net. Upon turning the machine a quarter round the point tackle rose again. There were no carriages.

In an endeavour to produce bobbin net, carried on by Green and Simpson, in 1707—

They wrapped the traversing threads round wires placed in long carriages held to their tension by strong springs. These threads rode in pivot holes in the springs at one end of the wires, and their other ends were in pivot holes in the carriages. By this method good net was made; but the wire held so small a quantity of thread before it became too thick to pass through the warp threads that a piece only one yard in length could be made upon it.

Simpson by intense study brought on a brain fever from which he died, and Green then abandoned the effort, and is said to have died of unremitting and unrequited study.

Afterwards it was proposed to warp each thread on two such wires placed a little apart, and so get a piece

of double length. Even in the single tier machines of later days when short lengths have been made, it has always been an objection, especially in plain nets.

Mr. William Hayne, the well-known lace manufacturer of Nottingham, constructed the model of a machine in 1799, intended to produce bobbin net—

It had several tiers of small bobbins with a rack or teeth on the edge of each bobbin; the main warp threads passing through the centres of the bobbins; the other threads being twisted round the centre threads, while revolving after being crossed at the close of the hole, then twisting back again. The plan was never put into operation.

Mr. Hayne hung up this model in the lobby of his warehouse, the purpose being, as he said, "for his 'point net' workmen to admire it, and if they could to improve upon it."

About the same time George Pindar, of Nottingham, tried to make bobbin net by—

Wrapping his bobbin threads round perpendicular flat wires. He also used a perpendicular warp with slaie points, so that he might keep the wire bobbins square while they were passing through the warp threads.

Other particulars of the plan have not been handed down beyond the above and the fact of its want of success.

In 1806-7 William Potts, of Nottingham, tried to make twist net.

He used a perpendicular warp fast at one end, the threads of which he twisted by passing hooks placed and working at the back and front of them, and catching and drawing them sideways round each other in passing through them.

Before he had accomplished his purpose, he went to Croydon, where he soon after died, leaving the attempted machine in an unfinished state. No doubt he went to Croydon to be near John Moore, if not to be employed by him on his platting machine.

In 1808 William Elliott, of Nottingham, employed himself in putting together lace machinery.

He used tubes through which to pass his stationary warp threads, and on the outsides of which tubes were catching instruments whereby he carried the traversing warp threads round; and upon crossing for the traverse were racked round and twisted the contrary way.

The attempt was unsuccessful.

The following is a very imperfect account of a machine, which was much talked of at the time (about 1808) attempted by Richard Palmer, of Bingham, where he was also engaged in perfecting the processes of stereotype printing:

> In the proposed lace machine he used very small brass bobbins shaped like common winding bobbins, having teeth to be racked by an under pinion bar; the warp threads when racked being in the teeth, and by having two such bobbin bars the crossing was effected by removing the warp threads one bobbin each way.

This machine was intended to shift the warp from bobbin to bobbin by one motion, to make the twist by one racking movement, and to run up the twist by point bars in the third motion. Palmer died early leaving his attempt incomplete.

CHAPTER XIII.

LACE MANUFACTURE.—1800 TO 1810.

IT has always been necessary in every business to secure not only the best machinery and workpeople, but also excellence in materials. This was eminently the case with the English and foreign lace trades, whether dealing in articles made on the cushion or by machines. Both classes were eminently indebted to a native of Nottingham, Mr. Samuel Cartledge, for an improvement in the manipulation of fine numbers of doubled cotton yarn, whereby that article was first rendered suitable for the manufacture of pillow lace, for which linen yarn had hitherto been the chief and almost the only material. In the eye of the connoisseur in lace, no doubt exquisitely fine linen thread used still for imperial and royal purposes will be preferred at whatever cost. But for any less exalted purposes the fine cotton yarns, which were introduced in 1805 to the acceptance of English cushion and machine lace makers, and since universally employed both at home and abroad, have some special advantages to recommend them. The cotton thread is more elastic than linen yarn, therefore breaks less in the hands of the lace maker. It gives to the finished article a more brilliant appearance, and is much less costly. After encountering much and deeply rooted prejudice carried to extreme lengths, this gentleman succeeded in establishing the use of his carefully twisted and otherwise specially prepared cotton lace yarn in the Buckinghamshire and Northamptonshire pillow lace districts, where, in February, 1815, at a meeting of manufacturers—

"It was resolved unanimously that Mr. Samuel Cartledge, of Nottingham, is entitled to the thanks of the lace manufacturers for his invention of cotton thread used in the manufacture of British lace,

and for his introduction of the same to the trade on liberal terms, and that the chairman do communicate the same to Mr. Cartledge.

"(*Signed*) J. H. HANDSCOMB."

From thence the use of cotton thread spread to the other English lace district of Honiton. And at length, just after the resumed manufacture and consumption of pillow lace on a large scale in France, it gradually became the material of which all but the most expensive articles were made (silk excluded), and, according to the testimony of M. Aubry, "it is incontestible that the use of cotton in place of linen thread, has greatly assisted to develope the fabrication of lace by augmenting the consumption and facilitating the production."

Although silk was used principally in the point net manufacture, which was the chief constituent of the lace trade at Nottingham from 1795 to 1815; yet there had been some amount of warp and other cotton lace made from coarse yarns since 1770. The advent of the twist net made for years entirely of doubled cotton yarn, and which required a strong, and even fine thread, gave rapid impulse to the demand for it in its most perfect form. Mr. Cartledge gained by supplying this material a considerable fortune—a well deserved reward for his ingenuity and persevering enterprise.

Messrs. Houldsworth, of Manchester, became spinners of these fine first quality yarns. Nos. 200 to 300 were principally used. Their nett list in 1805 was for No. 200, £3. 3*s.* 6*d.*; 220, £4. 1*s.* 6*d.*; 240, £5. 6*s.* 6*d.*; 260, £7. 3*s.* 6*d.*; 280, £9. 9*s.* 6*d.*; 300, £12. 8*s.* 6*d.* per lb. These prices continued for many years; and as finer numbers were enabled to be spun, still more extraordinary prices were obtained for them. It is said this house sold in one year £70,000 worth of fine yarns for lace purposes alone. In 1812, No. 320 were sold for £15. 2*s.*; 340 for £22. 6*s.*; and 352 for £27. 8*s.* per lb. Well might that very clever and successful house say, when writing in reference to their lists of prices, "In making similar researches to these, it is some satisfaction to look back upon good old days, when profits and prices were more substantial than at present." No. 100 has been sold since then for 2*s.* 4*d.*, and No. 200 for 7*s.* 6*d.* per lb.

It was in 1808 that Mr. Joseph Page, of Nottingham, made the first piece of double press point net, in which doubled fine yarn was used. It was sold for 3*s.* 6*d.* the square yard.

The following particulars given in 1831 by competent authority will afford some idea of the extent of the

production of lace thread, and the importance of the business to the spinners and doublers of that day:

There were 608,000 spinning spindles, 251,000 doubling spindles; of the latter, half were in or near Nottingham. The total value, including buildings, steam engines, and gearing, was £601,510, requiring also a floating capital of £200,000.

There were 3472 adults employed in spinning, at earnings varying from 8*s.* to £2 weekly, perhaps averaging 17*s.*; and 3906 children gaining 2*s.* 6*d.* to 7*s.* weekly, averaging about 5*s.* Hands employed in doubling: 861 adults from 8*s.* to £1. 10*s.* per week, averaging 12*s.*; and 1449 children from 2*s.* 6*d.* to 7*s.*, averaging 4*s.* 6*d.* 1,730,000 lbs. of raw sea island cotton wool were consumed, costing £129,750; and 1,110,000 lbs. of lace thread was produced, of the average value of £550,000; at that epoch leaving small gains for the employment of capital and labour in spinning and doubling cotton yarn of these fine numbers. In 1836, 1,850,000 lbs. of sea island wool were consumed, costing £185,000, producing 1,210,000 lbs. of yarn, worth £624,330. A large increase in the consumption of cotton yarn of numbers below No. 120 has since taken place for the manufacture of curtains and 'foundation' nets, but an approximate estimate of quantity or value cannot be obtained by us. The entire consumption, including that of France and Belgium, has now become very great.

The question of an equitable mode of reckoning in payment for work done by those employed in the making of any kind of lace on the loom, had for many years caused anger and contention, which increased with the rapid growth of the trade. The practice of the employers in taking in work from the machine was to measure out twelve stretched out arms' length of the piece, and consider them to be twelve yards, and to be paid for as such to the workman. This was manifestly so loose, and, by the necessity of the case, so unjust a mode of dealing with an elastic article like lace, as to make it a matter of surprise that it was borne with so long.

On the 24th August, 1809, the workpeople addressed the lace manufacturers then assembled to consider of any measures proposed for the good of the trade, and pointed out the equity of paying by count in length, shewing that the plan was quite feasible. Their memorial was signed and presented by John Blackner, the future historian, and three others on the part of the workmen. An instrument was devised by Handley, a lace maker of Nottingham, (afterwards poisoned in a frolic) and Thomas Brookes for the purpose of exact measurement by the movement of the machine itself acting upon

a tooth and pinion wheel, to which were attached a bell and hammer which announced the completion of every 240 meshes in length. To shew these, marks were placed on the selvages of the pieces. This 'rack' as it has ever since been called, was applied to the point net machines in 1810 by James Oakes, a workman of Sneinton, and by Mr. William Hayne; and in 1811 by Thomas Roper, a workman to the warp machine; and to the carrier bar of the bobbin net machines by Jonathan Brown, afterwards living at Calais; and notwithstanding the objections of Mr. Nunn, a large lace manufacturer at once became universal. It has since been the standard of measurement of labour in every department of the lace business, and of length from the maker in selling to the finisher for the market. As a check upon any fraud by the workman, or possible error in the rack, it has been the practice to enable buyers to ascertain for themselves the length of their pieces of traversed twist bobbin net, by filling one bobbin with a *coloured* thread, which placed at one end of the row at the beginning of the piece, by its diagonal courses, indicates infallibly the number of holes in its length. A flagrant case of misdemeanour in this matter was punished with marked severity by the Judge of Assize before whom it was tried forty years ago; since then similar frauds have become very rare indeed. Finished goods are sold by the yard, or dozen yards, or the article, as the case may be.

Where fancy lace is in question, in which there is much weaving of fine work, twisting, and pearling, combined with little elasticity, the Nottingham manufacturers are beginning (1866), when disposing of these goods as they come from the machine, to charge them by the yard and not by the rack as hitherto.

Our narrative now approaches the invention of the bobbin net machine. While tracing the events that previously occurred in the Nottingham lace manufacture, it has been seen that many persons in that district had been endeavouring, since the addition of the point net machine to the stocking-frame, to produce by machinery a more exact imitation of twisted and traversed cushion lace, and that some of these died in poverty, and others

became insane. The difficulty lay in providing by mechanical movements for the threads twisting round each other, and then travelling in three separate sets or directions; viz., half of them longitudinally, and of the other half part to the right hand diagonally and the other part to the left hand diagonally across the nets. John Moore and the others, whose ingenious labours have been described, had not succeeded in solving this problem. They had got the twist but not the traverse; the latter being essential to the soundness of the twisted net. Blackner justly intimates "that neither Morris, Lindley, nor Robert Brown made *traversed* net, nor furthered it by their efforts."

Amongst those who were afterwards engaged in these attempts were Edward Whittaker and Charles Hood. These names have been much linked together by their connection for a time with each other, and by subsequent legal enquiry as to how far they proceeded in them, and what was the result of their efforts. The accompanying (Plate III.) will give some assistance in arriving at an accurate conclusion upon these points. It is a facsimile of a pen and ink drawing representing the most important parts of their respective machinery designed to produce lace. It was exhibited in an action in 1813 on the subject of Heathcoat's patent right to a bobbin net machine, and is no doubt correct.

Whittaker was an uneducated man, yet possessed of mechanical talent; but being of intemperate habits his application to what he took in hand was fitful and uncertain, and as a consequence his circumstances were ordinarily very low. In the prosecution of his business of a 'setter-up' of machinery, he had taken a warp machine to France. On his return, he stated that he had there perfected a plan for making bobbin net; spoke mysteriously about his speculative movements; called some parts of his machinery 'indivisible,' and others 'invincible.' At this time Mr. and Mrs. Whittaker lived at New Radford, where Mr. Olive Moore knew him; and though he did not see what he was doing, yet remembers it was said afterwards, that "Whittaker's bobbin and carriage were the foundation of Heathcoat's."

Whittaker's own statement was, "that in the machine he constructed there were eight or ten threads in an inch, and that on it he produced an article shewing wavy lines like 'blonde' (Mechlin) net."

He seems to have used a comb bar like the jack bar of the stocking-frame. There was no warp, and all his threads were put on bobbins, each of which was fixed in a nick cut in a sort of carriage. Every other bobbin had to be lifted over the next one and let down into the vacant space. The first ends of the threads were fastened to the further end of this horizontal machinery; and the twist obtained was pushed up by the hand. When he attempted to cross the threads the bobbins tumbled out of their places. This attempt presents the use of a modified shuttle and pirn, or an ill arranged bobbin and carriage, not reduced to the space occupied by an interstice of lace; and the other parts, so far as they are known and can be understood, were not calculated to attain the end proposed.

The machinery, before being taken to Loughborough, was put into the hands of Leonard Elliott and Edward Morley, by James Hood, neither of whom could make it work. Mrs. Whittaker, then a widow, stated, in 1815, that her husband made some small pieces of lace from this machine, in which she said "there were besides comb bars and drivers, brass bobbins and carriages made by B. Thompson, the brass turner, before it went to Loughborough;" on the same occasion, Mr. James Taylor stated:

"That being partner in 1805 with Mr. James Hood, as hosiers, in Nottingham, Whittaker entered into an agreement with him about that time to bring and work a model of a bobbin net machine. Seeing a small quantity of lace on it, he was supplied with money to construct a machine. It had bobbins (called from their size 'guinea wheels'), carriages, jacks, comb bars, and drivers or points. Taylor, a joiner, made the wood work; B. Thompson the brass bobbins and carriages; Dalby, of Loughborough, the iron work. After a time Charles Hood persuaded them to let the machinery be taken to Loughborough, where his tools were. Whittaker went to instruct in the work. Taylor became tired of the delay and expence, and they gave up the business, upon which Whittaker returned to Nottingham."

Mr. James Hood, the partner, also stated—

"That he saw lace attached to the machine, but did not see any made; though an additional bonus was to be given to Whittaker when the machine was *seen* to make lace."

He stated also—

"That he had seen Whittaker make some lace on a cushion, and had no doubt now that what was on the machine was thus made.