

THE
INDUSTRIES OF SCOTLAND

THEIR
RISE, PROGRESS, AND PRESENT CONDITION.

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MANUFACTURE OF FISHING-NETS.

NET-MAKING BY HAND—STORY OF THE NET-LOOM AND ITS INVENTOR—THE
MUSSELBURGH NET-FACTORY—HOW NETS ARE MADE BY MACHINERY—EX-
TENSION OF THE TRADE, AND DECLINE OF HAND-NETTING.

KNITTING or weaving fishing-nets is one of the oldest branches of the textile manufactures of Scotland. Many centuries ago the dwellers on the shores of Caledonia knew how to twist the fibres of flax and hemp into traps for fish ; and for many years past the manufacture of nets, lines, and other engines for capturing the finny tribes, has been an important branch of industry in the towns and villages adjoining the sea. It became customary for the wives and families of the fishermen to spin and weave the nets required for their mutual support. The domestic spinning apparatus has now, however, been almost entirely discarded in that connection, though hand-knitting continues to be practised in certain parts. In Caithness-shire, for instance, some twine is still sold to be worked into nets by women in their own homes. A dozen years ago thousands of nets were made by hand in that county, and in the villages on the south side of the Moray Firth, the price paid being from 7s. 6d. to 10s. each. Such was the cheapness of labour in the north that, though it requires five weeks' close application in order to produce one net, there were always more willing hands than could find employment in that way, and a real hardship was experienced by many when machines began to compete with hand-labour. It is probable that in a few years net-making by hand will be entirely abolished, for the machine-made nets are much superior to the others. The material used is also undergoing a complete change. That "there's nothing like hemp for nets," was a maxim with the fishing fraternity from the earliest times, but within the past five or six years the virtues of cotton have come to be understood and appreciated, and now hemp is rapidly going out of fashion. It has been discovered that, while a

hemp net gradually loses its strength and becomes almost useless in five or six years, a cotton net remains unimpaired for nine or ten years—so that a cotton net, while quite as cheap as a hemp one, is twice as durable. Another advantage is that a cotton net can be made much finer and lighter than one of hemp. On the west coast, and on the south side of the Moray Firth, some flax nets are employed; but as they are considered inferior to cotton, they are not likely to remain long in use. When hemp comes to be totally discarded, hand-labour in the making of nets will cease; for it has been found impossible to produce cotton nets by hand either so cheaply or so satisfactorily as by the machines.

The ease with which hand-labour could be obtained in the coast villages, and the practice of fishermen having their nets made chiefly by their own families, were circumstances which tended to prevent mechanicians from considering the practicability of constructing a machine that would supersede netting by hand. The supply of nets had always been equal to the demand, and there was little prospect that fishermen—who, by the way, are notoriously conservative in matters professional—would patronise any contrivance which was destined to supersede the home employment of their families. Such were the circumstances under which the inventor of the net-loom set himself to work out an idea which he had entertained from boyhood. The history of the net-loom and its inventor has not previously been written, and what follows is the result of personal inquiries made in various quarters.

Towards the close of last century a young man named James Paterson followed the trade of a cooper at Musselburgh, and, being by it connected with fishing, he became conversant with the making and use of nets. As he watched the nimble movements of the net-workers, the idea struck him that it might be possible to devise a machine that would relieve the women from the tedious task of net-making. Not considering himself capable of putting the idea into practice, he did not mention it to any one. Some time afterwards he joined the army, and in the capacity of Deputy-Assistant-Commissary-General served in Egypt, the Peninsula, and at Waterloo. He used to relate how through all the trials of war the idea of working nets by machinery haunted him, and he devoted many spare hours to thinking over the matter. After Waterloo Mr Paterson left the military service, and, having acquired some means, resolved to devote himself to the invention of a net-loom. It would appear that he went first to Queensferry, but before he had completed the machine removed to his native place, Musselburgh. With the aid

of an ingenious mechanic, who was sworn to secrecy, and after many months of anxious labour and many failures, Mr Paterson saw the machine take promising shape, and at length things were so far advanced that a trial was to be made. Worn out by anxiety and galled by many unsuccessful experiments, Mr Paterson was disposed to regard this trial as a decisive one. He thought he had exhausted his inventive powers, and felt inclined, if the machine did not then succeed, to abandon the idea he had cherished so long. The critical moment arrived, the last lever and spring had been adjusted, and all was ready. With nervous touch the inventor and his assistant moved the machine. Its action was easy, and all the parts appeared to work in harmony to the desired end. After a few moments, however, the machine came to a stand, and no available power could move it. It was carefully examined in every part, but no cause for the sudden and complete stoppage could be found. Some hours had been spent in trying to discover what was wrong, when Mr Paterson lost his temper, flung the key of the workshop to the mechanic, said he might "make a kirk or a mill" of the concern, and then went home. The man was no less distressed than his master, yet he was not disposed to abandon the invention. He went to a smith who had been doing some work for Mr Paterson, and, accompanied by the smith, returned about midnight to have another look at the machine. The smith was quite puzzled by the apparatus, and held out no hope that he would be able to make it work; but as he peered with wonder through the ranges of needles, &c., his eye lighted on a bolt which appeared to be loose. He called the mechanic's attention to the fact, the bolt was adjusted, and a fresh attempt was made to start the machine. The loose bolt had been the cause of the stoppage, and the machine worked beautifully when the bolt was put right. After getting the smith to take a vow of secrecy, the mechanic sent him home, and, notwithstanding the unseasonable hour, rushed into Mr Paterson's house to announce the fact that he had got the machine to work. He met with an indifferent reception, for the news appeared too good to be true. Mr Paterson got up, however, and went to the workshop, where he had the pleasure of seeing that the idea which he had nursed for so many years was not an impracticable thing after all. There was the machine turning off row after row of meshes at a rate which would leave a dozen hand-workers far behind. Mr Paterson patented his invention, and established a net factory in Bridge Street, Musselburgh, about the year 1820. In order to preserve a secret that had cost so much anxiety, labour, and money, steps were taken to prevent

the workpeople from carrying away descriptions or sketches of the machine.

It was at first difficult to find a market for the machine-made nets, and many years passed before they found much favour with fishermen. In 1839 Mr Paterson had eighteen looms at work, and these, together with the spinning-machines, gave employment to upwards of fifty persons. About seven years before that date a Mr Robertson from Sunderland went to Musselburgh, and started in opposition to Mr Paterson. It was alleged that Mr Robertson made his machines from drawings which were obtained surreptitiously from some of Mr Paterson's workpeople; and Mr Robertson, in order to avoid an action for infringing the inventor's patent rights, sold off and left the country. The greatest difficulty that Mr Paterson had experienced in working out his invention was the formation of a knot which would not slip. The knot put on by hand is peculiar, and Mr Paterson did not succeed in making one similar to it, though the knot he made was firm enough. About thirty years ago a mode of forming the hand-knot on the machine was discovered by Mr John Low, manager of Mr Paterson's factory, and was adopted in all the machines subsequently made.

The principal manufacturers of nets in Scotland are Messrs J. & W. Stuart, Musselburgh, who in 1849 acquired Mr Paterson's factory and the patent rights to his invention. In their hands the business has grown steadily; and though there are a number of rival manufacturers, Messrs Stuart have been able to maintain the foremost place. Their new factory is one of the finest in the country. Finding that the building in Bridge Street, Musselburgh—which may be called the nursery of the trade—was, notwithstanding several additions, too small and otherwise inconvenient, the firm determined to erect a new factory. They selected a site on the right bank of the Esk, adjoining the railway station, and about fifteen years ago completed the first section of a new factory. It afforded accommodation for 100 looms, with hemp-preparing and spinning-machinery, to the extent of 3500 spindles. During 1867 they made extensions which more than doubled the size of the place. About ten years ago, when cotton began to be used as a substitute for hemp in making nets, Messrs Stuart turned their original factory into a cotton-spinning mill; but as the change of material advanced, the productive power of the cotton machinery was not equal to requirements, and the principal portion of the recent additions to the establishment on the Esk is a fine cotton mill containing 20,000 spindles. The buildings altogether form an oblong square, and cover a space of

four acres. One end of the square is occupied by the cotton mill, which is an elegant and imposing structure, consisting of four lofty storeys. The front of the cotton mill is of a highly ornate character, the lower part being rusticated, and the upper decorated with pilasters and finely sculptured emblematic figures. On either side of the square, and at the end opposite the cotton mill, are the hemp, spinning and weaving departments, stores, mechanics' workshops, &c. The inside of the square is occupied by a tastefully laid out ornamental garden, in one end of which stands a detached building containing the counting-room and private offices. The factory is connected by a branch line with the North British Railway.

Cotton-spinning has already been described, and a few sentences on the preparation of hemp will suffice. In tracing the hemp through the various processes of manufacture, the visitor must follow it from the spacious stores to the softening-room, where it is fed through sets of grooved rollers, which make the fibres more pliable, and so facilitate subsequent operations. The heckling comes next in order, but neither in that nor in the subsequent operations of drawing, roving, and spinning is there anything different from what has been described as pertaining to the manufacture of flax and cotton. The machinery used is of the most perfect description, and the fineness and evenness of the yarn produced is wonderful when the coarseness of the hemp fibre is taken into account. In twisting two or more folds or "plies" of yarn together to make twine, the yarn is made to pass through water. The water lays all the loose fibres, so that they get twisted into the body of the twine, thus at once increasing its strength and improving its appearance. After the twisting is completed, the twine, while still wet, is run through a rubbing-machine, which makes it perfectly smooth. The Musselburgh hemp twine has long held a high place in the favour of the fishermen; and though in recent years cotton has become more popular than hemp, Messrs Stuart have never had their hemp-spinning machinery idle. The twine is reeled off the bobbins of the twisting-frames into hanks. The hanks are stretched in frames, and placed in a hot-air chamber, where they are thoroughly dried in a few minutes. The twine intended for sale is made up into bundles of 28 lb. each, and that which is to be made into nets on the premises is wound upon large spools or bobbins. The machinery is driven by two handsome engines of 100 horse power each.

The weaving shed is an extensive place. It contains 200 looms, with space for 100 more, which are being put in. The shed is

lofty, well lighted, and well ventilated. Each loom requires the space of three or four common power-loom. Though called a loom, the apparatus has no resemblance to the ordinary weaving-machine, being more like the knitting-frame—indeed, some portions of the two are identical in shape and name. The part which forms the mesh consists of an arrangement of hooks, needles, and sinkers, one of each being required in the making of every knot. In a loom capable of working a net 400 meshes in depth, there are consequently 1200 moveable parts directly employed in the formation of each row. The looms are from six to eight feet in width, and about six feet in height. The hooks and needles are ranged horizontally at a height of three feet above the floor. The mechanism by which they are put into operation is of a peculiar and complicated kind. Indeed, it is obvious that the machine, however well it may accomplish its work at the slow rate at which it is worked, is not yet perfect, the clumsy looking system of weights, springs, and levers, and the singular movements which the operatives have to make in order to bring them into play, are decidedly primitive, and a long way behind the automatic spinning-machinery situated in another part of the establishment.

Messrs Stuart have made and patented various improvements on the original loom, but there is still scope for the exercise of mechanical skill in the way of effecting further amendments. It is at least possible to adapt the machine to be moved by steam or water power. The mode of working the loom may be briefly described. The operative moves a lever which draws the last completed row of meshes off the sinkers, and transfers them to the hooks. Another lever is moved, and the meshes are caught by the needles. The effect of these changes, and the movement of other parts of the machine, is to twist the lower part of each mesh into a loose knot. The foot of the operative touches another lever, and a steel wire is thrust across the machine through all the knots. There is a hook at the end of this wire—or shuttle, as it is called—into which the end of a piece of twine is fixed. The wire is then withdrawn, and as it goes takes the twine along with it. Now the sinkers play their part. They consist of thin slips of brass having a hook or notch formed on the upper end, and are situated between the needles. When the twine has been drawn across through the loops of the meshes, the sinkers are released in succession, and as they descend each draws down the cross thread into a loop, sufficient to form two sides of a mesh, the other two being formed by the same parts of the previous row. One or two movements more remove the knots

off the needles, and draw them firmly, thus completing the operation. In forming each row of meshes, the worker has to press upon half a dozen levers in succession, and pass from one end of the machine to the other. The occupation is consequently an unusually active one. As the work proceeds, the net is wound upon a self-acting cylinder which forms the upper part of the machine. There is an index attached to the cylinder which records the progress of the work. When a sufficient length of netting has been made, it is unwound from the cylinder, and taken to the "guarding-room," where several rows of stout twine are worked on what is to be the upper side of the net. That is called the "guarding," and its purpose is to withstand the friction of the "back-rope." It has not been found possible as yet to put on the guarding in the loom, and, accordingly, girls are employed to work it by hand. The net is next carefully examined, and any defect made good. It is then neatly folded up, and in that condition goes into the market, the subsequent operations necessary to fit it for use being performed by the fishermen.

In addition to their famous herring-nets, Messrs Stuart make nets for the salmon, mackerel, pilchard, and sprat fishing. The pilchard-nets are made of stout hemp twine, while the sprat-nets are composed of fine cotton thread. There is as great diversity in the varieties of the herring-nets. Many of the Dutch fishermen retain their old faith in heavy gearing, and have their nets made of three-ply hemp twine; others, taking a hint from the Scotch fishermen, are beginning to use light nets. The fishermen on some parts of the Scotch coast are now using cotton nets, which look like gossamer webs beside the Dutch "three-ply." An index of the different notions prevailing as to what a net should be is afforded by the fact that Messrs Stuart make for herring-fishing some cotton nets sixty yards in length, and 300 meshes in depth, which weigh only 12 lb.; and others of the same size which weigh 60 lb. The hemp-twine used is either two or three ply; while the cotton twine ranges from three to thirty ply. Messrs Stuart have shown their nets and twine at all the recent exhibitions, and received medals and honours at London, Dublin, Paris, Amsterdam, Boulogne, &c.

In their cotton mills and net factories, the firm employ about 800 persons, a large proportion of whom are women and girls. Nearly all are paid by piece. The average wages of men in the spinning department is 21s. a-week; of women, 7s. 6d. to 8s.; and in the weaving department men make 20s., and women 10s. to 18s. Many of the workers live at a distance from the factory, and it was custo-

mary with them to carry a supply of provisions for the day when they went to work in the morning. Considering that such a mode of food-taking was neither healthful nor pleasant, Messrs Stuart provided a dining-hall, kitchen, and cook; and now the workpeople can have a freshly cooked hot breakfast and dinner for an almost nominal payment. A breakfast of porridge and milk costs 1d.; of tea and bread, 2d. Dinner of soup and bread costs 1½d., the same with meat 2d. additional.

During the past ten years net-making, as a branch of manufacture, has increased rapidly. In Scotland there are thirteen or fourteen firms engaged in it. Nearly 600 looms are in use, and in making twine and nets upwards of 2000 persons are employed. The hemp and flax twine used is made in Scotland, but all the cotton, except what is made by Messrs Stuart, is brought from Manchester. Singular as it may appear, it is a fact that net-making by machinery was only recently introduced into Wick, the metropolis of the herring fishery. Though the greater portion of the nets used in that quarter were machine made, and though labour during ten months of the year is cheaper than in almost any other part of Scotland, no one had sufficient enterprise to embark in the manufacture until about two years since, when Mr George Manson gave the thing a trial, and was at once eminently successful. The trade has also been begun recently in Elgin, Largo, and Buckie. Messrs N. & N. Lockhart, Kirkcaldy, are next in extent to Messrs Stuart. They have been engaged in making twine and nets since 1854, and three years ago built a fine new factory in which they have sixty-four net-looms, and a large quantity of spinning-machinery for twine and yarns.