

safety-lamps in general use. But the mystery of the calamity at the Albion Mines is that every precaution imaginable seems to have been taken, and all the machinery made after the best patterns, and yet in vain. The deposit of coal is too valuable to be abandoned, being one of the finest in the world, and it is probable that at some time operations will be resumed. But it is certain that this cannot be done for a long time to come.

Meanwhile there are left to the charity of the public, it is said, "33 widows, 110 orphans, and 700 men, representing a population of 2,000 people, thrown out of employment in the face of a Canadian winter." An appeal on their behalf has been sent out by the managers of Nova Scotia mines, clergymen, and others. The case is certainly one that calls for an immediate and generous expression of popular sympathy.

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THE MANUFACTURE OF BOLTS AND NUTS.

Perhaps there is no other one cause so potential for the cheapening of production nowadays as the minute division of labor carried out in every leading branch of manufacture. And the cost of making is not only thereby greatly reduced, but the quality of the product is improved in yet greater proportion. The industry which forms the subject of the first page illustrations in this paper affords a conspicuous example of this course of development in modern manufactures. There is hardly a large manufacturing establishment or a respectable machine shop in the country which has not the available facilities for forging bolts, turning screws, or making nuts, yet it is comparatively seldom that one of either of these is made by the mechanics who put them in their machines or the manufacturers who use them in a thousand different articles of which they form an indispensable part. The reason is obvious: the manufacturer who has constituted this his especial business can not only make them far better than an ordinary mechanic, but so much cheaper that it seems like wasting time to do even trifling work of this kind in a general machine shop, the ready-made bolts and nuts being of such uniform good quality that a flaw or a weak spot can rarely be found in them, and of almost every desired size required for use in all kinds of work.

It is now nearly forty years since two of the present proprietors of the great bolt and nut factory of Russell, Burdall & Ward, commenced business in this line, at a point on the Byram river just within the Connecticut State line, about two miles from the village of Port Chester, N. Y., and twenty-five miles from New York city. The site selected was one of romantic beauty, in a picturesquely wooded dell, but their location here was for the purpose of utilizing the water power which over forty feet fall in the Byram river afforded. The contrast between their business of thirty-five years ago and its extent to day is well illustrated by the two views, which show their factory as it was then and is now. Then one horse and wagon was sufficient for the bringing of all their iron and the shipping of all their products from Port Chester, and every detail of the work not only received the personal attention of the proprietors, but the most important portions were the results of their own skill and handicraft. Even greater, however, than the difference in the amount of business, is the contrast between the way of making bolts and nuts at the commencement of their manufacture and that which is followed to-day, the many elaborate machines now used producing results which were hardly imagined possible at that day, and a large proportion of these machines, either in all their parts or in important improvements, being the invention of members of the firm.

The iron used is received in the form of bars or rods, both square and round, and in great hanks or coils, a large stock being always kept on hand. Iron only is worked here, and a considerable proportion of the goods are made from the best charcoal iron. In the main bolt making room, shown at the bottom of the page, there is probably as great a variety of machines for making bolts, and the capacity for as large a production, as can be found in any single establishment in the world. Nearly all the iron is worked cold, an improvement which has, within a few years past, been finding steadily increased favor, from the great additional strength which this manner of working gives to the goods, as against the former method of making all the blanks by the old-fashioned method of forging. Care is necessary, of course, that a bar of cold iron be not submitted to too many manipulations, but there is never any danger of this kind in the methodical operations of bolt making, where every blow the iron receives, and every time it is to be submitted to pressure, are accurately determined before the commencement of the work. The increase in strength in bolts, from working the metal cold, is estimated at between 50 and 100 per cent, and the effect in general is to give the iron a good deal of the qualities of hard steel.

For this cold working, however, powerful machines are necessary, as every portion of the labor of forming the iron is done by them, the labor of the hands being confined almost exclusively to the feeding of the machines. There are different patterns of machines here for doing the same work, but in the making of a blank for a bolt, either the wire or rod is fed into the machine so as to pass between a pair of feed rolls, which hold the metal by friction, and convey it into a steel tube or die in the central part of the machine, where the length of the bolt is accurately determined by an adjustable gauge, and is cut off in lengths sufficient to allow enough surplus metal for the forming of the pattern

of head the bolt is to receive. As it is cut off it is grasped between fingers and carried to the opposite end of the die, where it is pushed back into a hole having the form of the bolt head, where a hammer strikes it and forces the surplus stock into the desired shape, after which the blank is driven from the die and drops into a box beneath.

When these blanks so headed are of square iron, they are taken to another machine, where they are suspended by their heads in a long row, between two parallel lines, from which they feed themselves into the machine, where they are grasped, one at a time, by fingers, and each one is held between the jaws of powerful revolving cam formers, being advanced and withdrawn three or four times, until the square iron is perfectly rounded, either entirely up to the head or so as to leave a square shank. The fingers then drop the rounded blank to one side, and, reaching back, pick up another one, to go through the same operation, the whole process impressing one with the idea that the machine is almost possessed of reasoning powers, so careful, deliberate, and intelligent seems to be its imitation of the motions which a workman would go through in performing a similar part of the work.

The forming of the point and the cutting of the thread are done by other machines, in which are the same feeding device and similar automatic working, these operations, however, sometimes requiring two machines, while for some goods only one operation is necessary. When the blank is fed into the jaws, which seize the end bearing the head, it is advanced against a tool which forms the point, if that part is to be completed here, and, this work being done, the blank is then passed to a chasing tool, which cuts the thread as in an engine lathe, varying the number of cuts to the size and the amount of metal to be removed. This machine, as also the blank formers and headers, are so arranged as to guard against accidents as completely as if they were possessed of intelligence. If any one part ceases to operate, or to properly fulfill its functions, the machines will stop of themselves, or have self-adjusting contrivances to remedy the difficulty; if the blanks are too long or too short they cannot be worked, and if too great strain is brought on any part, from any displacement of the machinery or the introduction of foreign matter, the machine stops and makes a noise readily distinguished from that caused by regular working.

The above describes the main features of all the bolt-making machines, although, from the great variety of goods made here, no less than from the many improvements which have been successively introduced by the firm, there are many differences in the details of the operations in swaging and finishing. All of the work, however, is performed by machines which work automatically, and some of the machines here for forming particular patterns of bolts are different from those in use anywhere else. The firm have a large machine shop, in which they make their own machinery, and besides several patents which Mr. Ward has obtained, they have made other improvements, not patented, more especially valuable in the making of goods of which they have the almost exclusive production.

In the nut-forging shop, represented in one of the illustrations, the bars are heated, the workman keeping one bar in the forge fire while he feeds the heated end of another into the jaws of a machine which cuts off the required length and punches it, while at the same time the nut is formed by hammers striking it rapidly on the bottom, top, and sides, to compress the metal and give the nuts the desired shape. This machine works very rapidly, and the goods are certain to be perfectly uniform in quality and shape, whether the nuts are square, hexagonal, or any other form.

The packing room, represented in one of the views, occupies a large department, for here are put up in paper boxes each day no less than 125,000 bolts and nuts of the smaller sizes, the larger ones being generally shipped in bulk. This work is done principally by girls, who, in long practice, acquire a degree of manual dexterity in this part of the work which is surprising to any one who has not previously noted the results of such training.

It would be impossible to enumerate, in anything less than an elaborate catalogue, the number of different kinds and patterns of bolts and nuts made at this establishment. Every standard article in this line forms a part of their regular production, in all the lengths and sizes ordinarily used. A large business has been done from the first in carriage, tire, and sleigh bolts of every description known to the trade; stove bolts are made in large quantities; plow bolts are an important specialty, and bolts for mowing machines, cultivators, and elevators, with nearly all kinds of machine bolts, knob screws, etc., are a portion of the staple goods regularly manufactured. Besides these, however, the firm do a large business in the making of special sizes and lengths, to order, for use in particular departments of manufacture, their long experience, and the high quality of their goods, which it has always been their first care to maintain, giving them special advantages for filling the large trade of this kind which comes to them.

The Library Hall is a building erected by the firm for the purpose of affording their employes better opportunities of self-culture. It contains a choicely selected library of about 2,000 volumes, and the scientific portion of the books were chosen by Prof. Youmans with especial reference to the needs of such a class of working readers. There is here, also, a warmed and lighted room, intended to make a comfortable place in which the hands can profitably and pleas-

antly pass their spare hours. No intoxicating liquors are to be had within two miles of the establishment, and it is the design of the proprietors to make the surroundings of those who live in the immediate neighborhood, and who earn their living there, so pleasant that there will never be any call from their hands for a place where liquor can be bought.

The firm have no city warehouse, but do all their business from the factory at Port Chester, N. Y., where the partners reside and give their personal attention unremittingly to the work of the establishment.

DECISIONS RELATING TO PATENTS.
Supreme Court of the United States.

BALL *et al.* vs. LANGLES *et al.*

1. Reissued letters patent No. 4,026, granted to Hosea Ball, June 14, 1870, for an improvement in ovens, declared to be invalid, it being for a different invention from that covered by the original patent.

2. The Commissioner of Patents is invested by law with authority to determine whether surrendered patents are invalid by reason of defective or insufficient specifications or by reason of the patentee's claiming as his own invention or discovery more than he had a right to claim as new, and whether these errors have arisen by inadvertence, accident, or mistake, and without fraudulent intention. His decision as to the existence of these prerequisites is conclusive, and not subject to review by the courts.

3. The Commissioner, however, has no authority to grant a reissue embracing new matter or a broader invention than what was revealed in the original specifications, drawings, or models.

4. The question of identity of invention is to be determined by an inspection of the two instruments.

5. Where an original patent described an interior baking chamber as provided with perforations in its sides and back, whereby its interior had communication with the fire space only indirectly through side and back flues, *Weld*, that a reissue removing the restriction as to the location of the perforations, so that the interior of the chamber may communicate directly or indirectly with the fire space, is void for containing a different invention.

Appeal from the Circuit Court of the United States for the District of Louisiana.

Mr. Justice Strong delivered the opinion of the court. We cannot doubt, says the court, that the purpose of the reissue was not to cure defects in the original specification, or any deficiency in describing the invention, but to cover other devices which the patentee had not in mind when he first applied for his patent, and which may have subsequently come to his knowledge. Thirteen years after the patent was granted had elapsed before he applied for any reissue. However this may be, the reissued letters are so clearly for a different invention from that for which the patentee first applied, containing new matter, and so much broader, that we are constrained to hold that the Commissioner of Patents had no authority to grant them, and consequently that they are void.

The complainants' bill was, therefore, rightly dismissed, and the decree of the court below is affirmed, with costs.

Large Telegraph Wires.

At the recent meeting of the American Electrical Society in Chicago, Col. C. H. Wilson read a paper on the use of large telegraph wires. He held that the employment of large gauge wires for the quadruplex circuit was an advantage. A No. 4 wire recently laid between New York and St. Louis, was giving entire satisfaction. The question had been raised whether, in the desire to increase the conductivity of the wires, there was any limit to their size. There was a limit, and the conductivity could be increased by employing different conductors, copper instead of iron wire, for instance.

In a discussion which followed, Mr. Somers advocated the use of large wires, and said that their employment had simplified the quadruplex problem.

Phosphor Bronze Telegraph Wires.

M. E. Bède, formerly Professor at the Liège University, has recommended the use of phosphor bronze for wires instead of iron, phosphor bronze having four times the conductivity of iron, and being from three to four times as strong as steel. Aerial lines had the advantage of being easily inspected, but the disadvantage of being liable to accident, while underground lines were almost free from accident, but difficult of inspection. That inventor would render great service to telephonic communication who should devise a cheap method of constructing underground lines, that should at the same time permit of easy and complete inspection.

Lard Butter.

The success of butter made from beef fat (oleomargarine butter) has led to the use in Chicago of pork fat or lard for the same purpose. It has been reported that large quantities of this fraudulent butter have been shipped to England, seriously injuring the market for genuine American butter. The report is disputed by exporters, though it is admitted that sample lots have been sent by New York and Chicago dealers. Obviously if lard butter is wholesome and of good flavor it can be sold on its merits; if bad it should not be sold at all. In either case its sale as genuine butter would be a fraud and should be prevented.