



THE GREAT EXPOSITION—LETTER FROM UNITED STATES COMMISSIONER PROFESSOR R. H. THURSTON.

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In the Machinery Hall, the United States is most largely represented in that section of the classification which embraces

WOOD AND METAL WORKING TOOLS,

and we find strongest competition also in this section of the exhibits of the principal foreign countries. The largest and at the same time most noticeable exhibitors of metal working machine tools are Messrs. Sellers & Co., the Browne and Sharpe Manufacturing Company, and Pratt & Whitney, from the United States, Messrs. Sharp, Stewart & Co., Ransome & Co., and two or three other firms from Great Britain, and Ducommun & Co., from France. These firms all exhibit machinery which is remarkable for neatness and effectiveness of design, excellence of material, wonderful accuracy in fitting up, and also for the extent to which tool finishing has been made to excel and to supersede the older practice of finishing by hand. Many other firms, and especially those of European countries, exhibit fine looking tools; but there is usually but little originality to be discovered in their designs, and they present, to the eye and hand of the mechanic accustomed to our American practice, evidence that they have been produced under a system which is now rapidly going out of use in the United States and Great Britain. Half effaced file marks show that the more truly mechanical method of obtaining accurate surfaces by the use of the broadnosed tool and the many other refinements of modern practice are unknown to their builders.

The beautiful planer of Messrs. Sellers & Co., with its odd kinematic combination of the worm and the rack for driving the table, and its neat reversing gear, have long been known to mechanics at home. That at least some of the leading foreign builders have also appreciated it is proven by the appearance, in the exhibits of continental firms, of copies of this machine marked "système Sellers." All other nations, in fact, seem to copy American and British machinery, and rarely to produce original designs. In many cases, the copy is acknowledged, and sometimes the fact is made prominent in the circulars of the copyists, with the evident knowledge that it will render their productions more readily salable. Where attempts have been made to produce original designs, the departures from our standards have very generally been marked by most awkward proportions and frequently by extremely ungraceful shapes.

There is really very little in the exhibition which approaches, in any respect, the machinery exhibited by the several firms named; and those American mechanics who have come here to learn acquire only the knowledge that those from whom they expected to learn are simply following the leaders whose practice is already familiar to every American and British artisan. Nearly all of the machinery of this class in the United States section has been for a long time placarded "sold;" and it is extremely probable that several of the more novel machines have been purchased to serve as models from which to copy. Looking at these fine pieces of mechanism a few days ago, a distinguished member of the jury, whose opinion is probably as much respected as is that of any one of his colleagues, pronounced their builders "the leading constructors of the world, beyond dispute." And as even the leading French firm of Ducommun & Co., and the leading firms of every other nation (not excepting, in some departments, the British), copy their constructions, it may be readily believed that our American mechanics are occupying a most creditable position. The Sellers planer, the Browne & Sharpe universal milling machine, and the Pratt & Whitney screw cutter seem to have been most copied.

In the manufacture of metal working machine tools, the practice in America and in Great Britain is generally very similar. Strong, heavy frames, the absence of all moldings and other kinds of ornamentation which were so much in vogue a few years ago, great accuracy of workmanship, and the least possible use of hand tools (either in "assembling" or in finishing) seem the prominent characteristics on both sides of the Atlantic.

If a difference is remarked at all, it is usually that British builders put in more metal and build rather more substantial machines, while the Americans excel in the ingenuity and skill which they display in matters of detail. It may certainly be questioned whether the former do not err in

building machinery with a view to such extreme endurance. Improvements take place so rapidly that these very long-lived machines must frequently be superseded long before they are worn out; and when thrown into the scrap heap, they still represent considerable capital; and the machine which is set aside by the progress of improvement, at a time when it has more nearly reached the limit of its endurance, is the better machine of the two. To determine precisely where to find the proper limit is certainly a problem; but it can hardly be doubted that our best machinery is capable, usually, of doing good work for a length of time which will probably exceed that limit. It may be added also that, where capital is as valuable as it is in the United States and in all new countries, a good business policy dictates that a smaller proportion be expended in first cost and a greater in maintenance than in countries like Great Britain, where capital is plentiful and cheap.

The remarks which have been made in regard to metal working machinery at the Vienna exhibition will also apply to wood working machines. Here, also, the United States and Great Britain have been the leaders and the originators, and continental builders have copied from them. In this department, the American mechanic can probably claim more credit for originality than the British; but our transatlantic competitors, while adopting American machines, have sometimes improved upon them, and they have generally built them very much more substantially. This contrast is much more marked here than in the preceding class of machines, and attracts considerable attention. The British machines are also all painted a plain lead color, while those from the United States are often elaborately painted in "loud" colors. While the latter colors offend the eye of our friends on this side of the water, they also render more apparent the difference in strength and simplicity of frames. A comparison of the work done by the two is not at all to the disadvantage of the American; and a comparison of prices, making allowance for the difference in the cost of stock and of labor which is charged against each, is decidedly in our favor.

In the French section, the

BAND SAW

is exhibited by Perin, its earliest successful constructor; but the leading English firm of Ransome & Co. copy the beautiful machine of Richards, London & Kelley of Philadelphia. We consequently find exhibited, in the United States and British sections, a pair of precisely similar machines. The most thoroughly well contrived band saw in the exhibition is, perhaps, that of Mr. B. D. Whitney, the inventor of the pail-making machinery which has so greatly interested visitors, particularly foreigners, who are not generally familiar with machinery of special application. In this band saw, the arrangement of spindle bearings and of springs, and the contrivance for taking the back pressure of the blade, are exceedingly well planned. Perin uses neither springs nor weights, but the British builders use weights very generally for taking up the stretch of the blade as it warms up and expands while running. A well arranged spring, in consequence of its greater compactness and the absence of motion, is considered by our mechanics to be preferable; but the weight is almost invariably used in Britain, and Perin insists that, when a saw is hot enough to slip on its pulleys, it is time to stop it, and thus explains his omission of that detail. The French exhibit some beautiful specimens of band saw blades. Of

WOOD PLANING, MOLDING, MORTISING, AND OTHER MACHINES, the largest and finest collections are found in the British section. Rogers & Co., Fay & Co., and Witherby, Rugg & Richardson, who are the exhibitors of the excellent tools in the United States section, while equaling in quality, do not all taken together equal in magnitude the exhibits of either of several British and continental builders. The patterns used throughout are, however, generally those which, having become standard in the United States, have spread abroad. The continental builders exhibit nothing original; but a few firms make very creditable copies. Some of the Swiss work is excellent, and the German exhibits of Zimmermann and of Schmaltz, with the fine display of Carl Pfaff from Austria, are also well worthy of notice. The latter is "ausser Concours," its exhibitor being a member of the jury.

The British builders seem to find a market for what they call a

COMBINATION MACHINE,

and nearly every exhibit contains an example of this *multum in parvo*. A planing and a molding machine, a circular saw, a mortising and a tenoning machine are all placed on one compact but exceedingly complicated frame. Its compactness and the somewhat lower cost, as compared with a similar collection of detached machines, are probably the reason of its success in the market. It seems improbable, however, that it can be well adapted for use in establishments where much work is done. Separate tools, with ample space around them, with more accessible parts, and which may be used independently, are indispensable for such places. These combination tools seem well adapted for pattern shops and for small carpentering establishments.

The French section contains one wood planer which is particularly interesting and novel. The knives are slender strips of steel which are wound spirally in grooves about a metal cylinder revolving on a horizontal axis above the table of the machine. The knives are thus so contrived as to make a "draw" cut, and do their work rapidly and beautifully. The machine would, however, probably prove far less efficient were it not for the neat method adopted of setting and sharpening these spiral blades. Directly above the cylinder carrying the knives, and upon a parallel axis, re-

volves an emery grinding wheel, which can be very readily set properly; and being then put into rapid motion, it is moved from side to side by a slow feed while the knives are slowly revolved beneath it. The blades are thus sharpened in place and are given perfectly keen, straight and properly set cutting edges. The blades themselves are simple in form, very light, and are easily made by cutting them out of thin steel plate. This seems a most excellent tool. It does not require the fixed scraping blade which is now so generally adopted for making the smooth finishing cut on the ordinary tool.

In the manufacturing of

MACHINE TOOLS OF ALL KINDS,

the ideas which have been the secret of the success of our largest builders,—that of making them in large quantities from carefully considered and standard designs, and of doing as much work as possible by means of machines, specially constructed for the accurate production of each important detail; in fact, of manufacturing, rather than simply making (and of which the sewing machine and the gun-making trades are the most perfect illustrations),—are at last becoming appreciated and are being adopted on this side of the Atlantic, manifestly to the great advantage of both producers and consumers.

There is, however, one way in which it tells strongly against them where they compete with our own people. Lacking that wonderful ingenuity and originality which Nature and our

PATENT SYSTEM

have conferred upon the American mechanic, their standard designs are always a little less perfect than our own standards. They are what were standards with our builders at an earlier date, and thus it happened that, while always closely following, they never quite overtake. The modern system of manufacturing renders change of design a far more important matter than before, and the caution which is naturally induced by the expense of changing designs tends to keep them farther behind. A liberalization of patent codes and the gradual training of the workmen of Europe to a knowledge of the importance of good workmanship and of the methods of securing it will, at a time which we may hope is not very far distant, do much toward remedying all this, and toward the improvement of the condition of the people in Europe. We draw some of our best material from among them, and it seems sufficiently evident that not upon Nature but upon man's own imperfect political systems lies the responsibility of the existing unsatisfactory conditions of manufactures in Europe. R. H. T.

Arctic Regions.

The 80th of the series of papers on the progress of geographical research in the polar regions, published by Dr. Petermann in his *Mittheilungen*, contains a *résumé* of what is known from all sources respecting the American north polar expedition under the late Captain Hall, and is accompanied by an elaborate map, in which the results of this expedition, as far as these are known, have been critically compiled, together with *data* of the former voyagers, Kane and Hayes. The story of the Polaris voyage is already well known in England, and no fresh tidings of the ship, which wintered, 1872-73, with the ten remaining members of her company on the coast of Northumberland Island, in lat. 77° 20' N. in Baffin Bay, have reached us since autumn of last year. Two vessels, however, generously sent by the American Government, have for some time been on their way northward to find and succor the Polaris crew.

In his remarks on the general results of this voyage, Dr. Petermann draws a remarkable contrast between the advances made by the various expeditions which have been undertaken in steam vessels, and by those in which sledge traveling has been tried; maintaining that, since Hall's expedition had shown that there is no such thing as a permanent covering of ice in this branch of the Polar Sea, sledge traveling is little to be depended on, and steamships should alone be employed. The discovery of drift wood on the shores of Hall Land (the east coast of Robeson Strait, between 81° and 82° N.) makes it not improbable, Dr. Petermann believes, that the land breaks up here into an archipelago of islands, or at least that there is communication by which Asiatic drift wood finds its way hither; and on the other hand the presence of numerous musk oxen in these regions makes it very probable that Hall Land is in uninterrupted connection with the coast of East Greenland in lat. 77° N., explored by the second German expedition of 1870-71.—*Academy*.

PRODUCTION OF VEGETABLE TISSUE.—It has been ascertained by Professor E. N. Horsford that an ethereal extract of green leaves, which has been separated by hydrogen chloride into two layers, a yellow and a blue layer, contains in both portions phosphoric acid, iron, potassium and calcium. He has further observed that a mixture of sodium phosphate and iron protosulphate in presence of water is able both in light and darkness to reduce carbonic acid to carbonic oxide. From these observations it appears probable that the formation of a solution of a phosphate of iron protoxide may be a preliminary stage towards the production of vegetable tissue from the element of carbonic acid, water and ammonia. Formic acid, it is well known, may be formed by the direct combination of carbonic oxide and water.

THE cast-steel works of Mr. Krupp at Essen, Prussia, now cover an area of 1,000 acres—larger than the Central Park, New York city. Nearly 18,000 men are employed in connection with the works. The area under roof is 200 acres.