



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

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It is with mingled pleasure and regret that we take leave of Vienna and of this vast exhibition.

Several weeks of unremitted toil—of the most fatiguing kind of toil, in which body and mind have both been severely taxed from early morning until late in the afternoon, day after day, without relaxation,—have prepared us to look with pleasure to an early departure. There is probably no severer labor imaginable than that of examining critically the exhibits here grouped in the Machinery Hall. And when the visitor has kept at his work all day, the physical exertion of walking or standing so many hours, together with the mental strain which is occasioned by the uninterrupted work of examining and comparing competing machinery and novel methods, are found to be singularly exhausting. The excessive heat of the summer has also been seriously enervating. Yet probably no one can finally determine to take leave of this splendid collection of

THE WONDERS OF MODERN ART AND INDUSTRY without some reluctance. If he is a lover of the beautiful, the great picture gallery, containing contributions from the finest collections of Europe, the statuary, and the thousands of magnificent creations scattered in every direction throughout the vast enclosure, must still attract him. Hundreds of these beautiful objects would well repay him for the time which might be required to revisit them, and scores, equally beautiful, remain yet undiscovered. If he is essentially utilitarian, he desires to investigate more thoroughly some new and interesting process, or to trace the growth of some established department of industry, to learn more of some recent invention, or to examine yet a little more fully the construction of some novel machine. Here no one is ever satisfied. The longer the exhibition is studied, the more does the student find to occupy his attention. The task, once entered upon, becomes almost as endless as the study of Nature itself, and hardly less remunerative.

The engineer, however, who attends the *Welt-Ausstellung* soon finds that, to learn thoroughly the lesson which he has come here to study, he must pursue his investigations at a distance from, as well as within, the exhibition limits. He finds here a splendid exhibit of machinery and of manufactured products, but, to see the processes and the methods by which these products are created, he must visit the establishments which have contributed them. We therefore propose to leave at the earliest possible moment, after the most important work is done here, and to spend the remaining portion of available time in visiting some of the most successful or most interesting of those establishments in various parts of Europe, and also, where possible, to see something of that system of technical schools which has done so much for Germany.

Taking a farewell stroll about the grounds and buildings, we have found almost as much to interest us as on the first day of our visit. Even the Machinery Hall, where these several weeks have been almost exclusively spent, seems to be still rich in novelties, and we have not yet lost interest in many objects which are now quite familiar to us. At one side, and almost unnoticed before, we find one of the most singularly interesting exhibits to be seen in the building. An old glassblower's lamp and a roughly made reel, standing before a case containing a few new but not, apparently, remarkable specimens of woven goods, form a group which does not appear at all attractive. But when the exhibitor makes his appearance and, sitting before his lamp, begins to heat and to draw out a little rod of glass and to wind off, from its red hot semi-fluid point, a thread finer than that of the silk cocoon, and when it is found that this glass thread is spun and woven like silk, and that the cloths and made up garments, and the hats and feathers, and strong flexible cords exhibited, are all made of a material which we are accustomed to regard as the best illustration of combined inflexibility, brittleness and hardness, the collection awakens extraordinary interest. Cloaks, capes, ladies' and children's hats with their elaborate trimming of ribbons and feathers, muffs of apparently a curly fur or fleece, and dozens of other articles, are shown, having all the suppleness and softness of silk, with a remarkable variety of coloring. These

GLASS TEXTILE GOODS,

the exhibitor claims, wear well; and, if soiled, are readily cleansed by washing in strong lye or dilute acid. The vis-

itor, after examining this extraordinary collection, finds himself prepared to believe that the story told by a classic author of the discovery, by the ancients, of flexible glass has at least some foundation in fact.

In another part of the hall we meet with a train of "three high rolls," such as have now been long used by our own ingenious engineer, Holley, here exhibited as a new invention by a gentleman well known on this side of the water. In still another place, we discover the peculiar and very excellent form of bridge column, constructed of four rolled iron beams, having a section formed of the quadrant of a circle with each extremity turned outward to form a flange, which has so long been used by some of our best builders of iron bridges; this is also now claimed as a new invention here.

In some of the many cases in which well known American inventions are brought here by foreign exhibitors, they have been undoubtedly either "pirated" and adopted precisely as they have been brought out in the United States, or with slight modifications, which are usually claimed to be improvements. In other instances, the European inventor has actually produced the device contemporaneously with and independently of the American. Piracy is probably not unusual in those countries where the patent code is so incomplete and so unjust to foreign inventors, and instances of it occur quite frequently here, probably, although it is often difficult to distinguish the pirate from the contemporaneous inventor. The latter deserves as much of credit as the former does of reprobation. It is particularly creditable to produce an invention in a country where the talent for invention is so rare, and where it finds discouragement rather than assistance by existing legislation. In the majority of observed cases, however, the foreign exhibitor pays a royalty to an American patentee.

The aid which American inventors have extended to Europe is well illustrated in the agricultural halls, where

AGRICULTURAL MACHINERY,

and particularly mowing and reaping machines, are found in large numbers, all embodying the inventions of American mechanics. The English are now building some fine machinery of this class, and particularly excel in threshing machinery and steam engines for agricultural purposes, a direction in which our own people are doing too little. The German builders are also just entering upon this field. The English machinery is well built, substantial and finely finished, but American farmers would probably hesitate about adopting it on account of its weight, and would prefer our own styles which, while equally well made and quite as well finished, are much lighter and yet are exceedingly strong; and which, if rather less substantial and durable than the English machines, cost less and may be expected to last until later improvements shall have caused other styles to supersede them; that is to say, quite as long as is necessary or expedient.

Hofherr, of Vienna, is the only continental builder who has attempted to compete with American exhibitors of mowing and reaping machines. His machine, though creditable and doing good work, is far too heavy for our market and in several respects inferior to the best American machines. The English builders have all declined to compete at the field trials. The official trial was therefore a contest between American machines.

The American styles of

STEAM PUMPS

are finding an extensive sale in Europe, apparently, and some firms are building under royalties to American patentees. The Earle pump is exhibited both in the United States section and by their European builders, Decker Brothers, of Canstatt. The Cameron Special pump appears to good advantage in the exhibit of the great English manufacturers, Tangye Brothers. The Selden pumps, exhibited in the United States section, seem to attract attention and to receive much commendation.

The European exhibits would not attract very much attention in the United States. The exhibition of centrifugal pumps, by the two firms of Gwynne & Co. and J. & H. Gwynne, of London, are more interesting; not so much, however, on account of the novelties to be observed there, as because of the fact that the wonderful adaptation of the centrifugal pump to raising large quantities of water, where the lift is comparatively low, has been most convincingly illustrated by these pumps.

One of these firms is now building eight pairs of pumps to be used in draining the extensive Ferrara marshes in Northern Italy, where the quantity of water to be raised is stated to be 2,000 tons per minute—enough each minute to float a large ship—and the highest lift is 12 feet. This quantity amounts to 650,000,000 gallons per day. The pumps are stated by the agent to have disks of five feet, and nozzles of fifty-four inches, diameter. Each pair is driven by compound engines, of 27½ and 46½ inches diameter of cylinder and 2½ feet stroke of piston, furnished with steam by a boiler having more than 700 square feet of heating surface.

The proper construction of the centrifugal pump is not usually well understood by builders, either at home or abroad, and both theoretical investigations and careful experiment are probably required to assist in perfecting existing designs; but it is well known that the centrifugal pump affords the best known means of raising very large volumes of water to moderate heights, where the first cost of apparatus is a matter of consequence; and in extreme cases, as the one above given, it is the only form of pump which can well be used. The sale of centrifugal pumps in the United States, as well as abroad, is becoming an important branch of business, and when builders shall succeed in fulfilling guarantees of an efficiency, under moderate lifts, in ordinary work, of

seventy per cent. they will confer a great benefit upon the world and secure corresponding rewards for themselves. Experiment and competition are gradually producing a much desired and greatly needed improvement.

As we take a last glance at the long Machinery Hall and its crowded exhibits, the embodied inventive genius and constructive talent of the world, past as well as present, we feel that we are leaving it with our task hardly commenced and with an oppressing sense of the hopelessness of any attempt to accomplish it fully, were the whole period of the exhibition available. Indeed a lifetime would hardly suffice to make the best mechanic, of the thousands who visit it, familiar with all that he probably would desire to learn.

As the Machinery Hall may be considered to contain the apparatus with which the material civilization of the world has been produced, the

EDUCATIONAL DEPARTMENT

of the *Ausstellung* may be looked upon as the illustration of the system of machinery by which we are to-day endeavoring to aid the advance of the more purely intellectual part of the work of civilization. The collections in this department are not as extensive as they might be, or as they were expected to be. The ordinary and standard apparatus which are everywhere used in higher schools and colleges, text books in every branch of study for all grades and in every language, maps and charts, the familiar forms of physical and chemical apparatus, are all illustrated, with some few novelties, but with rare examples of strikingly interesting innovations or improvements. The school apparatus and furniture from the United States, our American text books, the French illustrative apparatus for very young pupils, the apparatus exhibited by London and Paris makers of philosophical instruments, are all attractive and exceedingly interesting to all who appreciate the public as well as private benefits which follow the adoption of effective and truly practical methods of education. The German exhibits of apparatus for technical instruction, we have found exceptionally interesting, both as constructions and as illustrations of German methods. Models exhibiting kinematic combinations, the various kinds of gearing, elements of machines, modes of transmission of power, models of typical forms of important machines, and other models illustrating processes of metallurgy and engineering, are here in great variety. Supplied with such apparatus, our American technical schools would, with their advantages of excellence of material in their classes, probably excel any schools even of Germany, in the efficiency of the education which they would confer upon their students. A few of our professedly technical schools are already nearly as well provided with this kind of *matériel* as are the German, and one or two of our schools are even superior to the continental schools in this particular, with perhaps one or two exceptions. It will probably not be long before we may expect to find ourselves in a position to offer to our young men all the advantages at home which they now seek abroad, and, in addition, some which can only be had in a country like our own, and among a people like ours.

Here we are compelled to take leave of the great *Welt-Ausstellung*, a gigantic failure financially, but yet a stupendous creation, which entitles those who have inaugurated the scheme and who have, with even moderate success, conducted its administration to far greater credit than the world generally will be inclined to accord them.

The result of her venture may be the temporary financial prostration of her government, but it can hardly be doubted, by those who have had the privilege of visiting the exhibition and of studying its political as well as its economical relations, that Austria will eventually derive from it, directly and indirectly, benefits which will far more than compensate her for all her pecuniary losses.

There are whole groups of exhibits, and numberless articles of specially interesting character, which well deserve notice, which we have had neither time nor space to give them in this short, hastily written and ill digested series of letters.

To the *Art Journal*, the *London Engineering*, and other periodicals devoted to special branches, we must leave the task of going more fully into detail and of giving more extended descriptions than would suit the pages of the *SCIENTIFIC AMERICAN*. One or the other of the editors of the second paper mentioned is always on the ground, and it is a gratification to learn that the vast amount of valuable engineering information collected by them will be published, at the close of the exhibition, in book form.

In the course of our journeyings among the manufacturing districts, and when visiting the great establishments of Europe, we may have occasion to refer again to a few important exhibits, while considering the methods adopted in their production.

R. H. T.

Cement for Making Concrete.

J. S. R., of Germantown, N. C., has read our article in our issue of August 9 on "Concrete for Building Purposes," and asks what the cement is made of, etc. In reply, we have to say that the cement is made from what is called cement stone. The stone is quarried from the mountain and burned in a kiln, similarly to the process for making lime. Cement is similar to lime, and is used with the sand instead of lime, in making mortar. It is termed "water lime" in some parts of the country, from the quality it possesses of setting or becoming hard under water. It may be procured in any of our principal cities. There are various qualities of it. It should be used with as little delay as possible after burning. To make garden steps or other pieces of artificial cut stone, it is safer to employ Portland cement. This is made in England, but is imported and for sale in New York city.