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

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The work of the juries has, at last, been nearly completed, and the members of the international jury are leaving Vienna for their widely separated homes.

In Group XIII, which embraces machinery and means of transport, the work is all done, even including the awards of the great *Ehren Diplom*, unless, as is almost invariably the case at such exhibitions, a few tardy or careless exhibitors have been overlooked.

The publication of the awards will not be officially made for some weeks; but it seems well understood that the distribution has been made with unusual discrimination; although the usual error of too great liberality will, very probably, be noted here, and an occasional obvious mistake may subject the jury to severe criticism.

Of these awards, the United States section is generally supposed, and probably with good reason, to have received a liberal share, and to have taken a proportion of the medals for "Progress" entirely beyond comparison with that of any other nation. The richness of our own section in original and valuable mechanical devices is thus well illustrated.

Unsatisfactory and incomplete as our exhibit in the Machinery Hall appears to every American engineer, it seems, to the European, remarkably rich in valuable novelties.

It will probably be found that, should any of our people find themselves undeservedly overlooked, or their exhibits not as fully appreciated by the juries as they should be, their misfortunes will, in most cases, be a consequence of their own errors, either in neglecting to secure good representatives here, or in the still less excusable, although extremely frequent, neglect to prepare for the jury exact and minute descriptions of their apparatus and of their claims. American exhibitors have been vastly more careless of their own interests, as a rule, than have the exhibitors of any other nation. Should the result prove that we have been kindly dealt with, it must be attributed to the conscientiousness of the juries, and to the peculiar ingenuity and the exceptional merit displayed in our machinery department, rather than to the efforts of those most directly interested in securing careful examination and thorough discussion of the merits of individual exhibits.

One of the most interesting records in our notebook is that of a day spent in looking over the

STEAM ENGINES,

of which a large number, of all sizes and varieties, are distributed throughout the exhibition. The larger examples of stationary engines are, very generally, more or less exact copies of the Corliss. The Sulzer engine, which is one of the largest on exhibition and which has attracted special attention, would be considered a modified Corliss engine—a modification also which is, on the whole, in the wrong direction. It appears in my notebook under the denomination of "the Sickels Corliss-Greene engine of the Swiss section." It has a "drop cut-off"—the invention of Sickels—and has the poppet valve which is usually found on American engines of the Sickels type. Its governor determines the point of cut-off, and it is therefore, so far, a Corliss engine. The peculiar motion adopted for engaging and disengaging is something intermediate between that of Corliss and one of the systems of Greene. The engine has a condenser, and is said to work with a creditable degree of economy.

Comparatively few of the Corliss engines seen here are precise copies of the original. Builders have usually endeavored to produce some difference of detail, which they claim to be peculiar to themselves, and to be improvements upon the standard machines. They seldom or never succeed, however, in either avoiding its defects or in introducing improvements. The defects of the Corliss engine are not numerous, and those which exist are inherent in that peculiarly typical and unique design which has grown into its most perfect shape in the hands of its originator. To eradicate them necessitates a change in every detail and the complete transformation of the whole design. To effect improvement, the engineer who makes the attempt must excel all who have yet made a similar effort.

The Corliss engine is a quarter of a century old, and is, to-day, very nearly as it was then, one of the most complete illustrations of a mechanical type that can be found. It affords, to the student of mechanical "comparative anatomy," one of his most interesting studies. But the Corliss engine cannot be claimed to be a perfect machine. English builders, who usually exhibit quite a different style of engine, while forgetting that an effective expansion (variable by the governor) can only be obtained, so far as engineers have yet learned, by the use of a detachable valve gear, unless at the sacrifice of delicacy in regulation, have persistently adhered to the use of the steam jacket, a detail never seen in the Corliss engine. The best

ENGLISH EXHIBITORS

have usually presented a type of engine which is quite different from the Corliss. The bed is usually flat and broad, and carries the cylinder, the guides, and the shaft pillow-blocks, as was formerly the universal practice with horizontal engines. The steam cylinder is jacketed, and the jacket is fitted with independent pipes to supply it with steam and to drain off water of condensation. The valve gear is that of Meyer: two blocks united by a screw with right and left hand thread, riding on the back of the main valve. In at least one instance, the designer has shown his appreciation of the importance of allowing the least possible clearance by dividing the valve and making of it two, which cover ports at either end of the cylinder, instead of adopting the ordinary form with its necessarily long steam passages. The governor moves a valve in the steam pipe and the degree of expansion is determined by the engineer, who, by use of the screw, separates or draws together the cut-off blocks as occasion may seem to require.

One English firm exhibits an engine in which this is done by a link motion, the link being moved by a Porter governor. The Porter governor, it may be remarked, is to be met with in every part of the Machinery Hall and its annexes. Even the rough and awkward looking engines which drive the machinery of the breweries and the sugar mills are frequently supplied with this American regulator.

The crank is usually given up for engines of short stroke, and a disk, carrying a counterbalance, takes its place. The workmanship of these standard British engines is usually excellent, and several firms present machines of the best of workmanship and having a most magnificent finish. Such a style of finish I have never been fortunate enough to see at home, even on engines "gotten up for the occasion," as these evidently are. One English engine, of considerable size, has a plain steam valve at each end of the cylinder, and, on the top of each, is an expansion valve, apparently of the "gridiron" sort, sliding *transversely*. The time of its movement, relatively to that of the main valve, is determined by an ingenious system of ponderous gearing, intermediate between the valve motion shaft and the main shaft, whose axes are varied in position by the action of a large fly ball governor. It may work well, as a number of certificates exhibited by the builder claim that it does; but the first impression of the stranger is that such a weight of gearing must add seriously to the cost of the engine, even if it does not impede the action of the governor, and add perceptibly to the resistance of the machine itself. It looks like a monstrosity of engineering.

Two compound stationary engines are exhibited. One, in the British section, by Galloway, has cylinders of 14 and 24 inches diameter, respectively, and a stroke of 2½ feet. Its cranks are set opposite each other. Regulation is effected by a peculiar governor, resembling Porter's in being weighted and running at high speed, which adjusts the link operating the main valve. The steam jacket is not used, this important defect being supposed to be compensated by the resulting simplicity of the cylinder castings, and by the convenience with which the intermediate valves may be reached. This engine is rated at 100 horse power, is well made, and moderately well finished. The

FRENCH

exhibit no stationary engines worthy of special notice, except, perhaps, in one case, where an engine has been built with crank shaft bearings spread far apart with no other apparent object than that of placing the eccentrics inside. The awkwardness of the arrangement is something remarkable and not at all to the credit of the designer. The

SWISS,

beside the Sulzer engine already noticed, exhibit two Corliss engines, and a fourth engine which combines the Corliss and the well known device known among our engineers as the "French cam." In this example, the condenser and air pump are contained in the engine frame.

The other engine, which would generally be considered the best of all from the fact that it least departs from the standard design, is well built and prettily finished. Its balance wheel is a mortise gear, and a very common feature of those foreign built engines. The only stationary engine presented by

BELGIUM

is that of the great firm of Bede & Co., which seems, in the opinion of engineers here, to divide the honors with that of the *Gebrüder Sulzer*. It is a "mixed Sickels-Corliss," and is one of the least objectionable of the new departures from the familiar American design. The steam valves are moved by two separate heart-shaped cams. The trip and the regulating apparatus are essentially the forms of Sickels and Corliss respectively.

GERMANY AND AUSTRIA

exhibit several Corliss engines, usually with useless changes, miscalled "improvements," and also a few engines of less creditable form.

The Dingler compound engine is one of the quietest engines in the Exposition, and attracts attention by its noiselessness and its rapidity of rotation. It seems to be fitted with continuously revolving valves, and to possess many peculiarities which will require further investigation.

On the whole, it may be said that the now well established principles of steam engine economy: dry steam, high pressure, a maximum expansion, high piston speed, efficient steam jacketing, and perfect regulation: are not fully recognized in the design of any one steam engine exhibited here, and that the best machines, of considerable size, which are found in the exhibition, are more or less exact copies of a well known standard American engine. Of this, or of any other of the several leading forms of steam engine which are so familiar at home, no single example is to be seen in the

UNITED STATES SECTION.

Of a smaller class, the two beautiful little vertical engines of the New York Safety Steam Power Company, which are in operation in the American department, are excellent examples. Their elegance of design, fine workmanship, and high finish attract attention and elicit many compliments from visitors. The neat horizontal engine of the Norwalk Iron Works represents also another of our best efforts in small powers, and another small engine, furnished by Pickering & Davis, is always under inspection. This latter engine has been designed especially for the use of the Underwood angular belting. Its fly wheel is in line with the piston rod and is driven by a pair of rods and cranks, one on either side. The narrowness of the face of the wheel which is allowed by the cord like belt permits this arrangement to be adopted without too great lengthening of the crosshead.

Judging by what is to be seen here, it must be concluded that the building of stationary steam engines for general purposes has made very little progress during the interval which has elapsed since the Paris Exposition, which last permitted a similar international competition, and indeed, it may perhaps be said, during the last score of years. Correct principles are but little more completely, although much more generally, applied now than many years ago, notwithstanding the fact that the great scientific principles which underlie all successful engineering practice have, during this same interval, received their most wonderful and essential development.

It is to be hoped that the same observations may not be called forth by the study of the American International Exhibition of 1876. Yet it rarely happens that marked changes in engineering practice take place in so short an interval of time as that which separates us from that event.

R. H. T.

Correspondence.

Boilers and Boiler Owners.

To the Editor of the Scientific American:

Your article on "Boilers and Boiler Owners," on page 38 of your current volume, reminds me of a specimen I saw three or four weeks ago. While in an engine room near here, the engineer showed me a piece of the feed pipe and mud drum taken from under his boiler. Two weeks previous to the time of taking the mud drum out, the boiler had been tested to a pressure of 125 lbs. per square inch, the pump and boiler gage agreeing. By examining I found that a hammer could be driven through the pipe and drum at any place, while, in some places, the blade of a pocket knife could be thrust through.

Query: Why is it that boilers and mud drums are enabled to sustain so high a pressure, in such a condition as the above, and the one at Bay City, Mich., were in? A. J.

Austin, Texas.

Jumping from Railway Trains.

To the Editor of the Scientific American:

The query of J. B. T., on page 27 of your current volume: "Why is it that engineers, etc., jumping from moving trains, invariably jump in the direction of the moving train?" induces me to write a few words on the subject; a subject that every one who rides, whether by horse or steam power, ought to fully understand for all such are liable to be sometime exposed to danger. They should know what is best to be done at the last moment of an emergency, never before; for jumping is so dangerous that it is only when the case is desperate that it should be attempted. The reason for jumping forward is that that course is the safest; the experience of engineers confirms this, and it is easily demonstrated by theory. Your correspondent argues that it is the most dangerous. If every one could, like him, jump with the velocity of 15 miles an hour, =21 feet per second, the difference might not be so great, but I consider only the case of average humanity. But in his case, if the velocity of the train is 30 miles an hour, and he jumps in the opposite direction 15 miles an hour, he will then move 15 miles an hour with the train, and strike the ground with a force that will almost certainly be fatal.

In the hope that some lives or limbs may be saved by a more general understanding of what should be done in such cases, permit me to explain this; I have not yet seen it in print.

The comparative safety of jumping from a moving vehicle does not depend on the velocity of the jump, which should not exceed the velocity of the vehicle, if it can be helped, but entirely and solely on the anatomical build, if I may use the term, of man. The jump should be made facing, as nearly as possible, in the direction of the motion; select if practicable the place; turf is best, sand is next. Never jump on a pile of stones; for a collision with stone is as dangerous as any possible casualty. One foot should be in advance, so that it will come in contact with the ground first. Follow it instantly with the other foot, and each will receive a part of the blow, and each will check the speed