Engineering, Civil & Mechanical.

STATIONARY BEAM ENGINE.

One of the engines driving the machinery at the American Institute Fair was a fine beam engine, the exhibit of Thomas F. Rowland, of the Continental Works, Greenpoint, Brooklyn, N.Y. It is an automatic cut-off beam engine, having a diameter of cylinder of 15 inches and a length of stroke of 30 inches. At 85 revolutions per minute, 80 pounds initial pressure, and cut-off at one-quarter, it is rated at 90 horse power. The diameter of the fly and pulley wheel is 8 feet, and it has a 30-inch face. It weighs 11,300 pounds.

The engine is very strongly built, the cylinder, column, and main pillow block resting on a heavy bed plate. The beam is of wrought iron, neatly ornamented. The cross-head, fitted with brass gibs, is carried in cast iron slides. The crank shaft is of the best hammered iron; the piston rod, wrist pin, beam centers, crank pin, and all wearing journals are of steel. The valve levers, and bell cranks, and smaller parts of the cut-off gear are steel castings nicely finished.

The valve gear combines all of the advantages of an automatic cut-off gear generally, with the particular merits of the well-known Corliss, and of other forms of valve gear of the disengaging type, with several points of special merit.

In this form of valve gear there are but two steam chests, from which the steam is admitted to and exhausted from the cylinder by means of a circular valve. The cut-off valve, also of the circular class, is located on the back of the main valve, and is operated through the hollow valve stem of the latter. The main valves are worked by bell cranks which receive a positive motion from a single eccentric. The cut-off valves are operated by levers which move simultaneously with the main valve cranks during the forward stroke through the intervention of a pawl which engages with a projection on the cut-off lever. This pawl is tripped, as in the Corliss gear, by means of a cam at a point of the stroke which is determined by the governor; the cut-off valve is at once closed by means of a spring attached to the main valve crank and acting upon the cut-off lever; a small air dash pot carried by the main valve crank serves to cushion the cut-off gear and prevents all undue jar. A fixed buffer stop arrests the motion of the cut-off lever as it travels with the main valve crank during the return stroke, and insures the proper opening of the cut-off valve and the re-engagement of its lever with the pawl at a definite point just previous to the beginning of the new stroke.

The power required to effect the cut-off is quite small, since the cut-off valve is balanced during the operation. The range of the cut-off is very liberal, and comes well within any demands that may be made upon it by variations in the load.

The entire valve gear is exceedingly simple and compact, and presents nothing that would make it liable to disorder. Engines with this form of cut-off have now been in continuous actual operation upward of two years. This valve gear is known as the Twiss Patent.

THE BURSTING OF SAW.

When the shaft of the Cunard steamship *Catalonia* recently borke, and the vessel was obliged to return to New York for repairs, the captain was interviewed, and asked to give an explanation of the cause of the accident. He could, says the *Northwestern Lumberman*, give no reason for it. Mr. Roach, the superintendent of the iron works where the shaft was made, was also interviewed, and the conversation led to a general discussion of the lasting qualities of iron. Mr. Roach said that iron had its time of usefulness just as men and horses have. That time completed, the iron must be born again, as it were.

Railroad men understand this law, and know how much weight their freight cars will carry, and estimate how many miles they will run before the wheels and axles will give out. When the shafts run out their natural lives, they are thrown aside, though there may be no visible defect in them.

Iron has a way of crystalizing in the process of time, and often when a piece of it breaks, one can find no flaw in the material—no apparent reason for its giving away. It has been held by engineers and scientists that a constant vibration of iron disintegrates it, the infirmity becoming pervasive throughout the mass of metal. For this reason iron bridges have been supposed to have a limit of endurance and safety, and it has been predicted that the time will come when the Niagara suspension bridge, by reason of the constant vibration caused by passing trains, will outlast its cohesive integrity, and suddenly go down, probably while a weight of valuable life is passing over it.

This mortality in iron and steel, under vibratory influence, may account for the bursting of circular saws, which often causes sad havoc of life and limb in mills. The intense vibration of the dizzy steel, by reason of its long use, at last brings the inevitable weakness, and it suddenly flies in pieces. If sawyers could arrive at some definite knowledge as to the life of a circular saw, as the railroad men do as to the endurance of axles and wheels, many serious accidents might be avoided.

THE EAST RIVER BRIDGE.

When the contract was made for the steel work of the East River Bridge the amount named was 5,000 tons, which by mutual consent was agreed to cover 5,500 tons. This has been taken as the maximum weight of this portion of the superstructure. Naturally, therefore, there was not a little surprise when it was announced recently by the engineers that 1,200 tons more would be required, increasing the weight of steel in the superstructure to 6,700 tons. The principal reason given for this increase of weight is the need of strengthening the bridge to enable it to carry heavier loads than were contemplated at first. According to a statement by Assistant Engineer Martin, who has had charge of the practical work of construction from the first, the growth of the cities to be connected and the preparation of the elevated roads to carry freight trains have made it probable that direct railway connection will be made between the Long Island roads and the roads entering New York from the East, the North, and the West. At any rate, in anticipation of such traffic, the bridge plans have been modified to enable regular passenger and freight cars to run over the bridge, and the weight had to be correspondingly increased. As reported by the *Evening Post*, Mr. Martin said, in pointing out the chief instances in which increased weight had been made necessary to get increased strength:

"The bridge will consist on each side of four massive steel beams, one on top of the other, into which are bolted the transverse beams upon which are laid the floor girders of the bridge itself. When it was decided to increase the strength of the bridge, the method adopted was to run what are called "over-floor-stays" wire cables which run down from the top of each tower at an angle of about 45°, and are fastened to the longitudinal steel beams which form the sides of the bridge. It follows that, when weight is put upon the bridge at the point where the overflow stays are fastened to the bridge, the strain falls upon the stays instead of the main cables and tends to press the bridge against the tower. In order that the bridge may resist this "back pressure" the steel girders between the tower and the point where the overflow stays reach the bridge have had to be stiffened and increased in size. This is is the chief item of increase, and will reduce the weight upon the cables by about one-fifth. In the next place the pullman cars are nearly three feet higher than the cars originally intended for bridge traffic, and that fact necessitated increasing the height of the 2,800 upright posts which divide off the steam tracks from the passenger and carriage roads. Thirdly, it may be assumed that all the castings used in the bridge are between two and three per cent. heavier than the contract calls for, because the contractor prefers that to running the risk of having them rejected, as they are of no value except for bridge purposes. "There are other considerations," said Mr. Martin, "which have caused the engineers to alter different parts of the steel work in the bridge, but they would not be understood without long and technical explanations. I repeat that the 1,200 tons extra weight of steel have materially increased the strength of the bridge instead of weakening it, as the public seems to suppose."

To remove bolts that have rusted in without breaking them, the most effectual remedy that is known to the *Boston Journal of Commerce* is the liberal application of petroleum. "Care must be taken that the petroleum shall reach the rusted parts, and some time must be allowed to give it a chance to penetrate beneath and soften the layer of rust before the attempt to remove the bolt is made." Bolts and studs on which the nuts are fixed with rust are broken off through impatience. In most cases a small funnel built round a stud or bolt end on the nut with a little clay, and partly filled with any of the searching petroleum oils, and left for a few hours, will enable the bolt or nut to be moved.