[For the Scientific American.]

Why the Cornish Engine is Superior to the Common Condensing One.

H. Haines, your Virginia correspondent, asks on page 47, this Vol. SCIENTIFIC AMERICAN, to ascertain the cause of the superiority, if any existed, in the Cornish engine over the other, provided they operated under similar circumstances. I think that will depend very much upon their construction, and the skillful care devoted to their attendance.

A badly constructed and attended Cornish engine would but poorly compare with a good ordinary condensing one, and, on the other hand, a badly constructed and attended ordinary condensing engine would compare still worse with a good Cornish. A Cornish engine is nothing more than a condensingengine with all the improvements added to it, to adapt it to desired purposes. These purposes vary, and it may not be out of place here to state them:—For draining mines the Cornish engine, proper, is used, in which the piston is attached to the pump rods through the medium of an over-head beam; there is no rotative motion, the piston is attached to one end of the beam by piston rod and parallel motion links, and the pump rods to the other end direct.

The Direct Action, or "Bull Engine," in which the piston rod passes directly downward through the cylinder bottom, and is attached directly to the pump rods.

The Plunger Lift or "Water Works" engine, which is the same as the Cornish engine, proper, except that a plunger pump takes the place of pump rods and drawing lift fixtures; and the hoisting or rotative engine, which condenses its steam or not, and is generally provided with a beam.

The name "Cornish engine" may apply to any one of these, but no one knows which one is meant until it is specified; they all possess Cornish peculiarities, and generally not only Cornish but world-wide superiority.

The ordinary double-acting condensing engine has not, and never will equal, much less excel any of the single-acting non-rotative engines just mentioned, when applied to the same purposes—that of pumping water—for reasons which can be readily set forth in detail, but which, in the main, may be stated thus:—It is not in the nature of things for a complication of heavy machinery laboring under indirect application of the prime motor, to compete with the direct-action principle.

But H. H. wants to know the cause of difference in action and economy in the ordinary condensing engine and the Cornish engine, having the same sized cylinders, and operating under the same circumstances. We suppose that the first is one of our best maker's, and the other a good Cornish engine from the "land of its birth," or by a regular Cornish engineer. In this view of the case, the Cornish engine will excel in the smoothness and gracefulness of its operation, as well as in its superior economy. The reasons are these:—The beauty and excellence of any machine will much depend upon the perfection of its details, and the intelligent care with which it is maintained in good working order.

You will quickly infer, then, that the Cornish engine is more perfect in its details; just so; and this virtue was brought into the mechanical world by the "mother of invention," and nurtured into important growth by a system of registration and encouragement held out by premiums, which have afforded the greatest scope for ingenuity in the improvement of the steam engine, as applied to manufacturing purposes as well as to the draining of mines. But what are these details, and how do they differ from those of our engines?

The valves are better, and work with more ease, and are less liable to derangement and leak. They are the Cornish double-beat balanced valve, a kind just beginning to be appreciated by our makers of rotative engines. The gear for working the valves is lighter, and in consequence keeps in good order longer, and works quite differently from the common eccentric hook, rock shaft, and lifter motions, getting rid of a great deal of friction. The adjusting and performance of valves, in reference to quantity of steam to be admitted, and time of action, both in opening and shutting, to the necessities of the piston's motion, are more under the control of the engine driver, and the engine's own motion.

The shortness of and enlargement of the induction steam pipe to a point—all the way from the boiler—near the steam chest, always with a snpply of steam; the engine losing little power by that horse-leech wire-drawing of steam in the supply pipe.

The employment of a very simple but very effective means of preventing the piston rod from carrying air into the cylinder during its in-motion.

Superior methods of clothing the several the several parts of the engine containing steam to prevent loss of power by radiation of heat. I mention this because a Cornish engineer takes more pains with this perfecting of detail than any other kind of engineer thinks it worth while.

The extent to which the principle of expansion is carried, and adapting the variation of expansion to different speeds, effective powers, &c., under which the engine may be worked, also the conveniencies of the adjustable valve gear.

The position and peculiarities of the condensing apparatus in the designing and arranging of which a Cornish engineer displays not a little engineering skill, aad in the managing of which a tact only to be acquired by long-continued contact with, and strict attention to its sensitive and subtle performances, a knowledge of which, applied to practice, can alone secure the economical results from this portion of steam action, or, I should rather say, the getting quit of its re-action, and that of those parasite gases (so to speak) which sap the virtue of atmospheric pressure.

These are some of the causes why a Cornish engine is better than the other more common variety, and they are real causes, embodying the secret of success of the engine's performances. Touching upon the question of fuel, there are peculiarities of furnace and boiler construction, and attendance of fires in the Cornish practice alike contributive of economy. J. West, of the Norris Works, Norristown, Pa., is an excellent and thorough bred Cornish Engineer. JOHN H. COOPER.

486 North 6th st., Philadelphia, Pa., January 1856.

[In the communication of H. Haines, page 147, on the third line above the last, for the words "effect radiation," read "prevent radiation." The foregoing letter corroborates the inferences of Mr. Haines.

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Steel Corked Horse Shoes.

MESSRS. EDITORS—I noticed in your paper of the 19th inst. the description of an improvement in Spring Heel Horse Shoes. I offer the following as a substitute:—

After the shoe is "turned" in the ordinary way, let the heel be split a little beyond the point where the angle is formed in turning down the cork, (say an inch and a half,) then take a plate of cast steel about 1-12 of an inch thick, corresponding in width with that of the heel of the shoe; lay it in and mold it firmly. Then turn and sharpen the cork in the common way, then harden or temper the steel by heating and cooling, so as to render the steel as hard as it can be made. Here you have a cork that will remain sharp till it is worn out, and needs no setting or sharpening so long as the shoe remains tight. I have been in the habit of having my horses shod in this manner for the last three winters without having them set for the purpose of sharpening from the time they were put on till spring. The smith charges me $4·50 for shoeing the span in this manner. A. FOSTER.

Dayton, Mich., Jan. 23, 1856.

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The Greatest Bridge in the World.

The people of Canada are gifted with no mean ideas relating to "the future progress and greatness of their country." The Britannia Tubular Bridge, in England, is justly considered to be the greatest engineering work of huge building in the world; but the Canadians have the courage to engage in building a bridge over the St. Lawrence, at Montreal, which, when completed, will completely dwarf the now famous Tubular Bridge referred to. We do not know if they will be able to carry out their designs, but judging from an article on the subject in the Canadian *Railway Guide*, which contains the report of Robert Stephenson and A. M. Ross on the subject, we believe they will make a bold attempt to execute them, at a cost of $7,000,000. This bridge is designed to be composed of huge wrought-iron tubes, like the Britannia Bridge, and the works to carry out the plan was commenced in 1854, some of which are already completed, such as approaches on the north side, 1344 feet; approaches on south side, 1033 feet, and two abutments, 484 feet. These are completed in a most permanent manner. The stone work is massive, and bids defiance to the largest masses of ice that are to be found floating in the St. Lawrence.

The masonry of the bridge piers, 24 in number, range from 40 to 72 feet in hight. The total length of this gigantic structure will be 9,439 feet, viz.: approaches 2377, abutments 484, tubular railway bridge 6578. The number of arches or openings by which the river will be spanned is 26. The iron tubing is to be 22 feet deep in the center, and gradually inclining towards the ends, one in every 30 feet, so that at each end it will be about 17 feet high. The center opening, which is the channel course, will be 350 feet wide, and each of the other openings 242 feet wide. The tube will be 60 feet above summer water level at the center, 37 feet at the abutments, and 16 feet wide. The weight of the wrought-iron tubing through which the railway will pass is estimated at 11,000 tuns, and the masonry will contain upwards of 28,000,000 cubic feet. It was designed by Robert Stephenson, and is now being carried out under the superintendence of Alexander M. Ross, the engineer of the company. The contractors are the celebrated firm of Messrs. Peto, Brassey, Betts & Jackson, England.

The great expense of such a bridge has led a number of those interested in the grand Trunk Railroad to suggest a suspension bridge in place of the tubing, as its cost would be far less—only about $1,000,000—but R. Stephenson objects to a suspension bridge as being too weak a structure, and unsuited to the position it would have to occupy. We understand that not a few engineering errors have been committed already in building the approaches to this bridge, and this has caused some dissatisfaction with the plan of the work itself. We hope, however, that nothing will prevent the complete execution of this gigantic enterprise. Science has its poetry, and great works of engineering are its Epics.

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Machine for Weaving Wire.

The accompanying engravings illustrate an invention for weaving wire of all descriptions, for which a patent was granted to Mr. George W. Smith, of Mauch Chunk, Pa., Dec. 25th, 1855.

This invention consists chiefly in certain means of crimping the wire while in the loom, and during the process of weaving, whereby wire of any size may be woven without previous preparation. Similar letters on both figures refer to the same parts.

The working parts of the loom are all carried by a strong frame, represented by A A, B B, C C, and D D. The warp wires, *a a*, are secured in a traveling carriage, E E, which rests on the longitudinal timbers of the frame, and is provided on each side with a toothed rack, *b*, shown dotted in fig. 1. This rack gears with a toothed pinion, *c*, by means of which it is moved. The warp wires may be of unlimited length. At the commencement of the weaving their front ends are attached to a bar, *d*, which is held by two hooks, *e*, in the screw clamps, *f f*, at the front end of carriage E E. The warp wires are also secured at the rear end of the carriage, all in a screw clamp, *g g*, and each is further secured by a separate pair of tongs, *h'*, which grasp it close behind the clamp, *g g*. The lower portion of the clamp *g g*, contains two female screws to receive two male screws, *h*, which fit to turn easily without moving longitudinally, in a standard, *i*, attached to the carriage, E E. These screws serve to keep the warp at a proper tension, and also to let out sufficient wire, by moving the clamp, *g g*, after every crimping and filling operation, to be taken up by the next crimping operation. The screws may be operated for the latter purpose by suitable gearing or by the hand of an attendant.

The shed is opened by two sets of heddles, G G, which are attached to endless bands, *i*, passing over rollers, *j*, on a rack shaft, H, at the top of the loom, and under rollers, below. These heddles work on guides, *c' c'*, on the framing.

The reed, I, of the loom, is substantially like that of other looms, but instead of being attached to a vibratory lay, it is secured in a carriage, I', which works on horizontal fixed guides, I'', and instead of having a direct movement back and forth to beat up the filling wires, *v v*, it has two distinct movements, first advancing a short distance, after the filling wire is put in, to lay the latter square with the warp, and to bring it to a proper position for crimping, then retreating while the crimping mechanism operates on the filling wire, after which operation it advances again far enough to beat the filling wire up to its place, and finally retreating all the way back at one movement. The forward movements of the reed carriage or lay, I', are produced by two cams, J'' J'', of similar shape on a shaft, J, near the front of the loom, acting upon two elbow levers, J2 J2, which work on fixed pins, *l l*, and are connected by rods, J''', with the lay, and the backward movements are effected by two other cams, K', on a shaft, K, near the other end of the loom acting on two levers, K'', which work on fixed fulcra, *l'*, and are connected by rods, K''', with the lay. The cams, K', are of such form that when they draw back the lay after its first advance, they hold it back long enough for the crimpers to operate before it makes its second advance to beat up the filling. The filling wires, if heavy wire is used, are all previously cut to the proper length, in which state they may be inserted into the open shed in front of the reed, either by the hand of an attendant or by suitable mechanical means, the insertion always being made after every second retreat of the lay, that is to say, after it returns from beating up the filling. In fig. 1 the lay and reed are shown in the position they occupy on their first advance to square the filling, and bring it into the position to be operated upon by the crimpers. If light wire is used, the filling may be put in by a flying shuttle.

The crimpers, whose form is best shown in fig. 2, consist of two bars or plates, *m m'*, of steel, one having a face of the form the upper sides of the filling wires are required to have after the weaving, and the other a face to correspond with the form required for the lower sides, and having recesses, 5 5, therein of sufficient size to receive the warp wires at their points of intersection with the filling. They are secured by screwing, keying, or otherwise, in cast-iron stocks, L L', the former above and the latter below the warp, the former stock being attached to a pair of long arms, M M, attached to a rock shaft, M*, and the latter to a pair of arms, M' M', attached to a rock shaft, M*'. The above arms have a proper movement to open the crimpers to allow the reed to pass between or through them, and to close the crimpers upon the wires to crimp them. The opening movement of the lower arms, M', being in a downward direction is produced by gravitation, but the corresponding movement of the upper arms, M, being in an upward direction is produced by a cam, N', on a rotary shaft, N, acting on a lever, N'', attached to a rock shaft, N''', the said lever connecting with the arms, M, by a rod, *n*. The closing movement of the lower arms, M', is produced by roller cams, O' O', or revolving arms carrying rollers, secured on a rotary shaft, O, and the corresponding movement of the upper arms, M, is produced by similar roller cams, P P, on the shaft, N, the said roller cams also producing the necessary pressure for the crimping operation. The necessary crimped form of the warp is produced by the filling wires during the act of crimping the latter. In order to adapt the crimpers exactly to the thickness of the wire, the stock, L', is made in two parts, the upper part to which the crimper is secured, being adjustable relatively to the other by screws, *q q*. For different sized meshes different crimpers are used, and any number of pairs of crimpers can be provided for every loom.

In the woven fabric, where any one of the filling wires passes under a wire of the warp, the next filling wire on either side must pass under the same wire of the warp, this brings the elevations in the crimping of one filling wire opposite the depressions in the crimping