Improvement in Constructing and Working o Locomotives.

(Continued from page 134.)

In the following part of his paper, Mr. D. K. Clarke discusses important questions relating to the arrangements of the machinery and running parts of locomotives. It is, certainly, the most interesting portion to locomotive engineers and managers of railroads. It deserves general attention, because he throws much additional light on constructing and working locomotives, just where light was wanted.

The Carriage.—In the design of the carriage it is required that a sufficiency of weight should be placed on the driving wheels for adhesion, and that the machine should run freely and steady at all speeds.

In the earlier classes of engines, various circumstances operated to make them unsteady—a short wheel-base, the overhanging masses, the unbalanced revolving and reciprocating masses of the crank and the piston and its appendages. The evils were aggravated with outside cylinders, as compared with inside, on account of the greater spread laterally of the swinging masses. These evils were sought to be remedied by various experiments. The extension of the wheel-base, lowering the boiler, loading the foot-plate behind the fire-box with cast-iron, coupling the engine very stiffly to the tender, the use of three balanced cylinders, stiffening the frame, and the most prominent expedient of all, placing the driving wheel behind the fire-box. On the system of the hind drivers, the load was necessarily placed almost entirely upon the extreme axles, fore and hind, to insure a sufficiency of driving weight; it followed that the horizontal leverage of the wheels with their loads, and their resistance to horizontal sinuous motion, were increased, in so far as a greater disturbing force is requisite to sway an engine about one of its extreme axles than about a central axle, and greatly superior steadiness was obtained. This system, however, though it removed instability externally, left the swinging masses unbalanced; it also involved a longer wheel base, and a heavier engine than on ordinary engines.

The form of engine primitively adopted in the *Planet* by Stephenson, was with four wheels and inside cylinders. This arrangement was succeeded in Stephenson's practice by an engine with a third pair of wheels behind the fire-box, to check the vertical pendulous movement of the engine. Expansions of this normal arrangement were, the inside cylinder engines of Sharp, Wilson, Kitson, Bury, Stephenson, Hawthorn, and Gooch. The course of improvement and alteration in the arrangement of outside cylinder engines was taken up by Stephenson, Stirling, Allen, J. V. Gooch, Crampton, and Adams. An adaptation of driving-wheels behind the fire-box to inside cylinders was made; and Stephenson's method of hind drivers was applied by Mr. Adams to light tank engines on four wheels. The position of the center of gravity, horizontally, in each of the engines, may be deduced by a simple process, from the loads on the wheels.

The remarkable uniformity with which the leading idea of a central driving axle, in front of the fire-box, initiated by Stephenson, is adopted by almost all the others, will be noticed. The reasons which led to this uniformity of practice are not difficult of appreciation and they are worth some consideration, as bearing on the general question of single-wheel engines.

In the first place, there is the demand for a sufficiency of driving weight to supply the required adhesion for traction; but the apportioning of the driving weight to one pair of wheels must be executed with a regard to the requirements of the others, which are carrying wheels simply. The function of the front wheels is to lead the engine, and that of the hind wheels, as carriers, is mainly to steady it; thus, the front wheels require a greater load than the hind wheels, but not so much as the drivers; and the drivers stand first, the leaders next, and the trailers last in the order of loading.

It naturally follows that for the driving-wheels of single engines, the most likely situation is at some little distance behind the center of gravity of the whole machine, because the supply of load to the drivers in that situation is the most direct, and, in the adjustment of the driving load, the loads on the other wheels are individually less affected than when the drivers are far from the center of gravity.

It might be said, as a precautionary suggestion with reference to the system of central driving-wheels, that the drivers should be placed some distance behind the center of gravity, to insure a sufficiency of weight on the leading wheels. This condition is easily met in practice, because, conveniently enough, the center of gravity of ordinary engines is situated three or four feet in advance of the fire-box, and there is room for the driving axle behind it.

[In two paragraphs he points out the defects of the well-known Crampton locomotive, its loads being mainly thrown on the extreme axles; it runs heavily and severely along curves, the labor being increased by an extended wheel base.]

He afterwards says :—

"All these objections are avoidable in the ordinary system with central drivers, and this system only wants maturing to make it quite satisfactory as a carriage. The one primary and sufficient condition is, that the revolving and reciprocating masses of the pistons, piston rods, cross heads, connecting rods, and cranks, should be balanced in the wheels. This condition was pointed out ten years ago, by Mr. Stephenson, in his evidence before the Gauge Commissioners, in 1845; and he at the same time exposed the fallacy that the action of the steam on the pistons had anything necessarily to do with unsteadiness :—"When the steam presses upon the piston," he says, "it at the same time presses against the lid of the cylinder; the action and reaction must be equal. Therefore I do not believe that it is the steam that causes the irregular action; but I believe it to be the mere weight of the pistons themselves, and, if we could contrive to balance the pistons by the weight upon the wheel, we should get rid of that very much." A complete balance can be effected, and it has been done by the author, for the first time in this country, so far as he is aware, in the outside engines of the Great North of Scotland Railway, designed by him. These engines run with absolute steadiness at the highest speed attained on that line, without the least internal disturbing action of any kind.

All classes of engines, with inside or outside cylinders, single or coupled wheels, may be satisfactorily balanced on the principle above indicated. In general, the locomotive stock of England is very imperfectly balanced."

Economy of fuel is materially promoted by the correct equilibration of engines. With Mr. Beattie's permission, he (Mr. Clarke) put in balance the *Canute* engine, to supply an example. This engine had previously a balance weight of 85 lbs. applied within the rims of the driving-wheels. New weights were put in, weighing 186 lbs. for each wheel, and balancing the whole mass, acting at the crank pin. The engine ran so much more steady and freely with the new balance weights as to take the engineman by surprise; on the first day after the alteration, it considerably overshot the stopping stations. The saving of fuel was found to be 20 per cent. of its original consumption.

Another locomotive—the *Norman*—an outside cylinder coupled goods engine, on the South-western Railway, was also equilibrated according to the plans of the author. Such engines, unbalanced, are the most unstable of all, and the saving by equilibration should be all the greater. The engine and tender were taken alone, on a trial run, with the balance weights complete, and they run at speeds of more than sixty miles per hour, with perfect steadiness, excepting the disturbances due to the road, there not being the least oscillating motion of any kind. The counter-weights were then taken out of the wheels, and the engine and tender again run out alone; but so violent was the oscillation of the engine, both laterally and fore-and-aft, and so violent also the concussions between the engine and the tender, that the engineer could not venture to exceed a speed of about twenty miles per hour; and two strong hooks between the engine and tender were successively broken across, owing to the lurches of the engine.

(Concluded next week.)

Experiments with the Chinese Sugar Millet.

MESSRS. EDITORS—Knowing that you take a deep interest in anything which promises to be valuable for our country, I send you the result of a experiment which I made with the Chinese Sugar Millet—*Sorghum Saccharatum.*

Having received from the Patent Office a paper of the seed, I planted it as a matter of curiosity, though not having the least confidence that it would prove to be worth anything. The seeds and stalks so nearly resembled our common broome corn as to make me feel quite sure that they were these.

I planted it in hills, about 2 1-2 feet apart, with 6 to 10 seeds in a hill. It was greatly neglected during its growth, from an impression of its worthlessness.

Some time in August there was a chance frost which nearly terminated its growth, and, in fact, completely destroyed some sweet corn growing in the same garden. The millet was just putting forth its seed stalk, and the seed was, consequently, all destroyed. The stalks, however, were left standing until some time in October, when—still supposing them to be worthless—I had them cut, and thrown into piles, to get them out of the way.

After they had lain upon the ground for some time, I took a handful of the stalks and gave them to my horse, who eat them greedily—eating both leaves and stalks.

About this time I saw a statement in the papers that some person had made some molasses from this plant. This led me to make the following experiment with mine, although I had reason to suppose that the frost and the exposure on the ground would have destroyed any good qualities which it might have originally possessed.

I took some of the canes and cut them into pieces about three inches long, when they were readily ground through one of Hickok's Portable Cider Mills, with cast-iron grinders; and then pressed with the powerful pressers attached to the mill. The quantity ground was about half a bushel of the pieces, and the juice expressed was about seven quarts. This juice, when evaporated, made one quart of molasses, that is pronounced, by those who have tasted of it, to be superior to the New Orleans molasses, and some say, equal to the flavor of the maple syrup. It is, at all events, good molasses.

From an estimate made, I judged that the square rod of ground planted—if the canes had all been used—would have produced four gallons of molasses, or at the rate of 640 gallons per acre. Such a crop would have proved valuable the last year, since sugar and molasses are so high.

There is little doubt in my mind that any person who has a small piece of land may manufacture his own molasses, and, perhaps, sugar.

If cultivated on so small a scale as not to warrant the expense of erecting the rollers for expressing the juice from the cane, they may be cut up in a straw cutter, and ground in one of Hickok's portable cider mills, with such facilities that two men could obtain five or six barrels of the juice per day by hand, and proportionally more if horse or other power is used. This juice could be cheaply boiled in one of the evaporators with which you are acquainted without burning the syrup or wasting any fuel.

Besides the molasses obtained from the stalks, the leaves will make good forage, the seed will nearly equal that of a crop of corn or oats, and the tops will make brooms.

With all of these advantages, may not the sugar millet prove of great value to the community? Every family in the country can make their own sugar and molasses, while, at the same time, the seed, forage, and brush for making brooms will pay all of the expenses of raising the crop.

Those having seed to spare, will do well to make it public, that more experiments may be made during the next summer.

H. G. BULKLEY.

Kalamazoo, Mich., 1857.

[The experiments of our correspondent are certainly valuable facts, not only to our farmers, but our whole people. We hope that fair and full experiments will be made with this millet during the next season, and now is the time for farmers to prepare and lay out their work

Steam Engines for Grist Mills.

MESSRS. EDITORS—Since you published my letter in your valuable paper (Nov. 10, 1856,) I have had frequent letters of inquiry in regard to running flour mills by steam with single engines, and as I am willing the world may have the advantage of my experience, I know of no better way than to give it through the SCIENTIFIC AMERICAN. My plan is to build the engine of a large bore of cylinder, short stroke, with single steam chest full length of cylinder, steam ports as near the end of the cylinder as possible and large, and with a single slide valve so made that it will cut-off at half stroke, worked by an eccentric on main shaft. I use double slide bars, cross-head between, recessed and filled with soft metal. I make a strong connection rod with two taper bolts through straps at each end; turn the main shaft its entire length, and have bevel pinions on its end to work in a bevel cone wheel on an upright shaft, and use a spur cone wheel for mill stone pinions, in the usual way. I employ one large double flue boiler, and find it better to have some steam to spare than not enough; I work the steam from 40 to 60 lbs. per inch, and gear the mill so as to travel the engine piston 500 feet per minute.

I am building mills of this description and have good success, I get a steady motion, plenty of power, with low steam, and a still running mill,—four very essential things to complete a good mill. LYMAN HATFIELD.

Cuyahoga Falls, Ohio, Dec., 1856.

Experience with Ice Houses.

MESSRS. EDITORS—I noticed a few weeks since, an article in the SCIENTIFIC AMERICAN in regard to Ice Houses; but your experience and mine do not agree, as you direct persons to dig into the ground, which I think they should avoid.

Two friends of mine—one a physician, and the other a man who wished to start an ice cream saloon—started at the same time to build ice houses. The doctor dug into the ground, and made a double floor and wall, and a double brick arch over the top, so as to leave an air space all around. It must have cost him $500 at least, and by the first of August his ice was all melted.

The other made a double house of slats and cheap boards, and set it in the shade of the surrounding buildings. It did not cost him over $25, and his ice lasts from year to year. Another friend dug down into a hill-side until he came to the rock, but his ice all wasted before the summer was half over.

To any one who wishes to build a cheap ice-house, I would say, build a double house entirely on top of the ground, with double floor and door, so as to have an air passage all around, and arrange it so that all melted ice shall be drained off immediately; if possible, set the house where it will be sheltered from the south winds and sun. Pack your ice into it tight, and freeze it down, and I will insure it to keep from year to year.

HENRY F. SNYDER.

Williamsport, Pa., Jan., 1857.

[Our correspondent's experience is very useful, but we advise him to read the article of ours on page 72, this volume, to which he refers a second time, and he will find that he has mistaken our views. Our specific directions for building an ice house and packing the ice were nearly the same as those in his letter.

Twenty-seven steamboat accidents occurred in 1855, by which 176 persons were killed, and 107 were wounded. In 1856 there were 29 accidents; 358 persons were killed, and 127 were wounded. This is very discreditable to the Inspectors; it appears as if they had grown more careless of their sacred trust.

A subterranean river has been struck by the persons engaged in boring an artesian well at Henderson, Ky., from which a jet of water is forced up through the bore, and thrown to the hight of fifty feet above the surface of the ground.