Machinery and Tools as they are.---The Steam Engine.

(Continued from page 91.)

Locomotive Engines—The locomotive engine, since its first introduction, has not undergone such alterations in form as might have been expected from the amount of mechanical talent employed in this department of industry. This is probably owing to the fact that a good arrangement was at first adopted, so that science and ingenuity were afterwards employed in improving the original model, and not in contriving a second. Perhaps the changes which are most conspicuous are in the arrangement of the cylinders, of the wheels, and of the springs. The first-named alteration has, in fact, given distinctive appellations to the two classes into which locomotives are generally divided, and "outside" or "inside" cylinder engines are the ordinary terms adopted when speaking of railway motors. The reasons for these different positions of the cylinders, we will enter upon as we proceed, but will previously review the general form of the Locomotive. The most important part is the Boiler, since both the speed and tractive power depend upon its capacity for generating steam; to say that it is not an economical form of boiler is unnecessary, for this deficiency is generally known, but it is equally certain that it is well adapted for the rapid formation of steam—a fact of extreme importance, since the only limit to the speed of a locomotive is in the inability of the boiler to produce steam sufficiently fast, and hence we find the only correct expression of the power of this description of engine to be that which states its evaporating ability. The employment of a number of small tubes to convey the hot air to the chimney, and the great draught caused by the use of the blast pipe, are the chief causes of the peculiar excellence of this sort of boiler, the quantity of whose heating surface, according to the best makers, we will here mention. An engine, with cylinders of 18 inches diameter and 24 inches stroke, had 156 square feet of direct heating surface, and 2,090 square feet of tube surface: another engine, with cylinders of 10 inches diameter and 15 inches stroke, had 88 tubes, each 2 inches diameter, the boiler being eight feet long, and the fuel used in them coke. The space allotted for steam is necessarily small, and the continual agitation of the water, caused by the rapid motion of the locomotive, tends to mingle water with the steam, or, technically, causes the latter to *prime*, a considerable evil, to prevent which many steam chests are provided with a sort of inverted cone, made of sheet iron, having an aperture in the centre, through which the steam passes in its course to the steam pipe, which is continued above the aperture. The effect of this arrangement is, that the water, in its ascent, is intercepted by the conical plate and flows back. Another plan to check *priming*, and yet to do away with a steam-chest, has been lately introduced, the steam pipe extends the length of the boiler, and is not bent upwards as usual to receive the steam, but takes it through a series of small slots perforating the upper part. The regulator (such being the name by which the throttle-valve is known), is made in various shapes, originally it consisted of two plates or discs, placed together, and with apertures which were made to coincide or not, as required; another form often adopted is the slide valve, and a third plan is to make the steam-pipe, where it forms two branches, enter a box *truly* bored, in which rotates a valve, so shaped as to close the apertures to the branch pipes as required.

The cylinders were originally always placed inside, between the wheels, and were inclosed by the smoke-box, long connecting rods communicated the motion of the piston to the cranks, so that the whole of the machinery was within the outer framing, and did not project beyond the track. This mode of construction required that the driving-wheels, which are keyed on to the crank shaft, should be placed nearly in a central position with relation to the boiler, in order that the cranks might revolve, which would be impossible if approached nearer to the fire-box. It is evident that this position of the wheels is objectionable for, as it is necessary to keep the driving wheels firmly pressed against the rails (the tractive power being derived from them alone) the locomotive frequently, during its progress, acquires what is commonly termed a see-saw motion, or, technically *rides* the points where the wheel touches the rail serving as a fulcrum. To remedy this defect, the cylinders were placed outside the boiler, to which they were firmly attached, the axle of the driving wheels was made straight, and could then be placed in a safer position, and even under or beyond the fire-box. In this plan of construction a crank was cast on the outer side of the hub of each driving wheel to which the connecting-rod was attached, greater longitudinal stability was thus attained, but the cylinders necessarily projected over the track, often causing a swaying side motion, which threw many engines off the track; for this reason the inside cylinder locomotive is still extensively used. A combination of the two principles has been lately introduced, the inside cylinders and crank shaft being retained, but no wheels are placed on the latter, its motion being communicated by coupling rods to the wheels on the other axles.

With respect to the number of wheels, originally only four, there are now usually six and sometimes eight; the truck frame, an invention of this country and which is now so much used, is too well known to need description, an improved truck of the kind is illustrated and explained on page 68, Vol. 8, Scientific American.

The arrangement of the springs has lately been the subject of many investigations and trials. In one species of locomotive which has the driving-wheels placed behind the fire-box, thus allowing of a very low centre of gravity, the central pair of wheels has very light springs, merely acting as safety wheels in case either of the other axles breaks, or else the boiler is supported by one spring between the two axles. This arrangement has the effect of throwing the greater part of the weight upon the two end axles, and the centre of a cross spring behind the fire-box carries the weight of this end of the boiler, so that it is very steady from resting on three points. By another plan, instead of fitting a spring to each wheel, only two on each side of the engine are employed, and these (instead of their usual position, which gives a direct action upon the axle boxes) are inverted and placed between the wheels longitudinally, iron beams connect the axle boxes on either side, and also receive the pressure of the springs, so that a uniform weight is maintained on all the wheels, irrespective of any irregularities in the level of the rails.

The manner in which the slide valves are worked, is in all classes of the steam engine a subject of considerable importance, and has been well studied by the constructors of locomotives. In the marine engine but one eccentric is used, which is loose on the shaft and is maintained in the proper position by stops, but in the engine that we are now discussing two fixed eccentrics are employed for each valve, to give the forward or retrograde motion, either of these, as required, is made to work the valve by bringing a notch, formed at the end of the eccentric rod, into connection with the weigh-bar. A more compact mode is now very frequently employed, and consists in attaching the ends of the eccentric rods to the extremities of a segmental frame. A corresponding curved slot is made in this frame, in which slides a steel block connected to the valve rod, the frame moving to and from on a joint at its centre. When, therefore, the machinery is in action, it is evident that the eccentrics will impart a rocking motion to the frame, and thereby move the valve. To shift the position of this latter, it is only necessary to raise or lower the frame, which, it will be perceived, can be used to work expansively, to effect this last-named purpose, many modes are also adopted, which, however, are not peculiar to the locomotive. When we consider that the slide valve of an 18-inch cylinder, with the steam at 100 lbs. per square inch, will have to move under a pressure of 1400 lbs., and that the two slides would thus require 35 horse-power to work them, we shall be convinced that an equilibrium valve is more required in this instance than for engines where it has long been employed. Some devices have already been proposed and introduced, one of which employs one valve casing for the two cylinders, and forms the backs of the valves in such a way as to have the desired effect.

(To be Continued.)

Beet Root Sugar.

M. Isnard, the French Consul at Boston, gives the following account of the manufacture of Beet Root Sugar, in a letter to the editor of "L'Invention":—

"In 1810 I conceived the project of establishing, at Paris, a factory for making Marseilles soap, that is, a composition of olive oil and soda. Before undertaking it, however, I determined to pursue a course of special chemistry in its application to soap-making, and for this purpose I cultivated the acquaintance of M. Baruel, who was employed in the Laboratory of the Ecole de Medicine at Paris. Having been shown by this latter some beet-root sugar, and knowing the importance attached to the manufacture of a home-produced article by the government, I made experiments on a larger scale in conjunction with M. Baruel, and finding that it could be manufactured for between 20 and 24 sous per pound, I directed a memoir to the government, which was published in the "Moniteur" of March, 1811. After several interviews with the Minister, which were unsuccessful, a sample of the sugar was presented to Napoleon by M. Chaptal, who donated 120,000 francs for establishing the manufacture, observing, with regard to a loan of that sum which had been requested for the purpose, "I do not lend, but give it." Subsequently, by the imperial decree of March 25th, 1811, M. Baruel and myself were nominally gratified with the necessary sums for the formation of two experimental schools, and shortly after we were credited by the Minister of the Interior for the sum of 10,000 francs, M. Baruel on the Prefect of the Department du Nord, and myself on the Prefect of the Bas Rhin. Not being satisfied with the conduct of the Prefect, nor the quality and price of the beet-root, I obtained permission to remove my establishment to Pont-a-Mousson, Department de la Meurthe, where I formed a partnership with two rich capitalists. After having erected a building capable of producing from 1500 to 1800 pounds of sugar, I demanded of the Prefect of the Bas Rhin the 30,000 francs remaining due. But we were on the eve of 1814, and this Prefect had other things to occupy him besides sugar. Strasburgh was shortly after blockaded, and Pont-a-Mousson attacked by the Cossacks; our work was stopped, five-sixths of our beet-root rotted, and our enterprise was ruined. Being occupied in the process of saccharification by means of sulphuric acid for applying it to distilling from potatoes, I was engaged by a wealthy individual in the United States to come over and erect a vast establishment of this kind. On my return to France, in 1837, I petitioned the government for compensation for the 30,000 francs yet due to me, but was refused, although its justice was not contested; I was, however, named to the office of Consul at Boston, on the re-establishment of a Consulate at that place, where I had for five years previously exercised the duties of Vice Consul.

[For the Scientific American.]

How to Elevate Water from Rivers.

To your correspondent from St. Paul's, Minnesota, who lives on the east bank of the Mississippi, on an elevation of about 100 feet above the river, I would just say, for his benefit and all others like situated, that I live at Ossipee Centre, N. H., on the east bank of the Danhole river, on an elevation of 90 feet and distant 300 feet from it, and after spending some $150 in trying to get a well, but without success, and thus being driven, from the necessity of the case, to study out some plan for raising water from the river; after several efforts on a small scale, I put the plan which I deemed best in successful operation. For almost four years it has supplied all our village on the east side of the river with water, forcing up 120 gallons per hour. I will describe it in as few words as possible: first, I laid under ground, from my house to the river, wrought-iron pipe of one inch bore (lead pipe of any reasonable thickness will not bear the pressure); I then connected with the pipe a small copper force pump, 11 inches long and 2 3-4 inches bore, and in said coupling I set a piece of pipe upright, of two feet long, with an air chamber of cast-iron of about five gallons' capacity, in order to ease the force of the pump against the downward pressure of the water in the pipe. I then commenced a penstock on the bank of the river, several rods up, and thereby obtained a fall of 3 feet, to which I attached a wheel 3 feet long by 3 feet diameter, with a 4 inch crank, which gives 8 inch stroke on the pump, and forces up the quantity of water above stated without further trouble.

John Moulton.

(For the Scientific American.)

To Prevent Lamp Explosions.

I wish to communicate to you the result of my experiments in making the spirit lamp nearly if not quite safe. I have made my common lamps, as I conceive, free from the danger of exploding, simply by filling the body of the lamp with coarse clean sponge in such a manner as to leave no spaces occupied by the fluid as a liquid free to run. You will perceive that when the lamp or rather the sponge is filled with fluid, that if by accident it should be upset, the fluid cannot escape from the sponge in consequence of being held by capillary attraction, therefore, as far as the danger of setting fire by spilling is concerned, the sponge prevents it. Again, the danger of explosions does not consist in the fluid being explosive, but the vapor which arises from it, which vapor occupying that (upper) portion of the lamp having no liquid in it, issues out from the screw aperture, and if a flame be within a few inches, it takes fire and explodes, carrying fire to whatever fluid may be left in the lamp. Now, the sponge which fills every portion of the lamp, leaves no space (comparatively) unoccupied, to hold this vapor, hence the amount of vapor which can possibly be in a lamp at any time cannot do much damage, as I have frequently shown to my friends by taking off the screw and bringing it in contact with a flame, the fluid held by the sponge would simply take fire and continue to burn until exhausted or blown out. It may be objected to on the ground that the lamp would have to be made much larger than is usual to make up the difference of the space occupied by the sponge—on this point I would say that I tried the experiment with two lamps of the same capacity, and found that there was but ten minutes difference in the time of one hour, the sponge burning one hour, and the plain lamp one hour and ten minutes, so that this is no proper objection. I have now used lamps arranged in this way for a year or more, and would not use the fluid in any other manner. I have nothing to make by publishing the subject, save the satisfaction of doing some little good in saving life, &c.

O.

Measurement of Logs.

Messrs. Editors—In the Scientific American for Nov. 20, a table of lumber measure is given which will not answer in this section, because lumber is too scarce. The following rule is that which is generally adopted in this part of Jersey and in Pennsylvania:—Extract the square root of half the square of the diameter, which gives the side of the greatest square contained in the circle; the other, and most simple rule, and that which lumbermen find most convenient, is to multiply the diameter by 5 and divide by 7, which will also give the side of the square, which, when once found, the number of feet of lumber measure can easily be found in one foot of the log's length; then multiply the whole length of the log by the one foot, and you have the number of feet in it. I could give you a large table of diameter of logs, but I do not wish to trespass on your columns by many figures.

Chas. E. Moore.

Groveville, Mercer Co., N. J.

Iron Floors and Roofs.

M. Liandiere, a locksmith of Paris, has contrived a new form of iron plate for floors, roofs, bridges, &c., which promises to be hereafter generally employed for such purposes—as neither keys nor bolts are required for joining, and the plates can be put up very easily, in a very short time. The advantages are less manual labor, perfect solidity, less space and less thickness in the flooring, no fear of fire, &c.