Information Relating to Steam Engines.

We oftentimes receive letters from correspondents requesting us to tell them the horse power of their engines; this we can easily do when the diameter of piston, the pressure of steam, and the velocity of piston are given; but unless this is done we cannot give the required answer. To such inquirers the following will be useful information:

The unit of a "horse power" is 33,000 lbs. lifted one foot high in a minute. To calculate the horse power of any engine, multiply the area of piston in square inches by the pressure of steam in pounds on the square inch, and by the velocity of the piston, and divide the product by 33,000; the result is the nominal horse power of the engine. It is the common practice, however, to deduct the fourth of this, as being expended on the engine itself, that is absorbed by friction and not given out to the machinery which the engine may be driving. For this reason some engineers use the divisor 44,000 in estimating the horse power of their engines. This is the case with the Clyde engineers, (the builders of the Cunard steamers,) the engines of which are rated lower than American ones of the same power.

We sometimes also receive letters making inquiries different from the above, relating to steam engines, and although easily answered by those who understand the subject, they involve considerable time and trouble to work out the calculations. One of these we will also present for the benefit of all such inquirers:

"I have an engine with a piston 5 inches in diameter and 20 inches stroke, how much steam must I carry to make it work up to six-horse power?"

The rule is (though not to be found in books) multiply the area of piston in square inches by a stipulated velocity of piston, and use the quotient as a divisor to divide the sum total of horse power which the engine is desired to work up to. Thus: Area of the above piston in inches $5 \times \cdot 7854 = 19 \cdot 6350 \times 300$ (velocity of piston in feet per minute) $= 5890 \cdot 5000$. The sum of six-horse power is $33{,}000 \times 6 = 198{,}000 \div 5890 \cdot 5000 = 33 \cdot 44$, or thirty-three and a half pounds nearly of steam pressure on each square inch of piston. The velocity of 300 feet per minute is high, but the rule is equally applicable to any assumed velocity. This speed of piston for an engine of 20 inch stroke, is equal to 90 revolutions of the crank shaft per minute. We would never run such a short stroke engine faster than 200 feet per minute. The velocity of piston should vary with the length of stroke —increasing as the stroke is lengthened. The old rule used to be 160 feet per minute piston velocity, for a 2 1-2 feet stroke; 228 feet for a 6 feet stroke, and 256 for an 8 feet stroke.

The proper velocity for pistons is still a question of dispute among engineers. Scott Russell says "220 feet per minute is the velocity of piston generally reckoned in Great Britain, but it is a rule as groundless and injurious as it is universal. With large ports, valves, and condensers, double the speed may be employed." Such a speed he can see economically employed on our fast river boats, in opposition to Tredgold, who set up 250 feet velocity of piston per minute to be a law of nature. It is, indeed, difficult to construct engines of a short stroke to run at a high velocity because the diameter of the piston has to be reversed so frequently; still, our locomotives are standing evidences of what engineering skill and science can do for high speed in short stroke engines. A steamboat engine of ten feet stroke, making twenty revolutions per minute, involves a velocity of 400 feet of piston, while a locomotive of two feet stroke, and the same velocity of piston, must make 100 revolutions per minute; its piston will have to be reversed 200 times for every 40 times that of the steamboat's.

By adopting a certain pressure of steam as a unit, we can easily determine the velocity of piston required to work up to any amount of horse power. Thus for a piston of 12 inches diameter, and steam at 40 lbs. pressure on the square inch, it will require a piston velocity of 291 feet per minute to work up to 40-horse power $(33{,}000 \times 40) \div (12^2 \times \cdot 7854 \times 40.)$ The result we have given in round numbers. The area of a piston is obtained in these examples by squaring its diameter and multiplying by the decimal, ·7854. The same result can be obtained by another rule, viz.: multiplying half the circumference of piston by half its diameter.

Some persons speak and write respecting a steam engine as if its power lay in the cylinder, walking-beam, and fly wheel. It should never be forgotten that the fountain of a steam engine's power is its boiler, but we will leave the subject of "steam boilers" for another article. The foregoing calculations have reference to the average steam pressure in the cylinder during the whole length of the stroke, not the pressure in the boiler, which is always higher than that in the cylinder, especially when working the steam expansively, and no engineer in his senses uses it otherwise. In practice, an engine running at a high velocity will do more labor by cutting off the steam before the stroke is completed, than by using the full pressure during the whole length of stroke. Many may suppose this cannot be so, but the fact is otherwise, for in using high pressure steam in short stroke engines, during the entire length of stroke, by the frequent rapid reversion of the piston's motion, there is experienced a reactive pressure of steam on the exhaust end which gives to them a thumping action, an evil which can be obviated by working the steam expansively, and which thus both saves steam and economises the power.

Curious American Patent Case in France.

We learn from our valued cotemporary, the *English and American Intelligencer*, published in Paris, of a singular lawsuit which recently took place in France, respecting a French invention, for which application had been made for an American patent in 1844.

"A person, named Mondot de Lagorge, invented some years ago a species of vessel, called by him a 'nautical locomotive,' which he pretended could go from Havre to New York in 90 hours, and, though merely skimming on the waves, could brave the most violent winds without rolling or pitching. He took out patents for his invention in France and England, and determined to take out one for the United States also. Accordingly in May, 1844, he went before Mr. Lorenzo Draper, who was then the American Consul at Paris, executed the ordinary formalities, and deposited the necessary plans for obtaining one. Mr. Draper offered to cause his brother, who was in business in the United States, to do what was necessary to procure the patent; and M. Mondot de Lagorge gave him the sum of 1,630f., which it was calculated would be required for the expenses. Ten years passed away, and M. Mondot never got his patent. Thinking that this was owing to the negligence of Mr. Draper, he, in January last, brought an action against him before the Civil Tribunal of Havre, to obtain restoration of the 1,630f., and damages for his neglect. Mr. Draper represented that all he had done in the matter was in his Consular capacity, and that, therefore, he was not subject to the jurisdiction of a French court. But the Tribunal decided that the objection was not valid, and ordered the case to be gone into on its merits. On the 2d March, the affair came on, but Mr. Draper did not appear. The Tribunal, after hearing M. Mondot de Lagorge's statement, condemned Mr. Draper by default to restore the 1,630f., and said that he was liable to pay damages, but before fixing the amount, it required the plaintiff to give an estimate of them. Mr. Draper having taken no steps to have this judgment set aside, it, after a certain delay, became definitive. M. de Lagorge, in virtue of it, applied to the Tribunal to assess the damages. His calculation was, he said, that his 'nautical locomotive' would have produced a profit of 1,080,000f. for each of the fourteen years, during which the patent, if obtained, would have lasted. But as no 'nautical locomotive' had actually been constructed, and, as therefore his invention had not been brought to the test of experience, he was willing to set the damages at the moderate sum of 200,000f., which was less than one-fifth of one single year's estimated profits, and less than one-seventieth of the whole fourteen years' profits. Mr. Draper resisted the demand, on the ground that having acted gratuitously for M. de Lagorge, he could not be held responsible for any damages which that person might have sustained, and that it was even hard on him to have to repay he sum which had been advanced; that, besides, M. de Lagorge had not proved that he had sustained any damage, as his invention had never been anything more than a mere project; and, finally, that it was by that gentleman's neglect to do what was required, that he (Mr. Draper) had not taken out his patent. The tribunal, after examining all the circumstances, decided that Mr. Draper had been guilty of some slight neglect in the business, but that as he had acted gratuitously, and as, besides, it did not appear that the plaintiff could have sustained anything like the enormous loss he represented, no other person having appropriated his invention, he (Mr. Draper) should only pay 200f. damages and the costs."

On the Management of Circular Saws.

The subject of circular saws is one of particular interest to almost every portion of our country, especially in the South and West.—Reciprocating saws were at one time almost exclusively used in the preparing of lumber, but the obvious disadvantages arising from their intermittent motion, in spite of many improvements made on them, has led to their partial abandonment, and the substitution of circular saws in their place. The day cannot be far distant when (except for scroll work,) straight saws will be numbered among the things that were, for circular saws, possess many advantages over them, especially as it regards the greater speed at which they can be driven, and the greater quantity of work they can turn out in a given time—as much time is lost with the straight saws in getting ready to work.

The greatest difficulty experienced in managing circular saws lies in their tendency to heat. Wherever there is much friction experienced in one, it will get hot and expand, and in that condition will not make good lumber, and sometimes, indeed, it will buckle, and thus become materially injured. If the heating of a saw be uniform throughout, no further harm will result than its becoming "limber," and unable to sustain itself under a strong feed, but whenever it is reduced in temperature, it assumes its original form. It is very seldom, however, that the expansion of a circular saw, when heated, is uniform, as the friction is always greatest on the side next the log, owing to the plank yielding. Friction is caused by a too small kerf being cut out of the log, and also by the springing of the timber. In the latter case, when a line is cut, each portion of the log has a tendency to assume the form of an arc with the bark turned inwards; this presses that portion of the log between the head blocks against the saw, while at the same time the opposite side of the saw is entirely relieved, thus causing unequal friction and expansion.

In adjusting a circular saw to timber, the blade is not placed parallel to the log, but has what is termed "rake," that is, the cutting edge of the saw comes nearer the log than the opposite edge. This is done for the purpose of allowing the saw teeth to ascend without scratching the face of the log, and also to relieve the center of the saw where the tendency to heat is greatest. If, however, too much *rake* be given the saw, it will cause undue friction, and the inner side of the saw will heat and expand.

The arbor of the saw should be kept well lubricated, and not allowed to get hot, as it transfers the heat to the center of the saw.—Whenever the center of a circular saw becomes heated, it has a tendency to cup. The side of the saw which expands most by heat becomes convex, and if run too long, it will not return to its former shape when cooled, but will require hammering on the edge to straighten it. This is a job which requires considerable skill, and besides, few who use such saws have suitable anvils to straighten them upon. To such the following will be useful information:—Prepare a suitable number of annular papers with their inside diameter about one inch less than that of the hub, and place them on the shaft adjoining the concave side of the saw. Prepare a lot of similar papers with their inside diameter equal to that of the hole in the center of the saw, and their outside diameter about one inch greater, and place these on the saw shaft adjoining the convex side of the saw. A sufficient number of these being so placed in, they are tightened up in the hub, and the saw is brought up true in the face. Care must be exercised to put in no more papers than will straighten the saw. It is not, however, *absolutely* necessary to take the *cup* out of a saw until it becomes of a considerable size, for a saw will do good work even when cupped a quarter of an inch; the increased difficulty, however, of managing it in this condition, renders it advisable not to work it in such a state. In working cupped saws, the teeth should be made to fill a wider gauge on the convex than on the concave side; and if the tendency to heat at the center continues, it should have more rake, if cupped towards it. The teeth of a cupped saw in ascending, in all likelihood, will scratch either the face of the log or the plank. This is another and a sufficient reason to straighten it at once.

The edge of the saw is guided by a pair of rollers or wooden pins placed just below the log and near the front edge. Pins are preferable to rollers, for they do not pack a ring of sawdust on the saw when it passes between them, as rollers do. The proper position of these guides relative to the saw, varies under different circumstances, but in no case should both press against the saw at the same time, as they would be sure to heat it. When a saw heats on the edge, it is far more difficult to manage than if heated in the center, for a "cupped" saw still presents a straight line on the edge, while a buckled saw (one stretched on the edge) does not.

The edge of a saw may become heated on account of the teeth not being in proper shape. If any part of a tooth except the edge rubs on the log, the friction at that point will heat it. If sufficient depth of tooth is not preserved, there will not be sufficient room to free itself from sawdust, which will crowd in the kerf, causing undue friction on the sides of the teeth. If the saw cuts out of a true line, it will press hard against one of the guides, and thus also cause undue friction. It should never be forgotten that the heating of a circular saw, causing cupping or buckling, is always the result of undue friction; to avoid this, therefore, every effort should be exercised. A saw sometimes gets buckled from other causes than heating. Its roller guides are sometimes placed to bear too *hard* against it, and when this is the case the sawdust is pressed between them with a force sufficient to thrust the rollers out of place. Or if the rollers be so rigidly fixed as not to be moved by such a pressure, they tend to stretch the saw at the point where it passes between them. Gumming machines also tend to stretch the edge of the saw.

It is not necessary at all times to straighten a buckled saw on an anvil, especially if only a narrow ring near the edge of the saw is stretched, as it may be remedied by cutting through it, either by drilling a hole at the root of each tooth, or filing towards the center of the saw until the stretched part is cut through.

Water is sometimes used to cool a saw; it also enables a saw to work in a smaller kerf, thus saving power; and it also acts as a partial lubricator. It should be directed in jets on each side of the saw near the center. Its use, however, should be avoided in cold freezing weather. Allowing the saw shaft to play endwise, is one of the most effectual means of keeping the saw cool. When the timber springs against the saw, tending to heat it at the center, the end play of the shaft allows the center of the saw to yield; at the same time, the guide pins at its periphery keep it in line and the friction is therely reduced, and liability to heat diminished in a corresponding degree.

I have pointed out some difficulties experienced in operating large circular saws, and the manner of remedying and avoiding them, hoping that my experience may be the means of benefitting others. J. W. Garey.

Grenada, Miss.

Improved Hydrant.

The Corporation of New York is beginning to introduce larger sized hydrants, which have six or eight apertures, for the simultaneous supply of as many different streams of water to different fire engines. This is a capital improvement. Heretofore only one engine could be supplied from each hydrant, rendering the employment of long lines of hose pipe necessary to conduct the water from distant supplies. Of course the loss of time in coupling the hose and bringing the water, under such circumstances, is considerable, meanwhile the building burns.