Correspondence

Further Improvements in Stoves Demanded.

MESSRS. EDITORS:—In consequence of a call made some weeks ago in your valuable journal for some mode of raising the bottom grate of a cook stove, so as to require less coal for summer use, a device has been invented which I understand meets the requirement. Now my wife says that "she wishes somebody would invent some improvement in the grates of cook stoves whereby the cook could at any time remove the stones and clinkers from the bottom of the fire, without dumping or letting down the whole and consequently putting the fire out." Our cook stove has a draw-bar in the middle to let out the fire for cleaning the grate, but we want something that will allow the grate to be cleaned of stones, etc., without letting out the fire. If you will make a call in your journal for such an invention I have no doubt the thing will be produced, and a great benefit rendered to those who use cook stoves.

JOHN FRUIT.

Camden, N. J., Sept. 12, 1864.

One of a Thousand.

MESSRS. MUNN & Co.:—You have already obtained two patents for me, and I have been so well pleased with the promptness and dispatch with which my business has, in each instance, been attended to, that I must solicit your services in another case of the same kind. You will please find enclosed a draft on New York for the first installment of Patent Office fee, etc.

WILLIAM NASH.

[The writer of the above not only knows the best place to have his patent business attended to, but he is a good inventor. The implement, which he refers to as having been sent with his letter, is the very best for the purpose we have ever seen.—EDS.

A Mechanic's Opinion of the "Scientific American."

Mr. O. Dunham, of West Paris, Maine, writes us as follows:—"I enclose $1 for the SCIENTIFIC AMERICAN. I am in the country for a short time, but I cannot do without my favorite paper, it furnishes so much food for the mechanical mind. I cannot for my life comprehend the reason why every mechanic in the country does not take it; for myself I can say I should take it were the price doubled."

A Strange Love--Fond of Emetics!

Louis, the greatest of living French medical authors, states that persons sometimes die of consumption without any cough, until within a week or two of death; while bronchitis, which leads to consumption, never can exist without a violent cough coming on any hour of the day or night, yielding an expectoration various in color, quantity, and consistency; and is always attended with "tightness," or other discomfort in breathing; the general health otherwise seeming to be good. Dr. Hall, the editor of *Hall's Journal of Health*, says that a gum-water emetic every morning has such a grateful effect in softening the cough, removing the phlegm, and otherwise ameliorating the symptoms, that the greatest sufferers have earnestly desired permission to take the emetic two or three times a day, but that it is not necessary, as the lungs are soon cleared out, and by employing means to avoid taking cold, and thus prevent the formation of more phlegm, permanent good health is sometimes regained, without a day's confinement to the house.

[See Tract on "Bronchitis and Kindred Diseases." Address Publisher of *Hall's Journal of Health*, New York, with fifteen cents.

MIXTURE OF SULPHURIC AND NITRIC ACIDS A SOLVENT OF GOLD.—A. Reynolds writes to the *Chemical News*, "While examining an alloy of silver and gold for the purpose of ascertaining the percentage of gold that it contained, I found to my surprise, that a mixture of sulphuric acid and nitric acid dissolves gold to a considerable extent. This fact seemed to be of some importance, and being unaware of a similar observation having been hitherto made, I send you a note of it."

THE POWER REQUIRED TO START A TRAIN.

The query propounded by Mr. H. B. Morrison, of Le Roy, N. Y., on page 164, current volume, of the SCIENTIFIC AMERICAN, has excited very great interest, and, simple as the question is, there are no two persons who have agreed upon the same solution of it. Some of our correspondents have indeed arrived at the same conclusion, but their methods of arriving at it are quite diverse, so that if one is right the other must be wrong. Before proceeding further we will present one letter from Mr. J. J. Coombs, of the Patent Office.

MESSRS. EDITORS:—In your paper of the 10th inst., in answer to the query—"Will it take more power to start a train when the crank is on the upper half center than when it is on the lower half center?" You say—"It will take more power on the lower half center than on the upper;" and you give as the reason that when the crank is on the upper half center the power of a lever of the first class is exerted, in which the fulcrum (being the center of the axle) is between the power (in this case the crank) and the work (in this case the adhesion of the tire to the track.) But when the crank is on the lower half center the lever becomes one of the third class, wherein the power is applied between the fulcrum and the work."

Is not this last proposition, at least, erroneous? From an off-hand view of the subject it so appears to me. I cannot perceive that any propelling power is exerted *directly* upon the driving wheels by the crank, when it is on the lower half center; and in respect to the *indirect* power exerted over them (hereinafter explained) it it appears to me that the leverage is of the same class as during the forward stroke, viz.: that class wherein the work is between the fulcrum and the power; and which, by the way, is the most efficient class.

It is manifest that if the power were applied to any point not on or connected with the car, no amount of back pressure upon the crank, when on the lower half center, could have the slightest tendency to move the car forward. It could only cause the wheel to roll back, or to slip upon the track. When the crank is in this position the only *propelling* power operating upon the so-called driving wheels, is a draft upon their axle, through the frame which couples them with the truck supporting the cylinder. and this power is derived from the pressure of the steam on the forward cylinder-head, which must move forward, propelling the truck with it, because the back pressure upon the piston is resisted at the point of contact between the tire and the rail. In other words, the primary propelling power is exerted upon the truck which supports the cylinder, and this is forced forward upon the same principle that a boat is propelled by means of a setting pole.

Considered as a lever, when the crank is making its backward stroke, the axle becomes the power, the point of contact between the tire and the rail, the fulcrum, and the crank the work, it being the point on the wheel which arrests the backward pressure upon the piston, and so transfers the work to the forward head of the cylinder. But when the crank is making its forward stroke it (the crank) becomes the power and the axle the work; the fulcrum remaining as before.

If these propositions are true it might seem to follow that it would require less power to start the train when the crank is on the lower half center than when in the opposite position, because, while the distance between the power and the work is the same in both cases the distance between the work and the fulcrum is least when on the lower half center. But in fact the power required is the same, whether the crank be in the one position or the other. The reason is, that when the crank is on the lower half center the whole back pressure of the piston does not find its resistance on the rail, but it is divided between the point of contact of the tire with the rail and the axle; and the ratio of this back pressure thrown upon the axle will be in exact proportion to the difference between the work and the fulcrum, at the two opposite positions of the crank above mentioned; or, what is the same thing, to the difference between the radius of the crank and that of the wheel. In other words, the propelling purpose will be just equal to the back pressure thrown upon the rail.

To illustrate, let us suppose the crank to be just half the radius of the wheel, say the frame one foot and the latter two feet, and the pressure of the steam on the piston to be 1,000 pounds. When the crank is on the upper half center the work (then being the axle) will be one foot from the power (or crank) and two feet from the fulcrum. It is manifest that a forward pressure of 1,000 pounds on the crank will give a forward pressure of 1,500 on the axle (or work.) But from this must be deducted 1,000 pounds of back pressure on the rear-cylinder head, in order to find the absolute propelling pressure exerted on the axle, which is 500 pounds.

Now, suppose the crank has passed round to the lower half center, the work (now being the crank) will be midway between the fulcrum and the power (or axle) consequently the back pressure of the piston will be equally divided between the rail and the axle, each receiving 500 pounds. From the pressure of 1,000 pounds on the front cylinder head, therefore, we must deduct the 500 pounds of back pressure thrown upon the axle, in order to find the absolute propelling pressure, exerted primarily on the track supporting the cylinder; which, as in the previous case, will be just 500 pounds.

If the crank be just equal to the radius of the wheel, then, when on the lower half center, the fulcrum and the work will coincide, and the work, being immediately on the rail, the latter will receive the whole back pressure of the piston, none of it being thrown upon the axle. The propelling pressure, therefore, will be the whole 1,000 pounds' pressure on the front cylinder head. And when the crank is on the upper half center the work will be midway between the power and the fulcrum, and therefore 1,000 pounds forward pressure on the crank will give 2,000 pounds pressure on the axle; from which deduct 1,000 pounds back pressure, and we have left 1,000 pounds on the absolute propelling power exerted on the axle, being the same as when the crank was in the opposite position.

Washington, Sept. 13th, 1864.

Here is still another letter, which takes a different view of the matter from the writer of the letter above.

MESSRS. EDITORS:—Mr. H. B. Morrison, of Le Roy, N. Y., furnishes a diagram of a locomotive driving wheel, for No. XI., current volume of the SCIENTIFIC AMERICAN, and makes the following inquiry:—

"Will it take any more power to start a train when the crank is on the upper half center than when it is on the lower half center, as shown by the heavy and light lines on the diagram?" (See page 164.)

Immediately following is the answer to the query, viz:—

"It will take more power on the lower center than the upper, for this reason," &c. The reason here appended is incorrect, and consequently the answer cannot be correct. The efficiency of a lever is not determined by the class to which it belongs—first, second or third—but by the ratio of the distance of the "power" from the fulcrum to the distance of the "resistance" from the fulcrum. Levers of the third class are generally called the least efficient, because with them the "resistance" must *always* have the long arm, and consequently power is always lost. With levers of the second class the "*power*" must always have the long arm and consequently advantage is always gained. With levers of the first class *either* the "power" or the "resistance" may have the long arm, therefore, circumstances must determine whether advantage is gained or lost.

The law of the lever is—*The "power multiplied by its distance from the fulcrum, equals the "resistance" multiplied by its distance from the fulcrum.*"

In the case of the "driving-wheel," let the "resistance" (the adhesion of the tire to the track) be called R; its distance from the fulcrum (the axle) be called T; let the "power" (the force exerted by the piston rod) be called P, and its distance from the fulcrum, when at the lower half-center, D, when at the upper half-center, D'. Then, according to the law above-stated, $P \bowtie D = R \bowtie T$, when the crank is at the lower half-center, and $P \bowtie D' = R \bowtie T$, when the crank is at the upper half-center. To find the power in either case we have the following:—$P = \frac{RT}{D}$ when the crank is below, and $P = \frac{RT}{D'}$ when the crank is above. The dividend is the same in each case, but D'=D. Therefore, P will be the same in each case. In other words:—It will take just the *same* power to start a train, whether the crank is on the upper half-center or whether it is on the lower.

Believing the answer given on page 164 is incorrect, and that the SCIENTIFIC AMERICAN is searching to establish truth rather than to defend a previously-expressed opinion, I submit the above, hoping it will find a place in your columns.

MORRIS PECK.

Cincinnati, Sept. 9, 1864.

From Natick we have this answer to the query:—

MESSRS. EDITORS:—In your issue of Sept. 10th, in answer to the query of H. B. M.—"Will it take more power to start a train when the crank is on the upper half-center than when on the lower half-center?"

Although you arrive at the correct result, viz:—that it will take more power on the lower than on the upper center, yet it seems to me that your reasoning is not correct. Is not this the true philosophy of the matter. Every lever has three essential points, viz:—the fulcrum or stationary point, about which the lever moves, the point at which the power is applied, and the point at which the weight or work is applied. For the sake of brevity let us call the first of these points, F, the second, P, and the third, W. Now, in all levers, whether of the first, second, or third class, the efficiency is in proportion to the relative distances of P and W from F. In the diagram you publish, the true fulcrum is at the periphery of the wheel, where it is in contact with the rail, the center of the axle is W, and the crank pin, P; consequently when the crank is on the upper center, P is farther from F than when on the lower center; so it will take less pressure to start when on the upper than when on the lower center.

STEPHEN MOORE.

Natick, Sept. 14th, 1864.

And from Clinton, Mass., this one—

MESSRS. EDITORS:—On page 164, No. 11, of your paper, present volume, I notice what appears to me a mistake in the answer given Mr. H. B. Morrison in regard to the power required to start a train when the crank is on the upper and lower half centers respectively. I am not sure that I understand what is meant by the statement that "levers are of three classes—first, second and third—and their efficiency is in the same ratio." If it means that a lever of the first class is more efficient than one of the second, and one of the second more so than one of the third (though I can hardly believe it does so mean) I submit that it is entirely erroneous. With regard to the power required to start a train, it appears to me that the *work* (considered as the "adhesion of the tire to the track") is at the extremity of one arm of a lever, which arm is equal to the distance from the center of the axle to the rim of the wheel, and is always of the same length, while the *power* is applied to the extremity of the other arm of the lever, which arm is equal to the distance from the center of the axle to the center of the crank-pin, and *this* arm is of the same length, whether the crank be upon the upper or lower half-center. Therefore, it seems clear to me that the power required to start the train is *the same*, whether the crank be upon the upper or lower half-center, and that the answer given Mr. M. is incorrect.

S. W. FOSDICK.

Clinton, Mass., Sept. 8th, 1864.

MESSRS. EDITORS:—A journal so honest and accurate as yours will be willing, and can afford, to be corrected when it happens to make a mistake. Your statement on page 164 (current volume) is perfectly correct, that it requires more power to start a train with the crank on the lower half-center than on the upper. But your explanation is sadly at fault. You say "levers are of three classes—first, second and third—and their effi-