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—

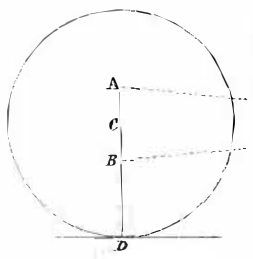
MESSRS. EDITORS:—On page 164, No. 11, of your paper, present volume, I notice what appears to me a mistake in the answer given Mr. H. B. Morrison in regard to the power required to start a train when the crank is on the upper and lower half centers respectively. I am not sure that I understand what is 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-

ciency is in the same ratio." This is not true, as levers of the third and second classes may be as efficient as some levers of the first. You also say that the axle is the fulcrum and the part of the wheel on the rail is the point where the weight is applied. If such were the case the power required would be the same in both cases, as can be easily proved.



Let C be the center of the wheel resting on the rail at D, and A B the positions of the crank at upper and lower half-center respectively. Now, let P be the power required to move the train with the crank at A, and P′ the power at B; W the weight to be moved, which, according to your supposition, acts at D, while the fulcrum is at G. Also, let AC or CB=b, and CD=a, now in any lever,

$$\text{power} = \frac{\text{weight} \bowtie \text{distance of weight from fulcrum.}}{\text{distance of power from fulcrum.}}$$

Applying this we have

$$P = \frac{W \times a}{b}$$

$$P' = \frac{W \times a}{b}$$

which means that the power is the same in both cases, which is not true. The error lies in assuming the point, C, as the fulcrum, instead of D. The point C is really the place where the weight to be moved is applied; D is the fixed point or fulcrum. With these suppositions, then, apply the formula for the power before given, and we have

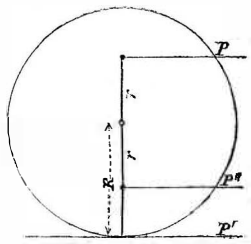
$$P = \frac{W \times a}{a+b}, \qquad P = \frac{W \times a}{a-b}$$

These fractions have the same numerator, but the denominator of the second is the smallest, hence the fraction is the largest, or P′ is greater than P; in other words, it will take more power to start a train on the lower than on the upper half-center. This is the true explanation. SETH C. CHANDLER, JR.

Boston, Sept. 9th, 1864.

MESSRS. EDITORS:—Your edition of the 10th inst. contains a query, viz.:—"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?"

The reason given for the first statement in the solution proves nothing, unless it be its incorrectness. It says that levers are of three classes; that when the crank is on the upper half-center it forms a lever of the first class; and when on the lower half-center one of the third—the center of the wheel being the fulcrum. All very true The next statement, that, "therefore it would take more power to move the train when on the lower center than when on the upper" is not logical, and must be incorrect. For the class of lever has nothing to do with the power when the lengths of the lever are the same, except in giving direction. A given weight will lift the same amount when applied to the lever of the first class, as when applied to the third.



Suppose, for convenience, we put the two positions of the crank in the same straight line, and apply the powers perpendicularly, as shown on the diagram. The center of the wheel is the fulcrum, the crank is one lever, r; the radius of the wheel, R, is the other; neither will change in length. The power, P, through the lever, r, is just sufficient to overcome the power, P′, working through the lever, R. The power, P″, working through, r, is also just sufficient to overcome the power, P′, through R. Condensing these statements we have Pr=P′R when on the upper center, and P″r=P′R when on the lower center, and "Things which are equal to the same thing are equal to each other," hence Pr=P″r or P=P″; no more power is required to move the train from the lower than from the upper center.

H. J. JOHNSON.

Providence, R. I., Sept. 17th, 1864.

It is related of Prof. Whewell, so famous for his vast learning, that he made a certain statement in one of his lectures, and after the lecture one of the class reminded him that he stated exactly the reverse the week before. He replied, "Don't you think I know more than I did last week?"

On page 164 we gave to a correspondent an answer, which, on more careful examination, we see was incorrect. It is manifest that the power required to start a train would be precisely the same, whether the crank was turned vertically upward or vertically downward.

A Change in Currency and Wages.

For a long time the wages of mechanics were maintained in California by the influence of the Placer mines. When a man could make his $6 per day with a sluice anywhere between Mariposa and Downieville, carpenters could not be hired in San Francisco for $5. But the Placer mines are almost exhausted. The solitary miner without capital has now no career open before him. The placers of the Sierra Nevada and of Frazer River; the argentiferous deposits of Washoe and Reese River, and prospecting for gold, silver, copper and coal have been successively "played out" as "spheres" for poor men generally, and now their chief reliance is in work for wages at a fixed price. Our labor market has a downward tendency. As the wages of the mechanic fell from $16 per day in '49 to $8 in '51, and to $6 in '43, and to $4 in '56, so they will go on falling hereafter. There may be no decrease this year or next, but no combinations can defy the laws of trade. It is plain that the laboring class would lose by the overthrow of our gold currency.—*Alta California.*

MISCELLANEOUS SUMMARY.

POVERTY A RELATIVE TERM.—Bulwer says that poverty is only an idea, in nine cases out of ten. Some men with ten thousand dollars a year suffer more for want of means than others with three hundred. The reason is, the richer man has artificial wants. His income is ten thousand, and he suffers enough from being dunned for unpaid debts to kill a sensitive man. A man who earns a dollar a day, and does not run in debt, is the happiest of the two. Very few people who have never been rich willbelieve this, but it is as true as God's word. There are thousands and thousands with princely incomes who never know a moment's peace because they live above their means. There is really more happiness in the world among working people than among those who are called rich.

INVENTION OF THE HAND GEAR.—It has been said that we are indebted for the important invention in the steam-engine, termed hand gear, by which its valves or cocks are worked by the machine itself, to an idle boy named Humphrey Potter, who, being employed to stop and open a valve, saw that he could save himself the trouble of attending and watching it, by fixing a plug upon a part of the machine which came to the place at the proper times, in consequence of the general movement. If this anecdote be true, what does it prove? That Humphrey Potter might be very idle, but that he was, at the same time, very ingenious. It was a contrivance, not the result of accident, but of acute observation and successful experiment.

HOME OF THE MUSCOVY DUCK.—At a meeting of the Academy of Natural Sciences, Philadelphia, Mr. Hill stated that the habitat of the Muscovy duck is the Lake of Nicaragua. There travelers see them at all times, either in small breeding coteries, or large flocks. In the wild state their plumage is dark without any admixture of white. They were originally procured from the Mosquito shore, the country of the Muysca Indians (see Humboldt's researches), and hence is derived the name of Musco duck, corrupted into Muscovy duck. The West Indian Islanders had early naturalized them, for on the discovery of Columbus, they speak of "ducks as large as geese," that they found among the Indians.

ENORMOUS BELTS.—The Boston *Commercial Bulletin* says:—"Messrs. Edward Page & Co. had on exhibition in State street, this week, five immense belts, made of heavy slaughter whole hides. The two longer were 246½ feet long, and 28 inches wide, double thickness throughout, and consuming 200 whole hides, and weighing nearly 1,000 lbs. each. These belts were made for the grain elevator of the Michigan Central Railroad Company. They were manufactured at Lawrence, Mass.

C. S. HUBBARD, of New Haven, Conn., Agent for Parson Brownlow's *Knoxville Whig*, has been notified that the non-reception of recent numbers of the paper has been owing to Wheeler's cutting railroad communication in Tennessee, thereby interrupting the transmission of the paper to Eastern subscribers. The missing numbers will be replaced by other numbers in the future.

DR. RICHARDSON, an English chemist, says that iodine, placed in a small box, with a perforated lid, destroys organic poison in rooms. During the continuance of an epidemic small-pox in London he saw the method used with benefit.

HAIR BRUSHES may be well and quickly cleaned, without wetting, by striking them, bristles down, flatly on a table. The dust shakes out and the down may be combed off.

THE *Magic*, of Bristol, R. I., a boat which beat everything easily at the Bridgeport regatta, was built and is owned and sailed by a blind man.

ENGLAND'S iron-clad fleet already afloat includes nineteen vessels, the largest of which carries forty guns and the smallest four guns, the aggregate being 409 guns, with a tunnage of 71,958 and horse-power 14,762. She has thirty-nine other iron-cased ships afloat, having from one to sixteen guns, and twelve powerful ships under construction, which will carry in all 255 guns, are of 43,160 tuns burthen, and 9,527 horse-power. Some of those vessels have cost as high as £381,000, or nearly two millions of dollars. England has expended $23,000,000 during the past year in building her iron-clad navy, a sum almost as large as it has cost our Government to build all the monitors, we being at war and England at peace. There will be thirty of these English iron-clads capable of firing a broadside. We have but one broadside iron-clad, the *Ironsides*.

A COSTLY DAM.—The *Railway Times* says:—"The cost of the mammoth dam nearly completed across the Deerfield river at the Hoosac tunnel, will be at least half a million dollars. The water power furnished by it is to be used to drive machinery for operating drills in the tunnel and furnishing it with air. The State has purchased ten and a half acres of land around the central shaft, which is the largest and deepest shaft ever sunk, the only one approaching it being one of 820 feet in depth to reach the tunnel grade. Only 60 feet of this distance is now accomplished, the size being 85 by 97 feet.

USELESSNESS OF EARTHING UP POTATOES.—By drawing up the earth over the potato, in sloping ridges, it is deprived of its due supply of moisture by rains, for when they fall the water is cast into the ditches Further, in regard to the idea, that by thus earthing up the number of tubers is increased, the effect is quite the reverse; for experience proves that a potato placed an inch only under the surface of the earth, will produce more tubers than one planted at the depth of a foot.

THE "west shaft" at the Hoosic tunnel is now sunk about 420 feet, and the temperature at the bottom during the warmest day is 35 degrees. The depth of water in the mountain is about nine feet, and the engine employed at the shaft removes 25 gallons each revolution. The engine also works a fan by which the men are supplied with air. The number of men employed on the west side of the mountain is 350.

A Submarine Vessel.

A correspondent who has been down in the submarine vessel recently invented and manufactured in this city by S. S. Merriam, and just tested by himself and the Government near New York, sends us the following account of his experiences:—"Entering the singular vessel from the top, the door was closed, and the order, 'Men, to your places' given to the little crew, who promptly obeyed. When everything was ready, Mr. Merriam turned some valves and the compressed air came hissing in, producing an unpleasant sensation upon the drum of the ear, of which one was at once relieved by inspiring and swallowing. The vessel seemed perfectly under control, for we stopped when half down to the bottom, and raised the door on the bottom of the boat, but the air inside of course prevented any water from coming in, even enough to wet the soles of our feet. One of the crew from your city improved the opportunity to dive out and come up on the surface of the water, much to the astonishment of the spectators on the bank. He afterwards returned and entered the vessel from the bottom, when the door was closed, another and heavier rush of compressed air came in, and we were on the bed of the river, 20 odd feet under water, this distance requiring an additional pressure to resist the water with the door open. We could stand on the bottom of the river and not wet our feet, and at that distance under water could easily see to read by the light that came in at the glass windows. Bells ringing outside were also heard distinctly. To return to the rest of the world only a few strokes of the pumps were necessary; the air rushed out of the bottom and the boat was quickly on the surface of the water. We moved with a propeller easily under as well as upon the water, and in all respects the vessel worked so completely that its success is undoubted."—*Springfield Republican.*