Correspondence.

The Editors are not responsible for the Opinions expressed by their Correspondents.

Propulsion of Vessels.

MESSRS. EDITORS:—Although it is admitted by all engineers that there is yet room for improvement in our present system of paddle and screw, yet very few are aware of the really immense disparity between the amount of steam consumed in the engine and that actually utilized in propulsion. The fact being, that if it were possible to utilize all the steam that passes into the engine in actually propelling a vessel, it can be shown that a saving of fully two thirds or three fourths would be effected—this statement is based on the following facts, viz.: Two horses can propel a loaded canal boat of two hundred tuns, at a rate of two miles per hour. Two-horse power of steam is equal to the power of two actual horses. Hence, if two-horse power of steam were fully utilized, this, and an allowance of ten per cent additional for friction, would be sufficient to propel same boat the same speed as two horses would.

The resistance of water in a canal is one third greater than that of deep rivers or more open waters; and the resistance of a canal boat, having no lines favorable to speed, is greater than the resistance of a well built schooner of same tunnage; therefore, it cannot be disputed, that if two-horse power of steam, plus ten per cent, can propel a loaded canal boat of two hundred tuns, at the rate of two miles per hour, the same power applied to a two hundred tun schooner, having good lines, and being in open water, should give a speed of two and a half miles per hour. Resistance increasing as the square of the velocity, it is easy to calculate power required to propel a two hundred tun boat, at any required speed. For example, to go ten miles per hour, or four times the velocity, evidently requires sixteen times the power. Therefore, $2\frac{1}{10}\times16=33\frac{6}{10}$ horse power, to drive two hundred tuns ten miles. Although the resistance does not increase in exact proportion to increased tunnage, it will be safe to calculate the amount required to drive any larger vessel, by taking the two hundred tun boat as a basis, and multiply the horse power for any required speed, by exact increase in tunnage. By this method it will be found easy to calculate power required to drive any given boat at any given speed. For instance, if all steam were utilized, it would be possible to drive boats of the following tunnage at following rates, with horse power of high pressure or low pressure, respectively, as follows:

200	tun	boat,	10	miles,	$33\frac{6}{10}$	high	press.,	$22\frac{4}{10}$	low press.
1000	"	"	10	"	168	"	"	112	" "
1000	"	"	20	"	672	"	"	448	" "
3000	"	"	20	"	2016	"	"	1332	" "

By comparing these figures with amount of *actual* horse power consumed in vessels at present, there will be great disparity. To invent a system capable of utilizing all steam consumed, it is simply necessary to know the primary laws or conditions of propulsion.

From a series of actual experiments made on a one hundred tun boat, the writer is enabled to construct the following hypothesis, viz.: That propulsion is produced by repulsion, that the one cannot exist without the other; hence they are coexistent, and the perfection of propulsion logically and practically depends upon perfection of repulsion; that, therefore, "slip" is but another name for imperfect repulsion; that propulsion is simply a question of power and comparative resistances—a greater and a less; and that perfect propulsion can only be produced by so applying the power to the body to be moved as to overcome the resistance in line of propulsion, without overcoming resistance, in opposite direction, or that of repulsion.

The foregoing hypothesis applies alike to the propulsion of all animate and inanimate nature, and will stand the most rigid logical or practical test as applied to a boat. It will be admitted that the area of immersed cross section, represents the resistance of propulsion, and the area of two buckets of a paddle represents resistance of repulsion. Hence it follows, that to produce perfect propulsion, it is necessary so to apply the power as to overcome a greater resistance, without overcoming a less. To do this, and adapt the means of doing so to any boat, in the simplest and best manner possible, is to construct a propelling apparatus capable of utilizing all the steam, and hence effect the immense saving of sixty to seventy-five per cent. With this end in view, the writer has invented a propelling apparatus, that he trusts will accomplish the desired result, as follows:

A horizontal engine is attached, by proper links, to a crank motion, at a point as near as possible to the center of an axis; a pair of piston propellers are attached by proper links to the points of a pair of vertical dynamic levers, most distant from same axis, the axis is swung athwart the boat, and works in proper journals. The engine being set in motion, puts the piston propellers in motion the cylinders in which the piston propellers work being open at one end, two proper holes or parts in the boat admitting the water to propelling face of pistons. These pistons impinge on the water on one side only, and are so arranged as to work in a vacuum on the other; so that they make propelling stroke by pressure of steam on the engine, and are brought back to original position by means of pressure of water alone. The resistance of the small area of water at the propellers being, by means of proper use of dynamic lever, made virtually greater than that of the larger area of immersed cross-section, it is evident (from the fixed law, that power applied to overcome to unequal resistances of necessity overcomes the least) that the water forming resistance of boat's motion can give way without displacing water at propellers, and, consequently, that the boat can be propelled by this means without "slip;" and it is also evident there can be no lift water, hence the economy. So that every pound of steam is actually utilized in propelling vessels, minus the friction, which will be less than ten per cent.

It will be found, the shorter the crank at which power is applied, and the longer the arms of the lever, to which propellers are attached, the greater the economy—for this dynamic leverage is the vital principle of my invention, the form of propellers used being that simply best mechanically adapted for impinging on the water, on one side only, and are, as is well known, worthless as economical propellers, of themselves, otherwise applied. The philosophy of this use of the dynamic lever is, simply, that by its means, power is applied as near as possible to the axis, because the axis represents the actual point of impact, or the true point of resistance of motion in a boat, and as far away as possible from point of resistance of propellers, which is the actual fulcrum; and by this means the water at propellers is much more difficult to displace than the resistance of boats' motion, which was to be done.

In addition to its great economy in fuel, and cost and weight of machinery required, this system presents many other advantages over paddle and screw—namely, great simplicity of machinery—hence less wear and tear, and much better protection from the action of rough seas, or the obstruction of ice, weeds, logs, etc., common to inland navigation, and its special adaptability for shallow rivers and gunboats.

I hope, at an early date, to lay before your readers drawings and more explicit details of my invention. F. K. P.

New York city.

Quadrature of the Circle.

MESSRS. EDITORS:—I am surprised that the *London Building News*, from which you republished an article under the above heading (page 375 of your last volume), is not better posted in regard to English investigations and London publications. The article states, that later researches brought the number expressing the ratio of the diameter of the circumference to 127 decimals. Now this is exceedingly old news, as later researches went much further. M. de Lagny, in France, found this in 1682, and published the 127 decimals in the "Memoires de l'Academie," in the year 1719; after that, we find in the library of Radcliff, Oxford, 155 decimals; and we find, further, that Dr. Rutherford, of Woolwich, presented a calculation of 200 figures to the Royal Society, London. However, it was, unfortunately, found out, that all his decimals, added to the 155 of Oxford, were wrong. Perhaps he was confident that nobody would take the pains to persuade him of error; this was, however, done by Dr. Clausen, of Dorpat, who found 250 decimals, and Mr. Shanks, of Durham, 315. This stirred Dr. Rutherford up, and he, in his turn, tried to find errors, but he found the figures all correct; and he extended them to 350 decimals. Mr. Shanks appears to have become jealous, and carried them to 527 decimals. Mr. Rutherford, wishing again to ascertain if they were correct, found them so to 411 decimals, and then gave it up. Mr. Shanks did not give it up, but went again to calculating, till he had obtained 607 decimals, and he published the result of his calculations in the "Contributions to Mathematics," London, 1653.

There we find the curious, famous, and, at the same time, useless decimal fraction of 607 decimal places, representing the relation of the diameter and circumference of a circle so near to the truth, that the difference, with the absolute ratio, is smaller than the strongest imagination possibly can conceive. We call it also useless, as, for the most delicate calculations, 10 or 12 decimal figures are amply sufficient.

Never has any continuous fraction been carried so far. For instance, no body ever had, till the present day, the patience to calculate $\sqrt{2}$ or $\sqrt{3}$, even to 100 decimal figures; we must, therefore, conclude that the relation between the diameter and circumference of a circle is numerically better known, at present, than many other quantities which are daily used.

We give here the beginning of this fraction for curiosity's sake: Diameter $=1$; circumference is

3·14159 26535· 89793 23846 26433 83279 50288 41971 69399 37510 + . . ., etc., 507 more decimal figures. This decimal fraction is not and cannot be repeating or periodical, but changes the order of its figures infinitely.

P. H. VANDER WEYDE, M.D.

New York, city.

Air Bubbles in Ice.

MESSRS. EDITORS:—In the SCIENTIFIC AMERICAN of Nov. 25th, I see the theory of C. D. Sutton, on the specific gravity of ice, which is lessened, as he says, by the retention of air bubbles in its substance. For at least twenty years I maintained the same theory with considerable energy and then from force of experiments, gave it up and sought other reasons for the phenomenon. It is now a good season of the year for him or others to try that kind of experiments. Let him grind ice to an impalpable powder and put it in water at 32° Fah. and then stir the mixture well, and if it or any part of it sink, it will strengthen his theory, and if it all should float he must look for other reasons. My experience has been that it all swims, and I gave up attributing the low specific gravity of ice to the air contained in it.

The Creator so in best wisdom ordered that the arrangements of the particles of water under congelation, should so stand apart as to cause ice invariably to float, so that rivers might continue, during long freezes, to vent their waters, and not gorge up, overflow, and destroy all the property along their banks, which would inevitably be the case if ice sank to the bottom as formed. Ice in a muddy running stream, will in a few days of warm weather, sink to the bottom by reason of the earth attached to it. I have ridden scores of miles on Lake Erie, when the ice was eighteen inches thick. At the distance of five or six miles apart, I found cracks in the ice running from the shore square off into the lake. These cracks, if I remember right, were about the width of one foot of shrinkage, for each mile of unbroken distance! I know that I had to course along these cracks until I came to a bend, or crook that threw the crack up and down the lake, where I could get across! This was proof to me that ice, like other solids, contracts after congelation is finished. JOHN S. WILLIAMS.

Cincinnati, Ohio.

Steam on Canals.

MESSRS. EDITORS:—What can you tell us about steam on canals, about boats constructed for cheap unloading of which you have one running in New York harbor, etc.? How do the English canals afford to pay dividends with 50-tun boats towed by steam, etc.? Can the expense of a skilled engineer be saved by adopting Loper's or other caloric engines for canal barges? In short, won't you wake upon the subject of modernizing canals and their motive power, by towage either by tug or locomotive, but not by submerged wires, which don't answer? NAVIGATION.

Philadelphia, Pa.

[We have published a number of articles on this subject, which may be found in previous numbers of the SCIENTIFIC AMERICAN. We have no confidence in the use of hot air engines for towing purposes. The conditions of canal navigation in England and in this country are so different that no conclusion based on the facts of either would be applicable to the other.—EDS.

Chrome Iron for Lapidaries' Wheels.

MESSRS EDITORS:—I see the new alloy of iron and chromium mentioned in your admirable paper, and I would ask of some of your valued correspondents, who I hope will favor me with a speedy reply, whether a lapidary's slitting wheel for jaspers, agates, and the like, could not be made from it? It cuts glass as well as the diamond, and I think might possibly take the place of the soft iron wheel fed with diamond dust, which is so extravagantly dear and so often shamefully adulterated. I think a wheel of this kind would answer for all the softer stones and pebbles, and prove a great boon especially to amateurs. Can any one tell me what genuine diamond powder can be bought for in America? MEDICUS.

Ensworth, Hants, England.

The Effect of Glaciers on the American Continent.

Proffessor Agassiz said some interesting things concerning his pet glacial theory at the Amherst agricultural meeting, recently. He declared that all the materials on which agricultural processes depend are decomposed rocks, not so much rocks that underlie the soil, but those on the surface and brought from considerable distances and ground to powder by the rasp of the glacier. Ice, all over the continent, is the agent that has ground out more soil than all other agencies together. The penetration of water into rocks, frost, running water, and baking suns have done something, but the glacier more. In a former age the whole United States was covered with ice several thousand feet thick, and this ice, moving from north to south by the attraction of tropical warmth, or pressing weight of ice and snow behind, ground the rocks over which it passed into the paste we call the soil. These masses of ice can be tracked as surely as game is tracked by the hunter. He had made a study of them in this country as far South as Alabama, but had observed the same phenomenon particularly in Italy, where, among the Alps, glaciers are now in progress. The stones and rocks ground and polished by the glaciers can easily be distinguished from those scratched by running water. The angular boulders found in meadows and the terraces on our rivers not now reached by water, can be accounted for only in this way. He urged a new survey of the surface geology of the State, as a help to understanding its constituent elements, and paid a high tribute to the memory of the late President Hitchcock.

Adulterated Liquors.

The New York *World* has been doing the country a service by some investigations into the quality of liquors sold at the different bars in this city. A large number of samples of brandy sold at from thirty to fifty cents a glass, and of whisky sold at from twenty to thirty cents per glass, were examined and found to be genuine in only two instances. If such be the case with liquors sold at the best places, what must be the character of the fluids retailed at the low grog shops where whisky can be obtained for from five to ten cents a glass. In this connection it may be remarked that some specimens of brandy pronounced by experts under oath in a recent revenue case to be genuine and worth twelve dollars a gallon in gold, were afterward found to have been manufactured in Brooklyn, and to contain not one particle of genuine liquor. How shall the sale of these poisons be stopped? By each and all refusing to touch, taste, or handle the filthy compounds.

The practice of using ardent spirits is exerting a very malign influence upon all classes in this country, and although we do not believe that mechanics as a class are more addicted to the practice than others, still a word of warning will not be out of place to them at this time. The waste of money, time, and worst of all, the ruin of mental and moral power which follows a career of dissipation, is sad enough and has been repeatedly and forcibly placed before every person in the civilized world. Nothing can restore what is lost in this way and we once again appeal to the noble army of mechanics in America to join in the suppression of the practice. Mechanics will you do it? Any one of you can commence the work in the establishment to which you belong, and we shall be most happy to announce in our columns the success you meet with in the good work if communicated to us.