Correspondence.

THE PROPERTIES OF NUMBERS.

To the Editor of the SCIENTIFIC AMERICAN:

For the past three or four months I have been much interested in the discussions of the curiosity of the properties of numbers. From the fact of the age and absolute truth of mathematics, there cannot be any curious properties in the science of numbers.

The citation of one correspondent of the sum of two prime or odd numbers being even is not curious, for the reason that every odd number is one more than even, and 1 plus 1 being 2, which is even, hence the sum of two odds must be even.

Another correspondent states, if the sum of the nine digits be doubled and the last term deducted, the remainder will be the square of the last term; which is not only true of 9, but of the last term of any like series, for the reason that the sum of the terms of a like series is half the sum of the first and last terms divided by 2 and multiplied by the last term—which, in this case, increases 9 five times—and being doubled ten times, or once more than its square.

Extending the series from 1 to 25, we have the sum of the first and last term as 26, the half of which is 13, and being doubled increases 25 to 26 times, or once more than its square. Or, we can say, the last term multiplied by the sum of the first and last is equal to one more than the square of the last.

Other correspondents, noting that numbers may be expressed by the difference of two squares, apparently manifest surprise, notwithstanding the fact that right triangles are governed by that law, which may be illustrated by the construction of triangles, the formation being primary. By assuming any quantity—odd or even, whole, mixed, or fractional—as either of the short sides, with any number slightly or greatly larger as the sum of the other two sides, as many commensurate right triangles may be formed as numbers can be found to express their sides. Some of the assumptions may involve intricate fractions, but when worked out will be found to comply commensurately with the conditions. One of the governing laws is embodied in the fact: The product of the sum and difference of any two quantities is equal to the difference of their squares. Versus: the difference of the squares of any two numbers divided by their sum is equal to their difference.

Assume 1 as a base with 1¼ as the sum of the other two sides. Dividing 1 squared by 1¼ we have 2/3, the difference of the two sides. Dividing 1¼ into two parts having a difference of 2/3, we obtain 13/12 and 5/12. Squaring and subtracting, we have 1 square.

Assuming 5 as an altitude and 12 as the sum of the other two sides, we have 5 squared divided by 12, which equals 25/12 as the difference; and dividing 12 into two parts having a difference of 25/12 we obtain 169/24 and 119/24 as the two sides. Squaring and subtracting, we have 25, or 5 square.

Assuming 5 as an altitude with 25 as the sum of the other two sides, we have 5 squared divided by 25, which equals 1, and 25 being divided into two parts having a difference of 1, we obtain 13 and 12 for two sides. Squaring and subtracting, we have 25, or 5 squared.

Assuming 12 as a short side and 16 as the sum of the other two, we have 12 squared divided by 16, which equals 9, the difference of the other two sides. Dividing 16 into two parts, we have 12½ and 3½ as the two sides. Squaring and subtracting, we have 144, or 12 square.

Assuming 13 as one of the short sides with 17 as the sum of the other two, we obtain 13 8/17 and 3 5/17 as the other two sides. Squaring, we have 48,841/289 minus 360/289 equals 169, or 13 square.

This may be continued without finding a single exception. Besides, the findings may be proportionately expanded or contracted to any extent with like results.

By permission I can, and will, demonstrate to the satisfaction of the lay mind that right triangles are also governed by the laws of proportion. In any right triangle whose base is equal to 1/3 the sum of the other two sides, then (and only then) 1/3 the sum of all three sides is equal to the altitude, as 3-4-5 and 6-8-10, etc.

Yet the properties of numbers, or the science of mathematics, have neither curiosities nor exceptions to their laws.

Hannibal, Mo. D. M. MORRIS.

THE COMMERCIAL POSSIBILITIES OF THE AEROPLANE.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of February 13th there appeared a letter from Mr. C. A. McCready in which he asks if there is any sound principle underlying these air vessels that is capable of development to the point of commercial success. He then goes on to define what the commercially successful airship of the future will be. While he does not actually say so, yet he intimates that there are better principles for the construction of aeronautic machines than have as yet been tried and that none of the present machines can eventually be commercially successful.

There undoubtedly is a field of usefulness for any practical airship, for exhibition, sporting, and pleasure purposes and as an implement of war. One can never tell to what extent any practical device will be commercially successful. The bicycle, the automobile, and the motor boat have not been used to any extent commercially compared with their use for pleasure purposes, yet the industries built up around them have been amazing. It would therefore look reasonable to suppose that inventors are justified in working along the lines so far disclosed rather than looking for new ones to turn up, like a famous character in Dickens. Especially is this the case when we consider that it is likely that the principal problems met with at present and which are being solved from day to day will probably be embodied in the airship of the future.

However, let us consider what has already been done and see if even in its present crude state the aeroplane does not give promise of commercial success. The Wright machine has demonstrated that it can travel for a couple of hours at a time at the rate of forty miles per hour. It does not seem unreasonable to suppose that this time could be extended to five hours. The distance between Boston and New York by air line is about 190 miles; by railroad it is 233 and by road 243 miles. The motor of the Wright machine consumes about three gallons of gasoline per hour. In other words for the trip between Boston and New York, following the air line, about four hours and forty-five minutes would be consumed and about fifteen gallons of gasoline. This, at the rate of twenty cents per gallon, would mean an expense of $3, and allowing a dollar for lubricating oil, etc., would bring it up to a total of $4. As there are only two five-hour trains per day and the fare on these is $6.65 per passenger and the Wright machine is capable of carrying two, it would look as if, everything considered, from both a time and money standpoint the aeroplane gives at least promise of commercial success, especially when it is considered that an aeroplane can be built at only a fraction of the cost of an automobile of anything like the same horse-power.

Boston, Mass. HAROLD H. BROWN.

A PROBLEM IN MECHANICS.

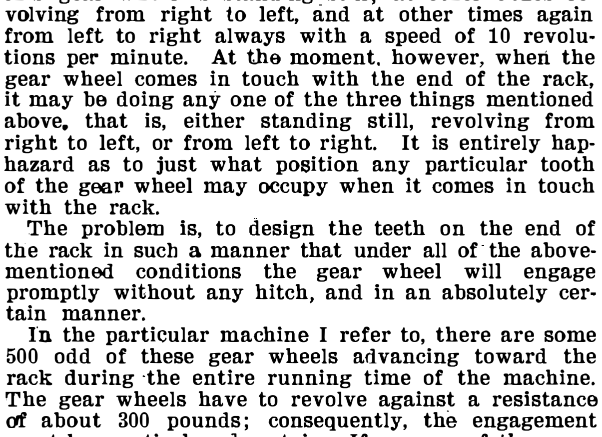
To the Editor of the SCIENTIFIC AMERICAN:

I have been a reader of your valuable paper for many years, and have been in the business of designing machinery of many kinds, some of it very complicated.

Lately there has come up in my work a very interesting problem in practical mechanics. I inclose you a blue-print showing a gear wheel and a rack. The rack is fixed. The gear wheel approaches the rack on a horizontal line parallel with the pitch line of both the gear and rack from right to left at a steady speed of 12 feet per minute. At indeterminate times this gear wheel is standing still; at other times revolving from right to left, and at other times again from left to right always with a speed of 10 revolutions per minute. At the moment, however, when the gear wheel comes in touch with the end of the rack, it may be doing any one of the three things mentioned above, that is, either standing still, revolving from right to left, or from left to right. It is entirely haphazard as to just what position any particular tooth of the gear wheel may occupy when it comes in touch with the rack.

The problem is, to design the teeth on the end of the rack in such a manner that under all of the above-mentioned conditions the gear wheel will engage promptly without any hitch, and in an absolutely certain manner.

In the particular machine I refer to, there are some 500 odd of these gear wheels advancing toward the rack during the entire running time of the machine. The gear wheels have to revolve against a resistance of about 300 pounds; consequently, the engagement must be practical and certain. If any one of the gears should fail to engage, the entire machine would become a wreck.



A PROBLEM IN MECHANICS.

After a long series of calculations and experiments, I have solved the above problem, and the machine has now been running for three years nearly steadily in an entirely satisfactory manner.

It lately occurred to me that this particular problem in mechanics may be of great interest to your readers; but thinking that possibly it may already be well known to a good many of them, I am writing this in advance, as possibly some of your readers may give another solution to the above problem than the one I worked out. CONSTANTINE SHUMAN.

Philadelphia, Pa.

STEREOSCOPIC ILLUSION.

To the Editor of the SCIENTIFIC AMERICAN:

On page 320, issue of November 7th, 1908, Prof. Michaud begins a stereoscopic essay with "Some stereoscopic relief is usually perceived," etc. This is a fallacy; all that he can see by the devices he explains is a heightened perspective effect, and no wise different in kind, or quality of vision, from what a good pair of eyes, and appreciative training of mind, can see in viewing a fine landscape painting (or photograph) such as Church's "Heart of the Andes."

In the illustration, Fig. 1, there is an illusory effect, simulating stereoscopic, caused by variations and defects in one of the two engravings—particularly in the background, which appears as a plane surface to the rear of the defects. The figure, books, flowers, etc., if the light is sufficiently strong to cut out imagination, are pictured as a plane surface.

I learned when young to make separate use of my eyes, which focus differently; can shoot a rifle well with both eyes open, ignoring the vision of either at pleasure. Can add a long column of figures, begin with one eye at the top, "switch off onto the other" eye on the way down, easily.

I do not need a stereoscope to enjoy stereoscopic views, as I hold the view card before me a little too near, then adjust an eye to each, and carry the card to its due distance. I then have, as it were, three pictures in sight, the middle one made up of two superposed, a clear stereoscopic view, clearer in detail than the others, which are flat surfaced. I can then run my attention, easily, from one to another, note defects, scratches, etc., without losing the clear stereoscopic effect on the central one.

Deland, Fla. ALFRED HOWARD, C.E.

[Prof. Michaud's reply.—Stereoscopic effect is that impression which leads one to believe that the observed relief is *not* produced—as in a drawing—by a combination of lines, lights, and shades, figured on a flat surface, but is the result of the fact that the object occupies the three dimensions of space. Such an impression and the consequent belief are easily produced in observers who look into the stereoscope for the first time, without knowing the real nature of the object. It comes still more readily and is stronger when one looks, through a pinhole, at a distance of one or two inches, on the diagram published in the March 30th, 1907, issue of the SCIENTIFIC AMERICAN. I refer Mr. Howard to that diagram, which he has probably not seen.

Stereoscopic relief is of course less apparent on the figure published in the November 7th, 1908, issue, and the reasons for the decrease (absence of artificial distortion and great distance of photograph from the eye) are fully explained in the May 2nd, 1908, issue; but, while weaker, that stereoscopic relief is no more illusory than that observed in the stereoscope. Mr. Howard believes that it should be attributed to variations and defects in one of the two photographs. The explanation is not plausible, as both photographs were made with one and the same negative, and will bear, from that point of view, the closest scrutiny. Moreover, the same impression of stereoscopic relief can be had with about the same intensity when a *single* photograph is examined through one of the apparatus mentioned in the article.

Few are the observers who can readily produce the parallelism of their optical axis, together with the necessary convexity of their crystalline lenses, while looking directly at a pair of stereoscopic photographs. Those who can, get the impression of stereoscopic relief just as strong as with the stereoscope. Most of those who cannot, will obtain the desired result through the use of the double diaphragm described in the November 7th, 1908, issue of the SCIENTIFIC AMERICAN.]

The Current Supplement.

The opening article of the current SUPPLEMENT, No. 1736, is an illustrated description of the recently-launched Hudson River steamboat "Robert Fulton." An instructive technological article is that which bears the title "Propeller Molding," and in which the amateur molder is informed how he may cast a true screw propeller. The second and concluding installment of the summary of Edison's inventions and their commercial value to the world is presented. A rolling lift bridge across a river in Burma is described and illustrated. The structure is of particular interest, because the bridge was designed by American engineers. The European oxygen industry is passing through a period of most remarkable development. One of the processes which is in use is the invention of Claude, and is fully described and illustrated by our Berlin correspondent. Prof. Harold Wilson's recent discourse on the electrical properties of flames, delivered before the Royal Institution, is summarized. M. Eiden writes on the sinking of the earth's crust, and explains how many of our geological changes have occurred. To the student of marine invertebrate biology, there is perhaps no other group of lowly organisms which presents a greater variety of exquisite forms or affords more bionomic interest than do the hydroid zoophytes with their offspring, the jelly fishes. This family is instructively described and illustrated by Mr. J. E. Bullen. A concise history of the whale industry is given. Dr. Koerner contributes a valuable article on the production of alcohol from cellulose. To look upon the wonderful and varied hues of the flowers that surround us, and not feel the desire to know something of the pigments that produce their colors, is well-nigh impossible. C. M. Broomall writes on the subject.

Official Meteorological Summary, New York, N. Y., March, 1909.

Atmospheric pressure: Highest, 30.45; lowest, 29.06; mean, 29.83. Temperature: Highest, 66; date, 10th; lowest, 21; date, 5th; mean of warmest day, 52; date, 10th; coolest day, 26; date, 5th; mean of maximum for the month, 44.6; mean of minimum, 32.0; absolute mean, 38.3; normal, 37.7; excess compared with mean of 39 years, 0.6. Warmest mean temperature of March, 48, in 1903. Coldest mean, 29, in 1872. Absolute maximum and minimum for this month for 39 years, 75 and 3. Average daily excess since January 1st, 3.2. Precipitation: 3.19; greatest in 24 hours, 1.66; date, 24th and 25th; average of this month for 39 years, 4.01. Deficiency accumulated since January 1st, 0.74. Deficiency compared with average of 39 years, 0.82. Greatest March precipitation, 7.90, in 1876; least, 1.19, in 1885. Snowfall, 4.1. Wind: prevailing direction, west; total movement, 12,344 miles; average velocity, 16.6 miles; maximum velocity, 60 miles per hour. Weather: Clear days, 12; partly cloudy, 10; cloudy, 9. In which 0.01 inch or more of precipitation occurred, 11. Fog (dense), 10th. Thunderstorms, 4th.

Electrolytic Chloroform.

Chloroform is now produced by electrolysis of a solution of 50 parts of crystallized calcium chloride ($CaCl_2$, 6 H_2O) in 100 parts of water, to which 0.6 part of alcohol is added. The electromotive force used is 3 or 4 volts and the current density is ¼ ampere per square inch. The solution is kept at a temperature between 136 and 145 deg. F. The chloroform distills over and is condensed and collected.