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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 309,

For the Week ending December 3, 1881.

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THE ACME OF MISINSTRUCTION.

The public schools of Philadelphia—some of them at least—have achieved the unenviable fame of having "about the vilest plan of education that was ever devised." So at least an indignant parent says, and the proof offered is, we trust, sufficient. We cannot bring ourselves to think that any school work can be worse.

Hearing his little girl sobbing over a rule which she was trying to commit to memory, he investigated the matter and found the words to run in this wise:

"Rule for Short Division Rule dash one write the divisor at the left of the dividend, semicolon, begin at the left hand, comma, and divide the number denoted by each figure of the dividend by the divisor, comma, and write the quotient beneath, period. Paragraph."

"2. If there is a remainder after any divisioncomma, regard it as prefixed to the next figure comma and divide as before period. If any partial dividend is less than the divisor, comma, prefix it to the next figure, comma, and write a cipher in the quotient period."

"Paragraph Proof period dash multiply the quotient by the divisor, comma, and add the remainder, comma, if any, comma, to the product, period."

The teacher's object was not to reduce this particular ten-year old girl to idiocy or insanity by the quickest possible method; the aim was simply to insure the "correct" writing and pointing of the rule in the recitation room. All the children had to study rules that way; and though a Philadelphia lawyer could not easily follow the sense of a rule through such a jargon of words, it seems that Philadelphia children are compelled to; or, rather, they are compelled to memorize the jargon and the sense is disregarded. In the course of his inquiries the parent found that if a comma was left out in writing the rule, though the sense remained unchanged, the pupil suffered as much in loss of marks as though she had committed a vital blunder.

A more thoroughly foolish perversion of arithmetical instruction could not well be conceived. And the professional stupidity and formalism which could devise such an outrageous method of teaching one subject is from that achievement alone demonstrably unfit to be trusted with any branch or department of instruction.

Taking the schools as they run, good, bad, and indifferent together, it is speaking within bounds to say that two-thirds of the work done in them might be wiped out and abolished to the benefit of the children. They might then have time to learn in a reasonable way some things worth their while to know, in the learning of which in a proper way they would be educated and not stultified, as they are under the more or less mitigated Philadelphia fashion now prevalent.

WATER FUEL ON A LOCOMOTIVE.

We learn from the *Tribune* and other papers that a locomotive in which neither wood nor coal will be burned is now in process of construction at the Grant Locomotive Works at Paterson, N. J. "In reality the fuel to be used is water," says the *Tribune*, and several of the other papers introduce their notices of the locomotive with the announcement, "The use of water as fuel." All this, coming in the dry season, is certainly very startling. But really no alarm need be felt about our Croton supply and our very useful rivers, for it is not exactly the water which is to be set on fire, but, as the *Tribune* explains, the water is first "decomposed in association with carbon, forming readily combustible gases, of which hydrogen is the chief." We are further relieved on learning that the project is in fact only the naphtha water vapor process which was about ten years ago fully tested at the Brooklyn Navy Yard, on the Battery, and elsewhere.

The explanation of former failures appears now to be that the older experimenters did not have the correct theory. The *Tribune* says: "The argument brought against the Holland," (naphtha steam) "process was that it was based on an erroneous principle, being in opposition to the law of conservation of energy. But it is answered that while the dissociation of steam must require as much energy as is later developed in the combustion of the hydrogen, that energy need not necessarily take the form of heat in the dissociation process. The form of energy which does take the place of the heat saved is stated to be chemical affinity." "The carbon of the naphtha gas, with which steam is brought in direct contact in the Holland process, lowers the dissociation temperature to 400° C. As the hydrogen resulting from the dissociation burns with a heat of nearly 8,000° C., a gain is effected, roughly speaking, of nineteen-twentieths of the whole heat."

The sentences quoted seem to be intended to represent that some new principle has been discovered relating to the decomposition of water, and that the Holland process effects a saving of nineteen-twentieths of the cost of heat by former processes. But there is nothing alluded to as of a scientific character which has not been familiar knowledge for a long time. As to the saving of heat it should be noticed that the nineteen-twentieths, roughly speaking, is only one side of the cost account. Admitting that nineteen-twentieths of the heat required to dissociate the elements of water would be "saved" when the elements were separated by an equivalent of chemical affinity, no advantage could be shown until it appeared that chemical affinity was cheaper than heat. Water at a freezing temperature may be decomposed by sodium or electricity, and the whole of the heat of dissociation be "saved;" in like manner the cost of going by the lightning express may be "saved" by taking the owl train. The accuracy of the figures, nineteen-twentieths, is not material to the argument, and it is not worth while to expose the fallacy of the calculation which has produced them.

The Holland apparatus, as described, seems to us somewhat crude in comparison with some others of a similar intent. He uses naphtha and water vapor under materially the same conditions as his predecessors, and even if he had discovered a new theory it is not likely that naphtha steam would behave differently on that account.

The most that can be reasonably hoped from the experiment is that it may result in some useful hint on the use of naphtha fuel in places where it is more needed than on a locomotive.

COMMANDER CHEYNE'S LECTURES.

The first of a series of lectures on Arctic Research was delivered in this city, November 17, by Commander Cheyne, of the British Navy. The lecture was illustrated by a series of beautifully colored vivid and spirited stereopticon pictures of Arctic scenes and incidents, in several of which certain of the objects were represented in motion while the general scene was at rest.

In substance, delivery, and illustration, the lecture was a notable and admirable innovation upon the usual custom in such cases. Though an old man Commander Cheyne retains much of the dash and vigor which he displayed years ago in the search for Sir John Franklin. His purpose in these lectures is to enlist the co-operation of our people in an expedition to the Pole, in which balloons are to be employed after reaching the coal deposits on Smith's Sound, 500 miles in a direct line from the Pole.

As our readers will remember, the plan of employing balloons in Arctic research, as proposed by Commander Cheyne, was described and illustrated in this paper two years ago (September 20, 1879).

THE RELATION OF AGRICULTURE AND MANUFACTURES TO POPULATION.

The Census Office has issued a bulletin presenting the results of a study of the statistics relative to the distribution and density of population last year, in comparison with the result of previous enumerations.

The settled area is taken to include all which contains a population of two or more to the square mile. Upon this definition the settled area of 1880 is mainly comprised in one large body lying eastward of the plains. Here reside 95 per cent of the total population of the country, the remainder being in detached bodies of comparatively small size, chiefly in Oregon and California.

Within the great settled area are several regions practically unsettled, like Southern Florida, the northern part of Maine, the Adirondack region in Northern New York, and Northern Wisconsin and Minnesota. Five grades of density are recognized, three of them denoting the predominance of agricultural pursuits. The first grade represents a sparse population—from 2 to 6 to the square mile. It is found mainly along the frontier, in Florida, Minnesota, Nebraska, Kansas, Texas, California, Colorado, Oregon, and the Territories. In these areas the population is sustained rather by the grazing industry than by agriculture. In some parts mining is obviously an industrial factor. The poorest tillage regions sink into this grade, which is not inconsiderably represented in some of the older States.

The second grade of population—6 to 18 to the square mile—indicates for the most part defined farms and plantations, and the systematic cultivation of the ground; but this, either in an early stage of settlement or upon more or less rugged soil. This grade is found largely in many of the Western and Southwestern States, and in the mountainous regions of the Atlantic slope.

The third grade—18 to 45 to the square mile—almost universally indicates a highly successful agriculture. Here and there the presence of petty mechanical industries raises a difficult farming or planting region into this grade of density of population, but in general, where manufactures exist at all, they induce a population of 45 or more to the square mile. Speaking broadly, agriculture in the United States is not carried to such a point as to afford employment and support to population in excess of that number. This third grade of population is predominant in Alabama, Delaware, Georgia, Illinois, Iowa, Kentucky, Maryland, Mississippi, Missouri, North and South Carolina, Tennessee, Virginia, and Wisconsin. Of the New England states, Maine, New Hampshire, and Vermont have also large tracts in this degree of settlement.

The fourth grade of settlement—45 to 90 to the square mile—almost universally indicates the existence of commercial and manufacturing industry and the multiplication of professional and personal services. This grade is found in excess of any other in Connecticut, Indiana, Maryland, Massachusetts, Michigan, New York, Ohio, and Pennsylvania.

The fifth grade—90 or more to the square mile—represents a very advanced condition of industry. In New Jersey and Rhode Island alone is this grade of settlement in excess of every other grade, indeed in excess of the sum of all the other grades. This degree of settlement is reached only where manufacturing and trading villages are numerous.

The States containing more than a thousand square miles in the fourth grade of settlement are Illinois, 13,500 square miles; Indiana, 24,810; Iowa, 1,100; Kentucky, 11,000; Maine, 2,795; Maryland, 6,860; Massachusetts, 4,840; Michigan, 16,630; Mississippi, 2,200; Missouri, 1,160; New Hampshire, 1,230; New Jersey, 2,440; New York, 33,000; North Carolina, 4,700; Ohio, 37,600; Pennsylvania, 30 ~

South Carolina, 2,300; Tennessee, 10,200; Virginia, 7,000; West Virginia. 3,645; Wisconsin, 6,900.

The States containing over a hundred miles in the fifth grade of settlement are Connecticut, 780; Illinois, 700; Kentucky, 600; Massachusetts, 2,900; New Jersey, 3,065; New York, 2,420; Ohio, 2,060; Pennsylvania, 10,750; Rhode Island, 685; Wisconsin, 450.

The distribution of population throughout the entire settled area of 1,569,570 square miles, is:

Grade I.	(2 to 6 to sq. m.)	384,820 sq. m.
" II.	(6 to 18 ")	373,890 "
" III.	(18 to 45 ")	554,300 "
" IV.	(45 to 90 ")	232,010 "
" V.	(90 and over ")	24,550 "

The practically unsettled area of the United States, exclusive of lakes and river surfaces bounding the republic or the single States, is 1,456,924 square miles.

THE NATIONAL ACADEMY OF SCIENCE.

The fall meeting of the National Academy of Science, at Philadelphia, beginning Nov. 15, called together as usual a representative body of working scientists. In response to the request of the United States Commission, appointed to take charge of the observation of the Transit of Venus next year, the Academy appointed as a committee to co-operate with the commission: Professor C. H. F. Peters, of Litchfield Observatory, Clinton, N. Y.; Professor S. P. Langley, of the Allegheny Observatory, Pittsburg; Professor E. C. Pickering, of Harvard College Observatory; Professor C. A. Young, of Princeton College; Professor H. A. Newton, of Yale College; and Professor Henry Draper, of New York.

Among the papers of the earlier sessions were three by Professor Agassiz—on "A Gigantic Salpa found in the Gulf Stream;" "The Echini of the Challenger Expedition;" and "The Distribution of Corals on the Tortugas;" and two by Professor Marsh—on "Classification of the Dinosauria," and "Succession in Time of the Allotheria."

A very interesting account was given by Professor Morse of changes and variations in the forms of recent shells. Professor Langley spoke of the late expedition to Mount Whitney and the solar observations made there. Professor A. C. Young described "A Form of Regulator for the Driving Clock of an Equatorial." Professor Silliman read a paper on a "Remarkable Mineral Vein in the Black Mountains of New Mexico." The life and services to science of the late S. S. Haldeman were considered by Professor Lesley. Professor Peirce read a paper on "The Logic of Numbers," contrasting the logical methods of logicians and mathematicians. President Morton described the preparation of a chemical substitute for quinine. Professor Newcomb's paper on the "Velocity of Light" was read by the secretary, the author's duties in Washington preventing his attendance.

The last day of the meeting Professor Silliman presented a paper prepared by Peter Collier, Ph.D., chemist in the United States Department of Agriculture, giving some important facts regarding sorghum, and conclusions as to its value as a source of sugar; Professor Wolcott Gibbs a paper upon "The Theory of the Dynamo-Electric Machine." Professor Barker followed with a paper on "Mascart's Electrometer and its Use as a Meteorological Instrument." The speaker suggested the great benefits to be obtained from an international communication among signal service bureaus. The subject was also discussed by Professor Abbey, of the United States Signal Service; Professor Langley, of Pittsburg, and Professor Rowland, of Baltimore. Professor Silliman offered a resolution, "That the subject of sorghum sugar is, in the opinion of the Academy, of sufficient importance to be referred to a committee of chemists, with the request that they give Dr. Collier's results and methods a careful consideration, and report at their early convenience the conclusions to which they come." The resolution was referred to the Council of the Academy. Professor E. D. Cope, of this city, closed the session with a paper on "The Fossil and Recent Fauna of the Oregon Desert."

The Electrical Congress at Paris.

All the proceedings of the Congress, says *Nature*, have been conducted in French, and it was a novel sensation to most of us to see our English friends mount the tribune and deliver their sentiments in French; a still more novel sensation to those who for the first time ventured upon such an undertaking themselves. You first rise in your place and say, *Je demande la parole*, at the same time holding up your hand to catch the eye of the president. On his replying, *Vous avez la parole*, you walk from your place to the tribune, which is a raised platform in front of the audience, and there, with the eyes of the assembled *savants* of Europe fixed upon you, you must carry out your rash undertaking, with all your imperfections on your head. It is like the sensation of diving for the first time into deep water, where you must swim or drown.

In these international gatherings very wide deviations from the correct standards of grammar and pronunciation are indulgently tolerated, and the English have certainly not appeared to disadvantage as compared with the Germans; though it has been by no means a rare occurrence to see a speaker of either of these nations in sore straits for want of a word. There is one great advantage in conducting a congress in a foreign tongue, and that is that the difficulty of the situation puts a wholesome check upon any tendency to verbiage on the part of a speaker; he is glad to express his meaning in the simplest manner that he can, and to desist as soon as his laborious task is accomplished; but this advantage is to some extent lost where, as on the present occasion, the language is the native tongue of half the members of the Congress. Some of the later sittings were decidedly dull and unprofitable, being mainly occupied with prolix dissertations of no general interest. The *Salle des Séances*, with its draped walls and high canvas roof, is very stifling to the voice, and much of what was said was insufficiently heard by the bulk of the audience.

The official reports of the proceedings were taken not by shorthand writers, but by young men skilled in science, who wrote abstracts of the speeches in longhand during their delivery; and it must be acknowledged that they did their work exceedingly well. The report thus taken of each meeting was printed and laid before the members at the next meeting, to be adopted before proceeding to any other business. It is called the *procès verbal*, and is treated like the minutes of an English meeting, but it is much fuller than our minutes usually are.

The Torpedo Boat Destroyer.

The first public exhibition of Captain Ericsson's torpedo boat Destroyer was made at Hoboken, November 14. Several prominent officers of the army and navy were present. The chief object of the exhibition was to demonstrate the practical working of the submerged gun by which the torpedo missile is sent upon its deadly errand; also to show the ability of the torpedo to penetrate protective network around a fleet or a single ironclad.

A dummy projectile was used—that is, one of wood without a torpedo charge. In the test the dummy was discharged from the cannon by use of 12 pounds of giant powder at a target net of manila rope and wooden slats 300 feet distant. The muzzle was 6 feet and 6 inches below the surface, and the projectile passed through the target 5 feet under water, and appeared on the surface 100 feet further in-shore, and rode on the water at a considerable speed for 200 feet more, making a distance of 600 feet traveled in all. The projectile, which was 25 feet 6 inches in length, traveled through the water to the point of appearance on the surface, 400 feet, in three seconds, and this with a charge of but 12 pounds of powder. The gun is fired by electricity by the wheelsman, who, through his lookout, must aim and discharge the gun in accordance with his best judgment as to effectiveness. The experiment, which was under the direction of V. F. Lassoe, was pronounced a success by all who witnessed it. It was the fifty-second time the gun has fired the projectile, and at no trial since the boat has been put in working order has it failed with the same charge to throw the dummy torpedo 300 feet in three seconds or less. The French officers were especially interested in the experiment, and though they at first pronounced it an impossibility to operate a gun constructed on such principles and with submerged muzzle, successfully, as many engineers have done before them, they were obliged to acknowledge that the theory had proved correct. Astonishment was depicted in every line of their countenances when they saw the projectile rise to the surface beyond the target after having traversed the distance from the muzzle of the gun and through the netting without making even the faintest ripple on the surface.

In actual service the torpedo projectile is to carry 340 pounds of dynamite—enough to destroy the largest ironclad. The gun will be discharged with a force sufficient to carry the projectile from 300 to 700 feet through the water.

Full details as to the construction and armament of the Destroyer, with engraved illustrations, will be found in recent volumes of the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT.

American Supremacy in Paper Making.

Recent estimates concerning the number and distribution of the paper mills in the principal countries of the world show that the supremacy of the United States as a paper-making country is remarkable. The number of mills in the United States is set down as 960; in the United Kingdom, 659; in Germany, 543; in France, 539; in Italy, 206; in Austria, 160; in Russia, 160; in Spain, 63; in Portugal, 16; in Belgium, 29; in Holland, 16; in Denmark, 19; in Switzerland, 15; in Japan, 6; in Greece, 1; in Roumania, 1; in Cuba, 1.

These figures, of course, are not in some cases exact, but they approximate to correctness sufficiently for all practical purposes. The total number of these mills, exclusive of those in the United States, is 2,425, or only about two and a half times as many mills as there are in this country. When we consider the great populations of European countries, and the high degree of civilization that has long prevailed in most of them, it is surprising that this country, settled recently—comparatively speaking—by civilized races, should have so rapidly stolen the march on older nations in the development of the paper industry. Interesting in this connection are the following figures, illustrating the rapidity of the growth of paper making in the United States in comparison with its development in Russia.

In 1801 there were 26 paper mills in Russia; now there are 160, an increase of 134. In 1854 there were 750 paper mills in the United States; now there are at least 960, an increase of 210. The latter number, in comparison with 134, makes a pretty good showing, in view of the fact that the large increase in the United States took place in about one-third of the time required for the above mentioned increase in Russia.

Rapid as has been the advancement of paper making in this country in the past, its development in the immediate future promises to be no less noticeable. In common with other branches of business, paper making is now enjoying much prosperity. During last year the improvement in the trade was very marked, it being conceded that 1880 was the best year since 1865. Paper makers were not largely at the mercy of buyers, as for some time previously they had been, and were enabled to speedily raise their business to a footing much more favorable to themselves. The present year has so far been eminently satisfactory, and the future is full of encouragement. Many new mills have been erected during the past few months, and the day is very near when there will be a round dozen hundred in the country. Not only will there be an increased demand for paper in the ordinary channels in which it is used, but the many new ways of utilizing this material, which are coming into vogue, will render important aid in swelling the volume of production. If, in addition, energetic efforts are made to increase our export trade with South America, Australia, and other foreign markets, the continued prosperity of the paper industry in the United States would seem to be thoroughly assured.—*Paper World.*

Another Horse Distemper.

A new and rather serious distemper has been prevailing among the horses in this city. It appeared in the latter part of October, coming from the West, and spread rapidly. Work horses have suffered more than carriage horses; those of certain street car lines most severely. At this writing nearly a quarter of the horses of the Fourth Avenue company are in hospital. The new horses brought in from the country to replace those lost at the late burning of the company's stables were the first to be prostrated, and their symptoms are more severe than in horses accustomed to the work and the climate.

Dr. Samuel Whelpley, the surgeon in charge of the Fourth Avenue horses, describes the symptoms as follows:

The eyes matterate, the nose discharges profusely, the legs swell to abnormal proportions, and every organ appears to be affected. Unless treated in time it will develop into pneumonia. It is very debilitating, and renders the animal attacked so weak that it can hardly stand. Dr. Whelpley said that he heard no name applied to it, but he regarded it as a form of typhoid pneumonia. Horses have died within 16 hours after exhibiting the first symptoms. Some animals recover in a few days, and others not in weeks. In their stalls the horses stand in a position to favor their weakening condition and keep their heads down. They eat very little and apparently have no appetite. Frequently cases are attended with coughing and strangling. The only remedy for the disease appears to be relief from work, good care, and the free use of stimulants and tonics. If taken in time, veterinary surgeons say, no case need prove fatal, but owners and drivers do not generally know the serious consequences, and so neglect the animals too long.

Electric Conductivity of Moist Air.

Some electricians have held that humid air acts as a conductor of electricity; and others, notably the Count du Moncel and M. Gaugain, have maintained that it does not. Recent experiments of M. Marangoni support the latter theory very decidedly, for he finds that a Leyden jar heated so as to prevent condensation of moisture on its glass walls and thus arrest surface conduction, gives a long spark as in the driest air. When, however, the precaution of heating the walls of the jar is not taken, the moisture condenses on the latter, and forming a thin film of water, causes a silent discharge which might be mistaken for a slow discharge through the conducting air. It follows from these experiments that the loss of electricity on telegraph lines is wholly due to surface conduction over the wet and dirty insulators or leakage along entangled threads and branches of trees at particular points, and not to a general discharge into the saturated air.

A Great Telescope.

The observatory in the neighborhood of Nice, which is being erected at the expense of M. Bischoffsheim, is rapidly approaching completion. The great equatorial telescope is to be one of the largest in the world—perhaps the largest—as it will have an object glass three feet in diameter and a focal length of upwards of fifty feet. The construction of this monster telescope has been intrusted to MM. Paul and Prosper Henry, of Paris, and the total cost of the observatory will be more than $400,000 in American money.

The Seventh Comet of 1881.

On the night of November 16, Director Lewis Swift, of the Warner Observatory, discovered the seventh comet of the year in the constellation of Cassiopeia, in a line between Polaris and the great cluster in Perseus, a trifle nearer Polaris. It is nearly round, faint, and has a slight central condensation, but no tail is yet visible. Its right ascension is 1 hour and 50 minutes; declination north. 71°, and its motion slowly westward. Its estimated diameter is about 4 minutes. As the comet of 1812 is anticipated from this quarter, it may be the great Pous comet. This makes the sixth comet discovered in this country since May 1.