perhaps we may safely say that one of the cardinal differences between the educated and uneducated is that the former are capable of instantly selecting the proper means of refreshing their memory, while the latter might spend days in search of the same.

Suppose, for example, that the reader has carefully studied the SCIENTIFIC AMERICAN over a dozen or more volumes. Now if a question occur, the answer to which he has seen in any volume, doubtless he will be able to turn to the proper page, or to its vicinity, and so easily obtain the desired information. But on the other hand, if an individual who had never read the volumes, although knowing, of course, the general nature of their contents, should undertake to find some special information, he would have to pore over the long indices of every volume, and search the pages, wasting perhaps valuable time. In this case the knowledge acquired has a direct pecuniary value, for "time is money"—and this apart from its intrinsic benefit to its possessor.

All this adds weight to our first advice, namely, have a specialty, and push it. Be sure that you are right before you select it. We do not believe that any man can rise to eminence in a calling which he dislikes, and herein lie the oft repeated mistakes of parents in forcing children into trades and professions against the latter's inclinations. A boy who has a feeling for art, who spends every moment with paint and brush, will chafe under coarse mechanical labor; while another whose delight is in his tool chest will rebel against the slavery of books and brain work. Both, when they become their own masters, will eventually abandon their distasteful tasks; and it is only a question of their continuity of purpose whether they become "rolling stones," drifting from one business into another all their days, or workers, firm and steadfast because buoyed up by a constant sense of enjoyment of their chosen labors.

Intermittent toil is wasted effort: so also are attempts to manage two or three different pursuits at once. There must be one definite aim; and toward this every thought must be concentrated, for nothing is more certain than that fame, wealth, and happiness are the rewards of only those who

"Still advancing, still pursuing,
Learn to labor, and to wait."

"OURSELVES, AS OTHERS SEE US."

It is pretty generally conceded that a newspaper may "blow its own trumpet" with moderation, and still not be considered egotistical, provided, however, that there really exists good reason for awakening the echoes with the brazen (adjective to be taken in its literal sense only) throat aforesaid. But when there is no substantial basis to warrant the instrumental flourishes, a discriminating public speedily unearths the fact, and, letting the aspiring soloist severely alone, permits him to exhaust his lungs in inglorious solitude.

These sententious observations occurred to us just now, while busily looking over a multitude of newspapers which have been pouring in lately from every quarter of the country. Scissors in hand, we have clipped from each journal a certain paragraph which to us is especially interesting—naturally, since it relates to ourselves. Each one of these scraps of paper is a blast from somebody else's trumpet for our benefit; and when we regard their number, we can hear an imaginary chorus which fairly overwhelms the feeble notes which we occasionally raise in our own behalf. This is very encouraging; there is a general verdict of "well done" which is more than reassuring, and certainly we may arrogate to ourselves the idea that we are far from resembling the luckless performer on the metaphorical clarion, whose efforts neither merit nor meet appreciation.

Compliments and kind wishes must, however, be acknowledged: and besides, perhaps there are some of our readers who may be sufficiently interested in our labors to desire to know what other people say and think regarding the same. Therefore, we print a few of the pleasant things written about us—if we had space, we would publish all—just to show the tone of the whole. At the same time, we gratefully tender our cordial thanks, not merely to the authors of the opinions below quoted, but to all of our professional brethren who have kindly said a good word for the SCIENTIFIC AMERICAN.

"We can cordially recommend it," remarks the *Mattoon* (Ill.) *Gazette*, "as an instructor that quietly and unobtrusively makes its weekly visits, and oftener than otherwise gives information that is so pat, so timely, and so much needed that you are disposed to sit down and drop the publishers a postal card, and inquire by what sort of divination they discovered just what you wanted to know."

The divination of nearly thirty years' experience in seeking just such information, is our answer to our contemporary's query.

The *Weekly Mirror*, of Lyons, Iowa, "can imagine no class of reading that would tend more to the advancement of boys in the useful arts and employments of life, or at the same time is presented in a more attractive form. Drop the trashy publications and take the SCIENTIFIC AMERICAN, which cannot fail to benefit any who reads it."

This last sentence is especially true. No one ever made a cent by reading maudlin love stories or yellow covered novels. Hundreds have made thousands of dollars by ideas suggested while reading the SCIENTIFIC AMERICAN.

The *Moline* (Ill.) *Review* thinks that, "of its class, this paper is the best in the world; and it is a compliment to the good sense of our manufacturing city to know that few papers are more largely read."

This reminds us of the remark of an eminent clergyman of this city, who said that whenever, in visiting a strange dwelling, he found a copy of the SCIENTIFIC AMERICAN about the room, he was assured that he was in the abode of people of intelligence and education. The *Corner Stone*, of College Corner, Ind., evidently has a like opinion, as it remarks

"Always full of the best of thoughts, it should find a place in every home."

The *Albany Sunday Press* chimes in with: "The man, or reading and studying child even, who is without it keeps himself at a disadvantage with others having it, for he who knows most of this world is sure of receiving the most of its productions. It would be impossible to compute the sum which is gained through the knowledge imparted by such a publication."

Here are a quantity of such laudatory opinions that, actually, we feel a sense of diffidence pervade us as we cull them from the various paragraphs; especially when the *Unionville* (Mo.) *Ledger* begins by saying that

"Words utterly fail us in attempting to describe this splendid periodical."

We—well, our natural modesty—we cannot—However, to proceed with others less embarrassing:

"Nearly thirty years ago we scanned its pages with extreme delight, and we have never since laid it down with a feeling of disappointment."—*Bellefonte* (Ark.) *Record*.

"This is one of the most valuable papers that a farmer or mechanic of any kind could possibly have in his household."—*Harrison* (Ark.) *Highlander*.

"Nothing like it can be found elsewhere."—*Waverly* (Iowa) *Republican*.

"One of the best papers for the farmer, the merchant, machinist, laborer, and in fact for everybody."—*Oregon* (Ill.) *Grange*.

"It is a promoter of knowledge and progress to every community where it circulates."—*Galena* (Ill.) *Daily Gazette*.

"There is rarely a number issued that is not fully worth a year's subscription."—*St. Charles* (Mo.) *News*.

"It contains more solid information than can be obtained in almost any other way for the same money."—*Trenton* (Mo.) *Republican*.

"Foremost of all industrial publications."—*Wichita* (Kan.) *Eagle*.

"Its reputation is so well established that no eulogy from us could increase the public appreciation of its great merits."—*Moncton* (N. B.) *Times*.

"Almost indispensable to any one who has a thirst for scientific news, or a desire to keep posted on the mechanical improvements of the day."—*Waterville* (N. Y.) *Times*.

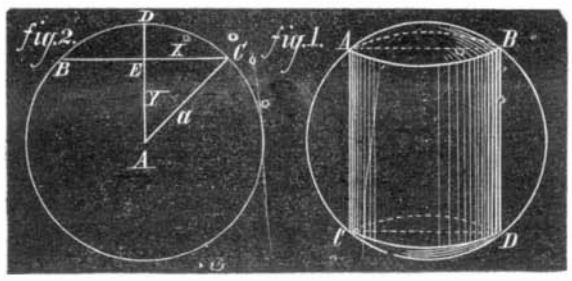
"Clear of technical terms, fully up with the times, and explains the latest improvements and discoveries in every department of Science."—*Dakota* (Iowa) *Independent*.

The above is but a portion of the collection before us, but we will not take room for more in the present number.

A PROBLEM RELATING TO THE SPHERE.

A correspondent, in a recent letter, asks us to solve the following problem: "What sized auger will bore out just half of a ball eight inches in diameter?"

This is a new question, so far as we know, with regard to the volumes that can be cut from a sphere; and though there is nothing very difficult in the solution, it affords an opportunity for showing the general methods employed in discussing such questions, and the rules that are given for finding volumes will be useful to many of our readers.



By a reference to Fig. 1, it will be apparent that, if a hole is bored through a sphere by an auger, the volume cut away is that of a cylinder, the diameter of whose base, A B or C D, is equal to the diameter of the auger, together with the two spherical segments, each of which has the same base as the cylinder, and a hight equal to half the difference between the diameter of the sphere and the hight of the cylinder. Now if we can obtain expressions for the volumes cut away, in some value of the diameter of the cylinder, we can readily form an equation from which the diameter can be ascertained. To do this, the following notation will be employed; and to make the solution as general as possible, we will suppose that, instead of half of the volume of the sphere being cut away, any portion whatever, represented by m, is removed:

x = radius of auger.
$2y$ = hight of cylindrical part of cut.
a = radius of the sphere.
$a-y$ = hight of each spherical segment cut away.

The volume of a cylinder is equal to the area of the base multiplied by the altitude, and will be, in the present instance, $3{\cdot}1416 \times x^2 \times 2y = 6{\cdot}2832 \times x^2 \times y$.

The volume of a spherical segment is found by adding three times the square of the radius of its base to the square of its hight, and multiplying the sum by 0·5236 times the hight. Hence, the volume of the two segments in question will be $[3 \times x^2 + (a-y)^2] \times 0{\cdot}5236 \times (a-y) \times 2 = 3{\cdot}1416 \times x^2 \times (a-y) + 1{\cdot}0472 \times (a-y)^3$.

The volume of a sphere is equal to the cube of its diameter, or eight times the cube of its radius, multiplied by 0·5236, or $8 \times a^3 \times 0{\cdot}5236 = 4{\cdot}1888 \times a^3$.

The volume of that part of the sphere which is to be cut away by the auger is $4{\cdot}1888 \times m \times a^3$.

Now, having two different expressions for the volume cut away, we obtain the equation of condition by putting them equal to each other: $6{\cdot}2832 \times x^2 \times y + 3{\cdot}1416 \times x^2 \times (a-y) + 1{\cdot}0472 \times (a-y)^3 = 4{\cdot}1888 \times m \times a^3$.

As there are two unknown quantities, x and y, it will be necessary to form another independent equation of condition. Fig. 2 is a section of the sphere, in which B C is the diameter of the auger, E C or x the radius, A C or a the radius of the sphere, and A E or y half the altitude of the cylindrical portion of the cut. From the right angled triangle, E A C, we obtain $x^2 = a^2 - y^2$.

Substituting this value of x^2 in the first equation of condition, and performing the operations indicated, the equation assumes the form: $6{\cdot}2832 \times a^2 \times y - 6{\cdot}2832 \times y^3 + 3{\cdot}1416 \times a^3 - 3{\cdot}1416 \times a \times y^2 - 3{\cdot}1416 \times a^2 \times y + 3{\cdot}1416 \times y^3 + 1{\cdot}0472 \times a^3 + 3{\cdot}1416 \times a \times y^2 - 3{\cdot}1416 \times a^2 \times y - 1{\cdot}0472 \times y^3 = 4{\cdot}1888 \times m \times a^3$, which reduces to $y^3 = a^3 - m \times a^3$. For the special case, given by our correspondent: $a = 4$, $m = \frac{1}{2}$, hence $y^3 = 32$, and $y = \sqrt[3]{32} = 3{\cdot}1748$ inches; and the diameter of the auger that will cut out half the volume of the sphere is

$x = \sqrt{(4)^2 - (3{\cdot}1748)^2} = 2{\cdot}4332$ inches.

As the numbers from which x and y are determined are not perfect squares and cubes, the roots are not exact; but by carrying them out to a sufficient number of decimal places, any desired degree of accuracy can be attained. The values given above, for x and y, are very nearly correct, as can be shown by the following proof:

Volume of cylindrical part cut away: $3{\cdot}1416 \times (2{\cdot}4332)^2 \times 6{\cdot}3496 = 118{\cdot}1033$ cubic inches. Volume of the two end segments: $(2{\cdot}4332)^2 \times 3{\cdot}1416 \times 0{\cdot}8252 + (0{\cdot}8252)^3 \times 1{\cdot}0472 = 15{\cdot}9371$ cubic inches. Total volume cut away: $118{\cdot}1033 + 15{\cdot}9371 = 134{\cdot}0404$ cubic inches. Half the volume of the sphere: $4 \times (4)^3 \times 0{\cdot}5236 = 134{\cdot}0416$ cubic inches.

The difference of only $\frac{12}{10000}$ of a cubic inch between the two independent calculations shows that the above values of x and y are exceedingly close to the absolute results; but any of our readers can reduce the difference still farther if they so desire.

SCIENTIFIC AND PRACTICAL INFORMATION.

A SULPHUR REGION.

The Winnemucca (Nevada) *Silver State* says: "Right here in Humboldt, within a hundred yards of the Central Pacific railroad, and in the immediate vicinity of the silver mines of the Humboldt range, are beds of sulphur, capable, it is believed, of supplying the whole world with that article for centuries. These sulphur deposits are located in the Humboldt valley, not much over a mile from the Humboldt House, and probably thrice that distance from the base of the Humboldt range. But little is known in reality of the extent of the beds, except that they cover a large area in the valley, and have been prospected in one place to a depth of several feet, where the excavations expose hundreds of tuns of the pure article, which can be made available for commercial purposes at no greater expense than loading it on the cars and shipping it to the great commercial centers."

VALUE OF DISCIPLINE.

A suggestive instance of the value of discipline in times of emergency is found in the circumstances attending the loss of an Austrian man of war, recently, off Sicily. After the vessel had struck and it was found that she must shortly go to pieces, the captain ordered every man into the rigging. The command obeyed, the word was passed for all hands to strip and be ready to jump overboard at the signal. The instant the latter was given, every one leaped. A few seconds after, the ship keeled and went to pieces. Every man reached shore safely, except one who neglected to remove his clothes as ordered.

A NEW EXPLOSIVE.

A new kind of prismatic powder is being tested by the German military authorities. Its specific weight is greater than that of ordinary prismatic powder (1·69 against 1·65) and its effect is so powerful that it is said to render the Prussian 28 centimeter 11·02 inches cannon a match for the English 11 inch gun.

IGNORANCE IN MASSACHUSETTS.

The Deputy Constable, appointed to look after the children employed in the factories of Massachusetts, reports that fully 60,000 children are growing up in ignorance on account of their being set to work at too early an age.

NEW DISCOVERIES ON THE ACTION OF GALVANISM ON THE THROAT.

The faculty of Jefferson Medical College, Philadelphia, have recently conducted a series of interesting experiments upon the body of an executed criminal, which have revealed several novel and important facts in physiological science. Dr. W. W. Keen, after dissecting the chords of the neck which connect with the larynx, galvanized each in turn. When the left chord was galvanized, this only responded, and the same was the case with the right. It was found that there was no crossing of the chords from one side to the other, and that the action of each was distinct and independent. The doctor also examined and galvanized separately the external and internal intercostal muscles (between the ribs) and found that their function was not uniform but different. Physicians have long been at variance on this question, but the present discovery seems to settle the matter, since it proves that the external muscles are for expiration and the internal for inspiration. It has been believed by some that, by the application of galvanism, vitality can in a measure be revived. This impression is incorrect; for while the application of a battery, to the cadaver from which life has been extinct but a short time, will serve to produce muscular action, the result shows that only a portion of the body, and not the brain, is excited by external power.

A BUTTER SALTING TEST.

A select committee of the New York Butter and Cheese Exchange is at present investigating the important question as to the best salt to be used for butter making. American and English salts are in competition, and the result which will be reached is of great pecuniary moment to dairymen generally. The report will appear during next April, and will be based on practical tests of butter salted by the various varieties of salt. The committee is to judge simply from the samples, no information being given as to the manner in which each has been prepared.