

the correct width, is fed to the proper length, and is then cut off. The picker, through air suction attachment, descends under the two boards, and the back lining, and picks them up. While it is making a half revolution in a horizontal plane, the cloth carrier draws into the center of the machine a piece of cloth which has just been glued. A picker then descends and positions the two boards and back lining, and the glued cloth and folding bars are brought into operation, making the top and bottom folds first. A distributor then comes into operation, and moves the case into the press, shown to the left of the machine. The case dwells in this press during the whole time occupied in making the next case. It is then discharged upon the receiving table, shown at the extreme left of our engraving. The cases are now ready for embellishment, which may be in metal leaf or in colors. Gold or other metal leaf is applied to the cloth, and it is then embossed with a heated die in an embossing machine, and the surplus gold is rubbed off and saved. Ornamental designs are printed upon the cloth covers, usually by special presses built for the purpose which can also be used for embossing. A common form of embosser is shown in our engraving, and is what is known as a rod embosser. Composition leaf is growing in popularity among bookbinders, owing to the fact that it gives a very solid color, while in a case of printing it is sometimes necessary to run the case through two or three times. The embossing is done in the same way as with gold, and the surplus leaf is rubbed off. The case is now glued to the jacket, and the books are placed between the boards in what are called standing presses. Fourteen hundred books, all of one kind, are shown in the engraving. We are indebted to The Butler-Ward Company, New York city, for the interesting series of photographs which we publish relating to bookbinding.

Glass Making by Electricity.

It will be remembered that in the columns of a recent number of the SCIENTIFIC AMERICAN the Becker process of making glass by means of the electric furnace was very fully described. Since the appearance of that number of the SCIENTIFIC AMERICAN, a patent has been granted for an improvement in this process.

In melting the raw materials used in the manufacture of glass by means of the electric arc, difficulty is often experienced with the mixture, which consists of a powder, or is made up of numerous small particles. It happens that these small particles become agglomerated by partial fusion before arriving at the electrodes, so that it is necessary to assist the passage of the mass by pushing it from time to time. Consequently the mixture arrives intermittently between the electrodes, so that the latter, both as regards the thermic effect and as regards the mechanical wear by the friction of the raw material, are subject to varying stresses. Furthermore, the intermittent movement of the mass causes much carbon dust to fall from the electrodes, so that the glass becomes adulterated and must be carefully refined.

It has been ascertained by a number of experiments conducted by Jegor Bronn, of Cologne, Germany, that the disadvantages mentioned can be entirely avoided if the raw material be passed under or between the electrodes in the form of compressed rods, balls, briquettes or the like, or better still in the form of a continuous rod. This end can be attained by providing above the electric melting furnace an apparatus in which the raw material can be kneaded and compressed before it is allowed to pass between the electrodes. In order to assist the operation, water or any binding agent—water-glass for example—may be added to the raw material; or the calcspar commonly used in melting glass can be either wholly or partially displaced by strongly-binding hydraulic lime, plaster, or the like. For the purpose of producing a continuous rod, the raw material after being mixed with a suitable binding agent is preferably passed between rollers. By means of this apparatus the process can easily be carried out in such a manner that the variations of the electrical current are reduced to a minimum, and that the contact of the material with the electrode when heated by the circuit is entirely avoided. Hence the glass is purer in quality than heretofore.

A patent was recently granted to Napoleon R. Thibert, of Worcester, Mass., for a device which he thinks will eventually displace the carpenter's brace for boring holes. He has devised instead what he calls a bit rack, and the rotary movement is imparted to the cutting tool by means of a handle, which works in a horizontal guide and with a single pull. The bit is turned with a speed ten times greater than is possible to secure with the present tool. An attachment is provided, by which it is readily possible to reverse the direction of the bit. The advantage claimed is that there are many instances when the use of the brace and bit is impossible, or at least difficult, and with this improved tool a much greater latitude in work is permissible.

Correspondence.

The Inventor of the Telephonograph.

To the Editor of the SCIENTIFIC AMERICAN:

Will you kindly correct an error which crept into your admirable account, in the issue of the SCIENTIFIC AMERICAN of October 24, of a test of the National telephonograph on the Rome, Watertown & Ogdensburg division of the New York Central & Hudson River Railway?

At the request of the officers of the National Telephonograph Company, whose headquarters are in Rochester, I gave the appliance the crucial test which you so accurately describe. Truth demands the statement, however, that I am not so fortunate as to have been the inventor of the National telephonograph. My interest in it is purely scientific and technical.

The honor of the invention of the appliance belongs to Mr. Edwin D. Grauel, of Rochester.

Rochester, N. Y., October 23, 1903. JNO. DENNIS.

The Geysers of Yellowstone and New Zealand.

To the Editor of the SCIENTIFIC AMERICAN:

In the SCIENTIFIC AMERICAN SUPPLEMENT for January 3, 1903, there is an article dealing with the geysers of Yellowstone Park, and reference is made to those in Iceland and New Zealand. It is stated that "while the geysers of Iceland and New Zealand are noted for their size and height, they are insignificant when contrasted with the Excelsior, Castle, and Giant. The Excelsior at times throws into the air a volume of water which is estimated to be from 50 to 60 feet in circumference and to often attain a height of 250 feet." The Waimangu geyser far exceeds in proportions anything described by Mr. Willey as occurring in Yellowstone Park. The writer has never seen Waimangu in action, but has often seen the Wairoa and Pohotu geysers, the former sometimes playing to a height of over 200 feet. I thought these particulars of the geysers might perhaps be of some interest to your readers.

J. A. RUDDICK,

Chief of Dairy Division,

Ottawa, Ont., October 20, 1903.

Draper's Specula Test.

To the Editor of the SCIENTIFIC AMERICAN:

Referring to an article on "Testing Specula of Reflecting Telescopes," by Mr. James Alex. Smith, in SUPPLEMENT No. 1450, criticising and condemning the method of testing parabolic mirrors at the center of curvature, mentioned in my article in SUPPLEMENT No. 1306; allow me to point out that he is altogether in error, and has evidently never used the method referred to so adversely and unadvisedly. Indeed, he so entirely mistakes it as to prove that he does not even understand what he attempts to criticise.

Mr. Smith's error arises from the supposition that the very elegant test first devised by M. Foucault, and so successfully used by Dr. Draper in the manufacture of his large photo-visual telescopes, is intended to measure the distance (aberration) between the radiant point z (in his—Mr. Smith's—diagram, page 23232) and the conjugate focal point x . He also wrongly states that the angle x, D, z is bisected by the constant HD ; but let that pass, although it is not correct.

What the test is intended to do, and does do very accurately, is to measure the distances of xz, zx , etc., representing the various focal points of the different zones of the reflecting surface of the mirror under examination. The radiant point z may vary considerably without affecting the value of the measurements.

The formula given by the late Dr. Draper is only a rule-of-thumb one, and of course is not mathematically correct; but unfortunately for the criticism of Mr. Smith, instead of being deficient, it gives a figure really a trifle in excess of the true aberration at the center of curvature, but for all the apertures ever found in practice, the error is so slight as to be quite unimportant.

I write this in the interest of your many readers, for should any one attempt to correct a speculum on the lines laid down by Mr. Smith, he would ruin it beyond recovery.

Had Dr. Draper corrected (?) his 15-inch specula by Mr. Smith's formula, he would have encountered a longitudinal aberration of nearly 3-10 of an inch and could have had no definition at all.

Camden, N. J.

EDMUND M. TYDEMAN.

A Weakness in Modern Educational Methods.

To the Editor of the SCIENTIFIC AMERICAN:

As the apex of a pyramid is that point toward which all the lines of the pyramidal shaft converge and in which they center, so God is the climax truth toward which all lines of natural philosophy point and in which they culminate. As certainly as that the sun is the center and source of all our light, so certainly God is the center and source of all natural philosophy. As to follow any ray of light to its source will lead to the sun, so, likewise, to follow any natural philosophy to its conclusion will lead to God. He therefore

who studies philosophy, or science, and stops short of God, philosophy, in his case, has utterly failed to answer the mission of its divine appointment.

Webster, the great statesman, well said, "No man can be a philosopher and deny the existence of God, for every step in the divine process goes to demonstrate the truth of the proposition he has denied." Look in what direction we may, we see the marks of fitness, adaptation, arrangement, and design, and if design there must be a designer. All philosophies, or the divine method of doing things, are but the footprints of creative energy which mark the Creator's everlasting going. These ceaseless and endless goings are uniform, if for no other reason than that man may follow on to know of the infinite intelligence and boundless benevolence of the Creator, and thus, too, to develop all the native faculties of the mind.

This suggests a new definition of the term "education." Were we to inquire of six intelligent men as to the meaning of this hackneyed phrase, we might have a half dozen different answers. Amid this confusion the student should closely examine the following definition of the word *education*: *It implies information, more or less, along all lines of useful knowledge, such as art, science, literature, sociology, good morals, and loving religion; and a corresponding development of all the native faculties of the mind, such as the intellectual, moral, social, and religious.* This definition of the word *education* seems to be the concession of all sound logic, of all sound philosophy.

Confronting this definition of the term *education*, what must we think of the modern state university which seeks to train only along *secular* lines, such as art, science, history, literature, and the like, giving little attention to the great science of social relation and the obligation of such relation, still less of the greater science of religion, which treats of man's relation to his Creator and the duty of such kinship, and absolutely nothing of the matchless science of God. The state university proposes to educate the intellect, largely to the neglect of man's social, moral, and religious nature. It is a proposition to educate the head to the almost utter neglect of the "heart, out of which are the issues of life." All this seems to be only unintentional blasphemy, and to unwittingly stop far short of the divine idea.

Recognizing the fact that a republic, to stand, must be based on the foundation of intelligence and virtue, it is marvelous that the state fails to see that to educate the head to the neglect of the heart is, to say the least, a very dangerous experiment. It ought to know that the more it puts in a man's head while his heart is wrong, the mightier engine it makes of him for evil. "Knowledge is power," simple power, serving alike in the hand of saint or sinner. Intellectual giants in all ages have gone up and down through the earth, seeking to destroy all that is beautiful of nature and lovely of virtue. The state should know that there is no necessary connection between the development of the intellect and that of man's higher and better nature. Such blindness to the possibilities of good citizenship and true manhood is the enigma of all enigmas. It is a misnomer to say that such a man is educated, when in point of fact he knows but little of the great science of good morals and a beautiful life, less still of the greater science of a religion of unity and of endless progress. Only one-half of the man, and that the poorest half, has been educated.

Not wonderful that the pulpit and the church have rushed to the rescue, and propose to educate the other and better half of man's nature, and thus allow the chariot wheels of civilization to roll on. The pity, shame, and disgrace, however, are that the pulpit and the church have been, and still are, largely handicapped by *sectism*, which seeks to give metes and bounds to honest religious thinking. They seem to forget what everybody knows, that "to think is to differ," and that the more we think the more we differ; while to love is to be united, and the more we love the more we are united. And the strangest thing of all is that these good people have failed to see that all human creeds are of the head, while true religion is of the heart.

The optimistic fact is, however, that little by little the ministry and the people are coming to read that "out of the heart," not the head, "are the issues of life;" that "with the heart," not the head, "man believeth unto righteousness;" that "Son, give me thy heart," not thy head, is the loving request of a benevolent Father. More and better, here and there colleges and universities are being founded in the spirit of liberty-loving America. They propose to educate along all lines of useful knowledge, and thus give a corresponding unfolding of all the native germs of the soul. Education with them means nothing less than humanity touched into manhood; they therefore teach a fellowship as broad as the love of God in Christ, and pray and work for a unified church and a saved race.

T. M. McWHINNEY,

Chancellor Palmer University, Muncie, Ind.
New York, October 27, 1903.