

quantity to render the mixture explosive, it loses its illuminating power, and burns with a pale blue flame. A gas, that will give a light from any ordinary sized burner sufficient to read by, is never explosive. The Mutual Gas Light Company propose to furnish *illuminating gas*, and if they do this, they will furnish a material as safe as any ever employed for lighting; for the same general principles apply to all kinds of gas from which light is obtained.

But it may be asked, why has the SCIENTIFIC AMERICAN made such a persistent protest against the use of naphtha in naphtha stoves and in lamps, if the material can be used as is proposed by the Mutual Gas Light Company? We answer that naphtha, so long as it is in a liquid state, can never explode. So long as it is confined in close pipes, it can never burn, whether it be in a liquid state or in a gaseous form. When not controlled as it can be in metal pipes, it may and does often generate vapors that, mixed with air, are explosive. When lamps are broken or overturned, a highly inflammable liquid is scattered about, which endangers life and property. The dangers arise from the careless and wrong methods of using this material. A lamp is no more a fit instrument for burning naphtha than is a man's watch pocket for the burning of gunpowder. Experience has shown that inflammable gases may be conveyed in pipes with very great economy and safety; and when the false prophet of the *Herald* cites, as an example of danger, an instance where coal gas exploded when mixed with oxygen, he, like other over eager witnesses, proves too much. He proves that gas, (which, rightly mixed with a supporter of combustion, will explode), can be and has been used for years with less damage than has arisen from any other mode of illumination. The same can be done with the naphtha gas, the safety arising in both cases from the manner of distribution through pipes.

The article in the *Herald* is evidently written by a person not ignorant of the facts and principles we have stated, but one who, out of his knowledge of the subject and his acquaintance with the general ignorance of the public in such matters, has seen his opportunity to frighten the people, and retard the new enterprise which is likely to become a strong competitor with the old gas companies.

EDUCATION OF THE EYE.

How few there are that appreciate that optical marvel, the eye! How few understand its mechanism, the principles on which it acts, and the wonders it accomplishes! As an avenue by which external impressions find their way to the mind, it is worth all the others man possesses. So gradually is its skill acquired, that we hardly recognize it as acquired skill. We educate, through long and systematic practice, hands, feet, and muscles; but in the main the eye is left to itself, to acquire as it may its power of estimating distance and size, color and the definition of form.

In this desultory way it acquires a skill beyond expression wonderful, yet we believe that with most the power of vision is only imperfectly developed. What is to hinder systematic discipline of the eye any more than that of any other organ? To be able to see correctly is of as much importance to the mechanic as to the artist. Mr. Ruskin in his admirable treatise on the "Elements of Drawing" lays particular stress upon teaching the eye to see correctly, and shows that the hand will have but little difficulty in learning to represent what is accurately seen.

The mechanic is often called upon to make forms for which his unaided eye must be the principal guide. The wagon maker may lay out his work by patterns, but the ornamental finish principally depends upon the nicety with which his eye can trace lines of grace and beauty. Even in shaping a boot sole there is required great skill of eye. If any one doubts this, let him try to shape a sole to the outlines of his own foot, and see what an uncouth, ungainly form he will make. None but novices will try the experiment, for any one who has tried it, knows the difficulty of combining comfort and beauty in a boot sole. Shoemakers have been much denounced for their failures in this respect, but the reader may rest assured that their art is a difficult one. They can not go by plumbline, square, and level, like the mason or the carpenter, and no one who has never tried to draw a sole pattern knows how slight variations will affect, favorably or unfavorably, its appearance. The cabinet maker, the carver, the sign painter, the decorator, all of these attain skill principally through the education of the eye.

An analysis of what the eye can perceive will give a clue to the proper method of educating it. The impressions gained through this organ may be classed under the categories of distance, size, light and shade, form, and color. It appears to us that, in the order in which these categories are named, the education of the eye should proceed, since that is probably the order in which we first learn to perceive. It is through the power to appreciate distance that we form our first estimates of size; then we begin to distinguish light and shade, and thus to gain power to define form, and lastly we distinguish, more or less perfectly, colors and tints.

We think a most profitable system of exercises might be devised by an ingenious teacher, calculated to train the eye in the exercise of its various functions in early youth, and to form correct habits of vision; for he who supposes the eye is not influenced by habit as well as any other organ makes a serious mistake.

The worst habit of all is the habit of partial sight. Instead of closely scrutinizing everything they see, the majority of men only superficially look at objects as they pass before them. They thus become inaccurate witnesses in courts, inaccurate in their impressions of material objects in general, and fail when they attempt to imitate, because the images they strive to reproduce are imperfect.

If in early youth, children were taught to look carefully at everything, and to constantly test the accuracy of the perceptions thus obtained, we believe the habits of close observation thus acquired would be of greater advantage than the result of any other mode of discipline now practiced in elementary schools.

THE ST. GOTHARD TUNNEL--ANOTHER GRAND ENGINEERING WORK.

The pass of St. Gothard was the most frequented of all the routes across the Alps until the commencement of the present century; but as it was not practicable for vehicles, it was gradually deserted after the construction, by Napoleon I., of the road over the Simplon. The loss of traffic induced the cantons through which the route passed to construct a carriage road quite as good as that on the Simplon. The work was commenced in 1820, and finished in 1832, and it is one of the greatest monuments of engineering skill to be found in Europe. In magnificence of scenery, the St. Gothard is superior to all of the passes, unless we except the Stelvio. To the mere pleasure seeker, it will, therefore, be a matter of regret to see this superb road deserted for a hole through the mountain. Ever since the Mont Cenis tunnel was projected, the Swiss and Germans have felt that a large share of traffic would be diverted to France. For military and strategic reasons, it was, also, felt that equally good facilities ought to be provided on the other side of Switzerland, and all of the necessary surveys were made many years since; but the jealousy of the French, and the fear of that nation, has prevented the commencement of the work. The moment, however, that France was powerless to prevent, the project was revived, and we now hear that a contract for the construction of the tunnel has been concluded between the Swiss government and a syndicate of German bankers under the protection of the imperial government of Germany. The work will be about twice as long as the Mont Cenis tunnel, and it will be considerably more difficult, as it must pass under several rivers and lakes, and encounter the hardest rocks of the Alps. The summit of the present carriage road is 6,507 feet, but the railroad will pass under peaks varying from 8,750 to 10,900 feet. There is no distinct peak of St. Gothard, but an extensive ridge of elevated ground which bears that name.

Geologists will be greatly interested in the work, as this part of Switzerland abounds in a large variety of choice minerals, and some important questions may be solved by the projected work. The total cost is estimated at \$37,000,000. Of this amount, the company will raise \$20,000,000, leaving the balance to be raised by assessment upon the cantons and countries immediately interested in the project. There is a general belief among engineers that the work will cost much more money than the above estimate, but, as rich governments stand as security, there seems to be little doubt that the undertaking will be pushed to final completion. The new road will bring Germany and Italy into closer political union, and, in the event of war, give these powers a decided military advantage; but this feature of the undertaking is of small importance in comparison with the enormous traffic that will flow through the tunnel between the nations of the North and the remote inhabitants of Asia. Its principal utility will consist in facilitating trade and travel between Europe and Asia, by way of Italy. The extreme Eastern points within its circle of traffic will touch the outstretched hand of our Pacific railroad, and the commerce of the whole world will be benefitted by the completion of the gigantic scheme. It is not many years since the river Danube was the highway for the commerce of the world. The boats, moored at the bridge of Ratisbon, far up in the interior of the Continent, were manned by sailors who were the boast of that period, when suddenly, by the discovery of the passage around the Cape of Good Hope, commerce was diverted to new routes, and we have nothing but the ancient bridge and the quaint old storehouses to tell us of the magnificence of the past. The completion of such works as the Suez Canal and the tunnels through the Alps are great illustrations of the triumph of science over all obstacles.

The trade, which, for a time, was diverted to new routes, appears likely to return to its former channels. The Austrian government already have a railroad over the lower Alps, connecting with Trieste and Venice, so that they will profit by the revival of trade in this direction.

It is difficult to anticipate how long it will require to complete the St. Gothard tunnel, but, with improved machinery and aided by the experience of Mont Cenis, it can hardly endure twice as long as the last famous undertaking. It is a bold enterprise, well worthy of the age in which we live.

A MOST INGENIOUS MACHINE.

There is on exhibition at the Progress Iron Works, 59 Lewis St., this city, a machine, for bunching, wiring and inserting and fastening bristles in brush backs, that is a marvel of ingenuity. In the accuracy, beauty and rapidity of its operation, it has scarcely been excelled in the history of invention. The machine was entered at the Fair of the American Institute only just before the closing, and it escaped notice from us at the time on that account. We shall, however, shortly give an illustrated description, which will be more satisfactory to our readers. The machine is, we believe, the joint invention of Messrs. O. D. and D. C. Woodbury, of the above named works. To any who like to see what mechanical skill of the highest order can accomplish, it offers one of the most profitable studies that has been brought before the public in a long time, and it must, we think, revolutionize the present system of brush making.

MECHANICAL BIGOTS.

Bigotry is by no means confined to religionists, any more than pedantry is limited to schoolmasters. The good old way, whether it be in science, art or mechanics, is so good, in many men's eyes, that to them there can be nothing better. To them, innovations and innovators are abominations. Because unwilling to adapt themselves to a new order of things, and reluctant to make the effort, they are sure to be left behind in the race. Instead of "trying all things and holding fast to that which is good," they hold fast to that which they have, and try nothing.

The other day we carried a lock to four different locksmiths, for repairs. In itself peculiar (we believe it was imported from France) and being attached to an article in such a way that it was impracticable to substitute for it another lock, it proved too much for the ingenuity of the mechanics who were solicited to mend it. "It can't be done," was the unanimous verdict. In each case, we delicately suggested a method whereby the repairs could, we thought, be easily effected, and in each case we were met with an impatient assertion that the suggestion could not be put into practice. At the fourth shop we lost patience and offered, with the aid of a few simple tools, to convince our mechanical bigot that "some things could be done as well as others." It took us about a quarter of an hour to prove our position correct, and put the lock into good working order. We silenced this bigot, but did not reform him. The next time he is asked to do something out of the usual way, he will be just as pig-headed as before.

We once had a similar experience with a pattern maker, who declared patterns could not be made to cast a certain article, which could be drawn from the sand; yet that same impossible feat was accomplished by the bigot himself, finally induced, by some stinging remarks, to get out of his rut.

This sort of wilful blindness, is quite a different thing from that intelligent conservatism that, after carefully examining new things, refuses to adopt them, because they are no improvement on those already in use. Heaven only knows what the world would come to, were there not such a thing as intelligent conservatism. But the latter never says things are impossible; it simply says of that which it rejects, "it is unprofitable or impolitic." It places a wholesome restraint on that class of mind which believes that everything new must be useful, and is always eager to embrace that which has the charm of novelty. It calmly sifts the chaff from the wheat, and gives the former to the winds, whether it be old or new, while the wheat is saved; if old, valued neither less nor more than the new, on that account. Whatever is valuable is retained on account of its value, not on account of its ancient prestige, nor the brilliant *début* it may have made into the world of letters, science or art.

The bigot, on the contrary, refuses to examine, and prejudices everything which has not the stamp of custom to commend it. To merit his disapproval, any proposition or process needs only to be different from that to which he is accustomed. He refuses to acknowledge proof, and turns himself away from attempted demonstration. He does not see, because he does not want to see, and hence his blindness is total.

We find plenty of just such bigots among mechanics and engineers, although the tendency of these occupations is to correct such a state of mind; but prejudice is so strong, and reasoning so difficult, that the world will probably never be rid of those who prefer to shut their eyes, rather than hurt them by looking at the light.

IMPORTANT IMPROVEMENT IN GLASS AND PLATE ENGRAVING.

We have heretofore chronicled the invention of Tilghman, who, by means of a powerful blast of steam or air, impels a jet of sand with such tremendous force against the surfaces of glass, stone, or other materials, that they are cut, engraved, or dressed, as may be desired. In fact, stone may be bored by this process.

We have now to record another improvement in an analogous direction, although the means employed are far simpler, while the results produced are very remarkable. We allude to the invention of George F. Morse, 287 West Twelfth street, New York, for which a patent has been recently granted.

The inventor provides a simple box or hopper, from which depends a small tube about eight feet long. No machinery whatever is used. A mixture of corundum and emery, in the form of powder, is placed in the hopper and allowed to descend through the tube. The article to be engraved, which may be a silver cup, a watch case, a sheet of glass, a goblet, or other object, is held under the extremity of the tube, so that the engraving powder will fall upon it, and in a few minutes' time the most splendid ornamental designs are cut, with marvelous exactitude and surprising beauty. We have seen engraved effects, produced by this process, upon glass and silver ware, that altogether surpass anything that has ever been attempted by the most skilled hand labor.

As fast as the supply of the engraving powder runs down through the tube, it is replaced in the hopper; and girls may do all the work. That portion of the surface of the articles that is not to be engraved, is protected by paper or other substance. The engraving, therefore, is done by cutting out the desired pattern in paper, which is then applied to the surface of the article. The powder only acts between the interstices of the pattern.

This simple and beautiful invention promises to revolutionize the art of plate and glass engraving. By its use the adornment of all kinds of wares, in the most superb manner, may be quickly accomplished, at a tithe of the cost of the ordinary methods. The invention is now in successful practical operation in this city.