Scientific American.

MUNN & COMPANY, Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW (PARK BUILDING), NEW YORK.

O. D. MUNN, S. H. WALES, A. E. BEACH.

☞ Messrs. Trubner & Co., 60 Paternoster Row London, are also Agents of the SCIENTIFIC AMERICAN.

☞ Messrs. Sampson Low, Son & Co., Booksellers, 47 Ludgate Hill, London, England, are the Agents to receive European subscriptions or advertisements for the SCIENTIFIC AMERICAN. Orders sent to them will be promptly attended to.

VOL. XVIII., No. 25....[NEW SERIES.]..*Twenty-third Year.*

NEW YORK, SATURDAY, JUNE 20, 1868.

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UNIFORMITY.

The only thing in nature or art that can be said to be perfectly uniform is the action of the physical laws which underlie and maintain the universe. Yet the results of these laws, the phenomena of nature, are endlessly various, and scarcely any two of her productions are exactly similar. A comparison between two plants, or animals, or minerals, of the same kind, always shows some point of difference. Even chemical elements, which if really elements cannot exhibit characters dependent upon combination, are found to vary in their color, the form of their crystals, etc., when different specimens of the same element are contrasted.

Why is it that invariable laws admit of variable results? The answer is that although any one of nature's laws acting alone would produce perfectly uniform results, that when they act in concert the effect produced is a resultant, and varies according to the accordant or discordant action of these laws. In fact, these laws may be so exactly and equally antagonistic that their resultant is nothing.

As in nature so in art that deals with her productions. The variable nature of the materials which are used in the arts, variations in size caused by variations in temperature, variations in appearance caused by optical phenomena, variations in judgment caused by differences in the power of sensation at different times, and variations in measurements which are the result of the above mentioned variations, all conspire to impede uniform production.

It is a well known fact that violins made by celebrated makers after the same model, and in each of which perfection was aimed at, differ widely from each other in power and quality of tone.

Chronometers have their individual characteristics also. Though they may be as uniformly made as human skill will permit, they will vary more or less from the true sidereal time. A knowledge of the ratio in which one of these instruments "gains or loses" is essential to its use in navigation.

It were an easy task to enumerate instance upon instance to show the utter impossibility of entire uniformity in production, although in many cases very close approximations to it have been made. Nature seems to disapprove of individual likeness, and this tendency to specific differences in individuals has been considered by Darwin and others to be sufficient to account for the origin of species.

By a selection of pigeons having certain peculiarities, and again selecting from their progeny such as had the same features as strongly marked as possible, Darwin obtained birds from the pigeon stock which had hooked beaks, talons like hawks, and that fed upon meat. In fact, so far as general appearance and habits are concerned, they were hawks.

The necessity of obtaining an approximate uniformity in the productions of the arts, and the impossibility of obtaining uniform materials and operating them under similar circumstances, are reasons why skill and experience are essential to success.

Could perfect uniformity in nature be depended upon, every thing might be reduced to formula, and exact results be relied upon. Chemical manufacture would become the easiest of conceivable occupations. No need then to take into account specific gravity, or to watch the thermometer. The photographer would no longer complain of failures depending upon the character of his materials; the child of ten would compound as good bread as the experienced matron of forty. In short, we should all be on a level, and a monotony would pervade the entire range of production. The word excellence would become obsolete, and ambition, the stimulus to all great enterprises, would share the same fate. There is as much truth and philosophy as poetry in the couplet

"Variety 's the spice of life,
That gives it all its savor."

WHY A LONG SCREWDRIVER IMPELS A SCREW MORE EASILY THAN A SHORT ONE.

In most cases, where there is an apparent conflict between theory and fact, people, who are not familiar with the facts involved, are too much inclined to give undue weight to theory, and too little credit to evidence which goes to support the facts. In such cases, however, it is well to be cautious in forming opinions, because it often happens that some point in theory has escaped notice and has led to wrong inferences and conclusions.

Perhaps nothing illustrates better the importance of giving attention to the opinions of practical men, in matters upon which they have a knowledge based upon experience, than the difference of opinion which is common upon the question, whether a long screwdriver impels a screw with more ease than a short one. A mechanic accustomed to the use of this implement will almost always answer the question in the affirmative; while a man whose knowledge of mechanical subjects is merely theoretical, generally conceives it to be impossible. For ourselves, we are assured that the opinions of mechanics upon this point are correct, and we obtained the assurance by means of a series of experiments, which not only convinced us of the truth of the statement, but also satisfactorily explained the phenomenon.

We experimented in the following manner:—We selected a piece of very thoroughly seasoned cherry timber: a portion of a frame of some old machine which had been lying in the shop for a very long time, and after having selected the screws to be used in the experiment, we drilled holes in the timber of a suitable size, and, by means of a reamer, gave them a very gradual taper. The screws selected were 4-inch, gimlet points, with very strong heads, and about ⅛ of an inch diameter. The screwdrivers compared were, respectively, 8 inches and 20 inches in length, including the handle. The holes were tapered so that it would be impossible to drive the screws home, and were made as nearly of uniform size as possible. The wood was very homogeneous, and the screws were calipered to ascertain and obtain those of uniform size. Eight holes were prepared, and the eight screws selected, oiled, and laid in order. The screws were put in alternately by the long and the short screwdriver, and driven as far as strength would permit in each case. The result was a pretty uniform variation. Nos. 2, 4, 6, and 8, which were driven by the short screwdriver standing about ¼ of an inch higher than the rest. Applying the long screwdriver to these screws they were driven down to a pretty uniform level with the others. With the short screwdriver it was found impossible to start back any of the screws, but with the long one, we were enabled to take them all out.

Being thus satisfied that the long screwdriver had the more power in impelling the screw, we set ourselves to discover in what the secret of advantage consisted, and were enabled by a repetition of the experiment above described, but with slightly varied conditions, to refer it to the principle of the lever. If both screw drivers be held in such a position that the axis of each shall form a continuous line with the axis of the screw to be impelled, no advantage in favor of either will be discovered. But the long screwdriver admits of considerable play from side to side without releasing the screw, while the short one admits of very little. It is easy to verify this by the application of screwdrivers of different lengths to screw heads. In the effort to put in a screw where much exertion is necessary, this play and the consequent purchase are always obtained.

To prove such to be the facts, we arranged a guide or rest over the holes prepared for the reception of the screws so that by placing a suitable adjustment upon the blades of the screwdrivers we kept them in line with the axis of each screw. In this experiment no variation which could be attributed to the screwdrivers was apparent.

Repeating the experiment, a third time with the short screwdriver ground so as to incline it out of line, about as much as the estimated inclination of the longer one without causing it to lose its hold, we found, if any variation existed at all, it was in favor of the short one.

Undoubtedly, however, something in favor of long screwdrivers must be attributed to the fact, that they have larger handles than short ones, and thus present a greater leverage to the action of the hand.

Thus it is seen how statements apparently incongruous, may, by proper examination, often be proved to be in accordance with sound science.

GRINDSTONES---THEIR ACTUAL AND POSSIBLE USES.

The grindstone is of so ancient and common use that for the one the "memory of man runneth not to the contrary," and for the other its employment is already considered circumscribed. Yet the grindstone is capable of doing a much larger share of the work in the manufactory and machine shop than is usually accorded to it. On the farm its sole use is the sharpening of implements, from the carving knife down to the hoe and plowshare, but in the shop it is employed for grading the surfaces of metals—cast and wrought iron, steel, and some other of the obdurate metals. It is used either dry or wet, revolving swiftly or slowly.

Stones for grinding purposes are found in England, Scotland, Sweden, France, Nova Scotia, Ohio, and Michigan. Most of those, however, used in the East are from Nova Scotio and Ohio. From a practice of many years we prefer those of Nova Scotia to the Ohio stones because of their more even composition and genial grit. We are told, however, by one of the first saw manufacturers in the country that the artificial stones made by the Ransome process in Trenton, N. J., are superior to either in homogeneousness of texture and good grit. He uses them in preference to the others, although their first cost is somewhat greater.

One great trouble with the natural stones is the presence of spiculae, of hard, flinty substances standing out toward the circumference and resisting every legitimate effort for their removal. When a stone is found to contain these spikes of flint or obsidian the cheapest way is to discard it—roll it out of the shop,—for so long as it remains it will be a perpetual torment. Chipping off the obdurate spike, by the cold chisel is only a temporary expedient, as it will be sure to show itself again. A stone containing these hard spots is not fit for use in the shop; it will prevent any good work and be a permanent annoyance.

Much of the time and the cost of tools spent on the dressing, and even finishing of castings and forgings, which are now expended at the vice and by the use of cold chisel and file might be saved by a judicious use of the grindstone. It is singular that this ready means of abrading surfaces of metals and preparing them for after processes should occupy the very lowest place among the tools of a shop. Yet it is the fact that the grindstone, even when used only to give an edge to tools, is the worst kept appliance. The reason, we believe, is that its capabilities and possible uses are unknown. Why it should be so we are at a loss to conjecture. It may be made capable of saving much time now employed by skilled and costly labor and much waste of files and similar expensive tools. Many jobs generally submitted to the slow action of the planer might, by the more rapid action of the grindstone, be fitted for the after processes of the filer's art, with just as perfect satisfaction in the finished work.

TO ADVERTISING CORRESPONDENTS.---AXES TO GRIND.

We receive daily a great amount of very voluminous correspondence, upon subjects of great importance in the eye of the writer, but of no interest whatsoever to the readers of the SCIENTIFIC AMERICAN, and such articles are, of course, cast into the waste basket. In many cases, however, the subjects are important enough, but the writers have such a roundabout style that several pages are written in order to convey ideas that could easily be expressed in half a page, or even in a few lines. Correspondents should keep in view that the space in a journal of the circulation of this one is very valuable, and that the chance of having articles published is considerably increased by condensing them as much as possible.

We commend to the consideration of such correspondents the advice given by the editor of the London *Times* to a correspondent, who furnished him a very verbose article on an interesting subject. Said the editor, "You must reduce this one half." He did so, and reappeared with the article. "Reduce it one half," said the editor again. The abridgment was made, but not yet proving entirely satisfactory, a third condensation was ordered, when, in the editorial judgment the article had assumed reasonable shape, and shorn of every thing non-important to the subject, and in this condition made its appearance.

Often the whole purpose of the article, although sometimes ingeniously sugar-coated, is to recommend something the writer manufactures, or vends. To such correspondents we respectfully suggest that we are seldom deceived, and they are usually referred to our advertising columns to offer their wares. A Dr. Chase, of Ohio, for instance, sent us a long article on the non-explosiveness of all hydrocarbon oils, provided a certain kind of lamp burner was used, in which he has, no doubt, an interest, as also probably in making the combustible fluid, and offers to subscribe for our paper when we insert it. Now the extent of his article—entirely written in promotion of his private interests—is such, that at our regular published rates one insertion would cost $150; this will explain to him one reason for refusing to publish his communication, the other being that we by no means can endorse his assertion that the government test of kerosene oil is all nonsense; that only the lamp should be tested, and that gasoline, benzine, and other combustibles, are just as safe as kerosene He should keep in view that the cause of the kerosene explosions is not the deficiency of the government inspection, but the adulteration of pure kerosene oil with cheaper benzine, made by men of his stamp, who have some new kind of lamp or oil for sale.

THE COOPER UNION IN NEW YORK.

During the last three days of May, this institution was in a blaze of glory, the occasion being the so-called yearly reception of the pupils, which, however, is nothing more than an exhibition of the work of the classes for drawing, painting, and sculpture. The exhibition was indeed very creditable, and it is doubtful if anywhere in the world a similar institution exists where several hundred pupils, receiving gratuitous instruction, at the end of the winter session are able to exhibit not only so many specimens of their industry, but so large a number of creditable productions, evincing a high degree of application and intelligence on the part of the pupils, as well as good thorough instruction on that of the teachers.

The department of mechanical and architectural drawing did not show any thing particularly noticeable above former years; but in that of free hand drawing, a decided progress was apparent. There were not so many copies of those familiar drawing-class lithographs, of which we have seen too much in former years. It must not be forgotten that copying a drawing is no art, in the higher sense of the word. True art is only attained by drawing from natural, or, at least, material objects; it is the only road to artistic power, and it was in this specialty that in former years the ladies' classes in the Cooper Union were far ahead of those for the young men. That this state of affairs existed, was the fault of the system of instruction, and the professors of male department appear to have at last waked up to its realization, as the exhi