other, he can bring about a sharp and rapid conflict among them, leading to their separation and rearrangement, so as to form new groups with characters and powers very different from those belonging to the previous groups, or to the individuals composing them. Individuals previously harmless or benign he will sometimes combine together, so as to form a band of poisonous murderers. Awkward and spiritless dolts he can associate, match, and arrange together in such a way as to develop in them high-spirited and estimable qualities. By selecting, drilling, and arranging a lot of the most worthless and unattractive of things, he can turn out some of the most beautiful, useful, and valuable combinations that have in these times enriched the world. But besides the changes in regard to qualities easily recognized by our senses, such as color, taste, and smell, there are many other and more subtle changes which he can effect that are not so readily appreciated by us.

The exact rationale of these changes is, I suspect, almost beyond our comprehension. With regard to color, knowing as we do that Electron, if not identical with light, is allied and even superior to it, and may therefore be believed to have some command of those elementary colors contained in light, and it is quite conceivable that the molecules and the ultimate atoms of matter may have, through the influence of Electron, special affinities for certain of these colored elements, or specially electrized atoms, if such they be, as we know that they have for the other spectroscopic elements of light, and that they will, in consequence, reflect some but absorb others, appearing in that color which they reflect, and showing black if they absorb all, but white if they reflect them all.

So subtle and all-embracing is the essence of this great genie that there is no part of the world, or of what it contains, that is not more or less imbued with it. But, though embracing all things, he shows a decided preference for some above others, and this in so manifest a way that the magi who are devoted to his service have had no difficulty in making out a list of things in the order of his preference for them. Among those for which he shows the highest favor and attachment are the great family of the metals, and it is chiefly through their means that mankind have been enabled to become acquainted with his character and qualities, and with at least some of the laws by which he is governed in the work which God has ordained him to do. By their means it is, too, that his extraordinary powers are being more and more applied to the direct service and benefit of mankind. For example, while we can travel at the rate of a mile per minute along an iron railway, one of the same material, at a fraction of the cost, can be made to convey Electron, with whatever store of intelligence we choose to intrust to him, thousands of miles, and to any part of the world, in the same space of time.

(To be continued.)

ELECTRO MOTORS.

ALTHOUGH the technical journals in this country and abroad have frequently published paragraphs and descrip-

FIG. 1.

tion of the telpherage system of Prof. Jenkin, we do not think it has yet been generally mentioned that the telpher lines supplied to South America and that for the Royal Agricultural Society's Show at Shrewsbury are worked in connection with the electro-motors designed by Mr. A. Reckenzaun.

We understand that Mr. Mylne of the Telpherage Company, representing Prof. Jenkin, has recently made some tests with a motor employed on the telpher line at Weston. From the results given in the appended table it would appear that the Reckenzaun motors, considering their small size and comparative lightness, show a very fair efficiency. We are assured that there is not the slightest sparking at the commutator brushes, no matter at what speed the motor is revolving or even with the sudden and frequent reversals of current required in Prof. Jenkin's system.

These machines are provided with reversing gear, and weigh, complete, 117 lb.; they will work continuously up to 1.5 brake horse-power, or, intermittently, to as much as 2 horse-power. Their dimensions are 16 inches long, 16 inches wide, and 8 1/2 inches high; the resistance of the armature is 0.455 ohm and that of the field-magnets 0.090, giving a total resistance of 0.545 ohm between terminals.

The power tests were made by Prof. Jenkin's own dynamometer, the construction of which may be gathered from the sketches. It consists of a cast-iron V grooved pulley fixed on a shaft, C, by means of an American chuck, D, in order that it may be fitted to spindles of various diameters. A loose wooden pulley, B, having a well lubricated gum-metal boss, is threaded upon the motor spindle, C. The cord passing over the upper quarter of the circumference of the wooden pulley, B, is fastened by an eye, S, and carries the smaller weights, P. Another cord held by the bracket, E, which is fixed to the loose pulley passes over a quarter circumference of the iron (fast) pulley, A, and this chord with weights, P, determines the work absorbed by friction; the circumference of cord in this case = 3.09 feet.

By adding or removing weights on either cord, the speed or power can be varied. An advantage which this dynamometer has over the Prony brake is in the fact that no soap and water lubrication is required. The following table shows a few of the tests:

Rev. per min.	P—p lb.	H. P. dynamometer.	Current amperes.	E.M.F. volts.
2244	8.25	1.73	29.8	75.8
1934	8.25	1.53	29.4	69.9
1784	12.25	2.04	41.7	72.5
1300	9.5	1.15	31.5	52.3
996	9.75	0.91	31.9	60.1
548	11.75	0.60	36.5	37.3
428	11.25	0.45	35.2	31.8

$$H. P. = \frac{3.09 \times \text{revolutions} \times (P - p)}{33,000}$$

Do any of our readers know of an electro-motor weighing less than 160 lb., giving the same power and efficiency as the apparatus to which we have referred?

We may mention that these motors are manufactured by the Electrical Power Storage Company, Mr. Reckenzaun being highly satisfied with their construction both mechanically and otherwise.—*Elec. Review.*

GEOMETRIC ORNAMENT.

By LEWIS F. DAY.

THE necessity for a geometric basis of ornamental design has been so rigidly insisted upon by departmental authority that the student is like to be irritated into opposition; all dogma cuts two ways. In one important division of design geometry is inevitable. Wherever, that is to say, a pattern is repeated a number of times, a geometric succession of the parts becomes apparent; and where this consideration of geometric order has not been duly considered, the result is often most disastrous. Suppose you commence without any idea of formal distribution, and merely design a scroll as graceful as may be—a series of such scrolls side by side will most likely show lines not in the least contemplated by the designer, and as inelegant as they are unexpected. So commonly is this the case, that it is really wisest to base your design upon some regular arrangement of lines which, if they should be apparent in the finished design, will at least be comely.

It is one of the strangest things in the experience of a designer to see the tricks his patterns will play him when repeated. A wall paper design, for example, which appears to be so evenly distributed as to show no leading features of any kind, will prove, when hung, to run in lines slanting so as to give the impression that the walls are not true, or that the paper has been hung askew. It is not impossible, of course, however difficult, to design an absolutely free scroll that shall yet conform to all decorative conditions, even when repeated many times over. But one thing is imperative, namely, that the parts which appear to balance one another should do so absolutely. If, for example, a scroll is reversed, the two sides of it should take identically the same curve, and any two corresponding flowers should be exactly on the same level. The main lines and more important features thus balancing one another, we may take what liberty

FIG. 2.

we like with details which do not assert themselves; and it is always a charm in a design to find variations showing that the pattern has not been just traced and reversed; but it is the little difference in level, or the slight departure from the perpendicular, where the eye expects mechanical accuracy, that is in most cases responsible for unfortunate lines in repeated surface patterns.

If the repeat of your pattern is small, you naturally get all the variety you can get into it, knowing that repetition will bring with it quite enough of order and formality; but if you have a large space to cover, it is as well always, unless you wish it to present an absolutely uniform appearance, to settle points in it which shall be marked so as to form, as it were, links between the inevitable points which recurrence will reveal in the design.

As for ornament which is not merely based on geometric lines, but consists of geometric forms, it is very easy to have too much of it. Its most satisfactory use is perhaps to be found in mosaic, to which it seems naturally adapted, more especially where the colors are varied in an accidental manner, as is the case with marble and wood. Such accidental variation is, in fact, exactly what is necessary to geometric work. The unexpectedness of the tints just counteracts the certainty of the forms, and redeems the effect from mere mechanism. The very reverse of this fit relation of form to color is seen in the ordinary encaustic tile work, which seems somehow to be always harsh and common, even when the colors employed are not in themselves absolutely crude. At all events they are never sufficiently varied—perhaps it is not in the nature of the manufacture that there should be much variety; in which case the look-out is hopeless. Certain glazed Moorish tile work of this kind is not free from harshness and even crudity. Yet we see in Italian Giottoesque decoration, which is mainly, so far as its ornamental detail is concerned, in imitation of the forms of geometric inlay, that even in flat painted work the color can be subdued to a key so admirably in accord with mechanical forms that literally the only fault to be found with it lies in its pretense. Perhaps the charm is largely due to the fact that

the forms are not precisely mechanical, but put in with some freedom, and even with a sketchiness that would horrify the British workman. Time, too, has doubtless been kind. Still, there is the happy result, which is not without its lesson for us.

By the way, in the ornamental glass mosaic of Giotto's time we get the very perfection of relation between geometric form and glowing color. Nothing like harshness of form is possible with these little facets of glass, which catch the light at all manner of angles, and glitter according to their own bright will.

Lines of a more or less geometric character are so useful in ornamental design that one is bound to avail one's self of them. But there is always a danger in using them, lest they should assert themselves unduly. What admirable use Grotto, for example, made of them! Yet there are many of his bindings in which they stand too emphatically pronounced.

One has noticed in many an instance of old stained glass and painted decoration the satisfactory result of a portion of the design being worn away, or nearly so, hinting to us that it is not absolutely necessary that geometric forms should stand confessed in all their naked severity. It is quite possible, and quite permissible, to subdue if not to obliterate them here and there, so that the logical cohesion of the design exists, without the obvious stiffness which results from the preponderance of geometric forms.

There is a way of relieving the monotony of geometric design, used in Byzantine art (one sees it at Ravenna), by interspersing sprigs of very conventional foliage in the midst of interlaced strap work, which is very charming. But in Byzantine art this is scarcely necessary; so little mechanical are the forms that they are scarcely to be called geometric.

Some sort of geometric basis to a design gives scale, severity, and strength to it, so that, apart from any necessity there may be for repetition (which, of course, involves recurrence of the parts in geometric order), we habitually adopt it as an element almost indispensable in design.

The point to which geometric design has been carried by the Arabs is something really marvelous. Not so marvelous as it at first appears, for it seems at first as if human ingenuity could never so much as grasp the thread of such intricate pattern work, much less invent it—yet still sufficiently bewildering, even when one is familiar with the, after all, simple lines on which it is constructed. But even in such work as this, where geometric design certainly reaches its zenith, one cannot escape a certain weariness of interlacing lines and parts repeated; and a certain amount of wear and tear, and even of dilapidation, is a relief to the eye. I have always found the greatest pleasure in examples that, whether by design or accident, are not altogether mechanical in execution.

This brings me to the conclusion which has pressed itself upon my conviction, that it is the geometric distribution of ornament which is valuable, while geometric accuracy of execution is not merely worthless, but fatal to ornament. Why is it that modern Gothic tracery is apt to be so hideously hard compared to the old examples from which it is copied? Simply that it is what the builder calls "true," which the old work is not, and probably never was. Even in old work, whose edges have been softened by time, what a relief it is to get away from the evidence of mechanism! In German geometric tracery one is conscious of the part played by the compasses in the design; and in English perpendicular work, there is always a suggestion of the T square; but in French flamboyant forms one sees only the artist. There is a geometric relation of the parts, but the lines flow freely from the hand of the designer.

Great importance has sometimes been attached to the construction of ornament, not only on a geometric basis, but upon the principle of the multiplication of one simple unit throughout. It is quite true that a great deal of Arab and Moorsque pattern work is reducible, for all its intricacy, to the simplest possible elements; and that star shapes, diamond forms, hexagons, and other polygons are all multiples of the simple triangle upon which this particular variety of Eastern design appears to be built up. But I am not so certain that it is altogether a building process with the Oriental designer. When you come to deal with absolutely geometric shapes, the subdivision of such shapes into similar geometric divisions is almost a natural instinct, with any one whose ingenuity lies at all in the direction of such art. The space to be ornamented, suggests, in fact, its being broken up into segments of like shape. The square, for example, suggests a smaller square set anglewise within it, and the resulting triangles at the corners suggest, again, a triangle placed in the same way in its center, dividing the space into four equal equilateral triangles. Whether, however, the design be the result of a process of multiplication or division of parts, matters little; except that too much stress has been laid, I think, upon this constructive form of design. No doubt the construction is there; and there is significance in the fact. But I fancy that the Mohammedan artists were not always thinking of the principle underlying their work, even if they were always conscious of it. Their art was traditional and instinctive to a degree. And, anyway, I disbelieve entirely in the advisability, and even in the possibility, of our designing on any such scientific principles as may doubtless be discovered in Alhambresque design. It is possible, very likely, mathematically, to reconstruct the subtlest curves of Greek architecture; but does any one imagine that they are the outcome of mathematical science? A scientist perhaps! I have heard such a one enthusiastic in the anticipation of a time when color shall be reduced to a matter of mathematical certainty—in which case it will be about as interesting as a game of chess where, one move made, the rest follow as if the human machines engaged in it had been wound up. Art proceeds, happily, upon quite different lines. And though the results of art may be scientifically explained perhaps, the effects of art are not to be scientifically produced.—*The Architect.*

A HINT TO SHIPPERS OF APPLES.

AN English agricultural paper prints some excellent advice to American apple growers. In the first place, it complains of a kind of two and three-quarters bushel barrel, which is extensively used in New York, and advises all who wish to ship fruit to England to use the old-fashioned three-bushel barrel, with an honest bulge. Then it alludes politely, but plainly, to the American habit of sorting the fruit, and stowing the second rate article in the middle of the barrel, while the red checked, plump apples are invariably placed in the exposed ends. The apple packers of New England will do well to ponder on these remarks, for they are good. Let them check their inclination to place the pleasant faces of their apples all on the outside, and rest assured that if they can get a reputation for honest sorting, their reward will be substantial.—*Advertiser.*