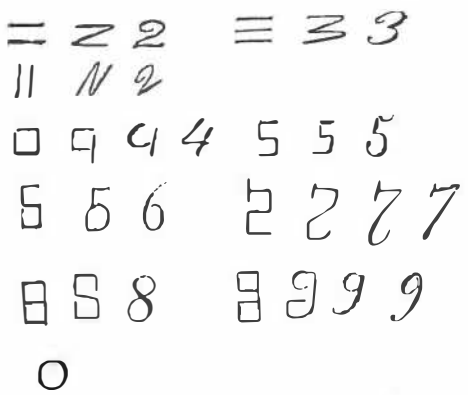
THE ARABIC NUMERALS REPRESENTATIVE, AND NOT ARBITRARY CHARACTERS.

It can hardly be successfully disputed that the first methods of expressing ideas to the eye were by means of figures which were, in some measure, representations of those ideas. Such was the picture-writing of the Aztecs, by which their rulers were informed of the appearance, character, numbers and supposed designs of the Spanish strangers. The same mode of pictorial representation was subsequently adopted by the Christian teachers of Europe, who endeavored and succeeded by it in imparting to the Mexicans the primal truths of the Christian faith.

Sir William Jones traces an analogy between the present written language of the Chinese and the true hieroglyphic, which represented ideas by pictures. The Egyptian characters are of this nature. Our North American Indians employed the same means for the expression of ideas. It is easy to see that so far as the written language attempted to deal only with visible objects, and even the qualification of them by comparison, this picture writing would serve a purpose. Possibly the relation of one symbol to another, or of the qualities of one written object to another could be expressed in the same way; but either a phonetic or alphabetical script became necessary to give coherency of expression and facility of interpretation, when the information intended to be conveyed was of a more abstruse and abstract character than that concerning visible objects. But this form of written communication was of necessity confined to those who understood the particular language to which it was adapted, while the representative method was of universal application.

In the representation of numbers, especially, the most expressive characters would undoubtedly be adopted. Numbers depend upon no distinctions of character either in the climate, soil, or scenery of a country, or the pursuits, inclinations, or habits of a people. They are immutable, unchangeable. Therefore, we find to-day every enlightened people using the same characters in their written expression. The Arabic numerals may have been first adopted by Europeans because of their immense superiority over the cumbrous Roman system; but its originators probably intended each character to express the number it was used for. Let us look at this subject for a moment critically.

Of course it can be seen that one straight line, as in our figure 1, represented that number. The starting appendage was undoubtedly added by carelessness in writing it, the pen being brought close to the surface before the downward stroke was given, and in preparing for that stroke making the preparatory upward hair line. Now let us, by means of the following diagram, see if the succeeding characters can be as successfully found to represent the numbers they are designed to express.



Let us analyze these characters by the light of common sense and the natural movements of the hand in writing. In tracing the formation of the 2 we have supposed that two horizontal lines, in stead of two vertical lines were used; but if this assumption may appear to be too much of an assumption, it may be shown, as in the lower group, that the two upright lines might be corrupted into the present form of 2. The second character of this group is a 2 in a leaning position. But it serves our purpose to assume that originally the 2 was two horizontal lines. Beginning at the left of the top line, in bringing the pen, or other writing instrument, from its right to the left of the lower line, it was perfectly easy, and, indeed, almost unavoidable, when in haste, to leave a connecting diagonal line between. In time this became the accepted form. But as it is easier and more natural to write in curves than in arbitrary straight lines and angles, the form became ultimately that which we now use, ornamented and perfected.

The progress of the 3 can be readily seen. The 4 was a square, made by beginning at the right of the top line and forming, by a left, downward, and a right-hand movement, the three sides, the square being finished by a downward stroke on the right. This was easier than forming the whole square without lifting the pen from the writing surface. The progress of this character can be readily traced.

Looking at the 5 it may be asked why depart from the standard furnished by the 4? Why not add to the 4 by another line? Because the 4 being made in the way just described, and any addition to it being naturally merely a prolongation of one of the lines already existing, it might be difficult, in many cases, to distinguish one from the other. This character was begun, originally, at the upper right hand, but afterward, as in the second example, the upper horizontal line was the finishing stroke. The curl upward of the body shown in the third example was a scratching caused by carelessness in lifting the pen when going upward to give the last stroke. As in former instances, however, it furnished an excuse for the adoption of the present form.

The figure 6 can be traced from its original form to its present appearance without special explanation of the examples given in the diagram.

But the 7 may be somewhat puzzling. Let us consider, however, that to get a simple and convenient form which should represent the number and be sufficiently distinct from the 6 and the 5—one of which the 7 would resemble if another line was added to the 6—a new combination of lines was required. So the upright across the upper horizontal was made to count two intsead of one, as it was bisected by the horizontal. Note the progress of the figure from the exact perpendiculars and horizontals to the present form, the lower portion being gradually simplified into a mere thickening of the stem.

Of the 8 it is scarcely necessary to speak. It is apparent that it is but a double 4, and its change to the present form is easily accounted for when we remember, what is stated above, that it is more natural and easy to write in curves than in right lines and angles.

The 9 is two figures 4 united by a line. The remarks in regard to the lower portion of the 7 will be found applicable to this figure. It certainly is opposed to the idea of representative characters to believe that the 9 is but a 6 reversed.

The last character is styled "naught," or "cipher," both meaning when applied to this figure "nothing." And see how perfectly its form carries the idea when viewed in connection with the others. Each of them derives its power and value from straight lines without curves. This, however, when alone, having no value whatever, is a continual curve without an angle or a right line.

Possibly some may consider these examples and explanations far-fetched, but the writer believes that the more they are examined the more it will appear that the present form of the common numerals is a corruption of what were once merely representative characters.

DOMINUS.

MANUFACTURES IN HARTFORD.

Hartford, Conn., is known the world over for its vast insurance business, but it is not so well known for its manufactures; although the Colt pistol and the Sharps rifle have made it somewhat famous. Still, many who have heard of these weapons never knew the place of their manufacture. The Spencer rifle, also, was first tested in Hartford, and the manufacture was commenced by Hartford men, who owned the patent, in Boston, Mass. This celebrated arm was invented by an employé of the Cheney Brothers, silk manufacturers, whose works are located in Hartford.

The manufactures of this city are varied, and in each department are important from their extent, the amount of capital invested, and the large returns realized. The Colt's Patent Fire-arms Company should, perhaps, head the list. The extent of this concern can be judged from the facts that the flooring of the buildings contains an area of six and a-half acres; that the capital invested is one and a-quarter millions of dollars, and the number of hands employed about fifteen hundred. Sharps's Rifle Factory is another important Hartford concern. The arms manufactured here have proved exceedingly efficient weapons, and have, during our late war, sometimes decided the turn of a battle. They are wonders of simplicity and durability, and are great favorites with those who have used them.

The Woodruff & Beach Iron Works are one of the most complete establishments for the manufacture of stationary and marine engines in the country. Work of the heaviest character can be done here. They have a planer capable of finishing a condenser weighing thirty tuns, steam derricks with a lifting power each of seventy-five tuns. The engines of the celebrated *Kearsarge* were built here. Their engines are remarkable for finish and easy working; those of the *Nipsic* gunboat sustaining a trial of ninety hours at the dock and three months at sea without heating a journal, driving a propeller screw of bronze eleven feet diameter, and weighing 3,500 pounds. The engines of the *Pequot* were built here, on a new plan. The cylinders are curved tubes, segments of a circle, thirty inches diameter. The piston rod is a complete circle, corresponding to the radius of the tube and works on centers. The connecting rod leads to the piston rod without the intervention of a cross head. These engines are reputed to work well.

The belting manufactory of P. Jewell & Sons is probably the largest in the country. It converts six hundred hides into belts every week, using leather tanned at an establishment in Michigan owned by the company. Messrs. Jewell & Sons also manufacture immense amounts of lace leather from Patna hides, from the East Indies, which they cure in salt, alum, and hot tallow, and not by the ordinary process of tanning.

The Cheney Brothers are probably the largest manufacturers of silk goods in this country. They import from China and Japan their raw silk by the cargo, and manufacture it into ribbons, neckties, and dress silks. They have an auxiliary concern at Manchester, about twelve miles from Hartford, the two establishments being connected by a telegraphic wire.

Tobias Kohn is another silk manufacturer, who devotes his attention mainly to the making of sewing silk, embroidery braids, and cords and tassels. He has lately patented a new machine for "twisting, stretching, cleaning, and reeling silk and other threads" (see SCIENTIFIC AMERICAN, No. 16, Vol. XV., current series, page 255), which produces a more even and better-finished quality of silk than is usually found in the market. His braids are considered superior to those of the same style imported.

J. L. Howard & Co. have a large manufactory for car trimmings, which sends its products all over the country, and they are to be seen in the cars of nearly all the principal roads.

Among the new manufactories of Hartford may be mentioned one for the production of toys, and the new concern of Pratt, Whitney & Co., referred to in another column. This company is composed of three young men, all practical mechanics, and more earnestly desirous of permanent celebrity founded on excellence of workmanship, than of present advantage at the expense of workmanlike reputation. Their establishment is a thorough school for the mechanic. Every article that goes from the shop is thoroughly tested and elaborately finished. No sham work is permitted. Their machinists' tools are models of beauty and convenience. They have recently added to their engine lathes Slate's device for turning tapers, the simplest and most efficient contrivance for the purpose we have ever seen.

These are but a portion of the manufactures of this thriving city. There are many others, some of them of great importance, to which we have no time nor space to allude.

A CALIFORNIA paper asserts that a grain of wheat, lately unearthed, put forth a sprout and commenced to grow, having been imbedded for thirteen years.