It is especially urged that all chemists who intend visiting the World's Fair take this occasion to do so, by which they can combine the pleasure of visiting the Exposition with the benefit derived from attendance at the congress. To American chemists an especial appeal is made to be present for the purpose of welcoming our foreign visitors and showing them the progress of chemical science in the United States. HARVEY W. WILEY.

THE EFFECT OF FOOD UPON THE COMPOSITION OF BUTTER.

BY FRED W. MORSE, DURHAM, NEW HAMPSHIRE.

Practical dairymen, who produce a high grade of butter, lay great stress upon the quality of food with which their cows are fed. Chemists, who have had much to do in the examination of butter for adulterants, have observed that the samples from one region have steadily varied in their composition from those of another region, where different practice prevailed in feeding. These facts have led to many experiments, both in Europe and America, to find out the specific action of different foods upon the composition of butter.

This product of the dairy is composed of fat, water, salt and curd; and of these, the cow is responsible for only the fat and the curd. The former constitutes about eighty-five per cent and the latter barely one per cent of the butter, therefore chemical examinations for variations due to food have been confined wholly to the fat. Butter-fat differs from the fat deposited in the body of the animal by having from five to seven per cent of volatile fatty acids, and only eighty-seven to ninety per cent of insoluble, fatty acids, while tallow has ninety-five per cent of the latter and less than one-half of one per cent of the former. The volatile acids give butter fat its characteristic flavor, and also cause it to be softer than tallow. Butter fat also differs from tallow in having less oleic acid among its insoluble acids. These two characteristics of butter-fat have been studied more than any of its other properties, because of their relations to adulterations, and the studies of food effects have so far been confined to the same lines.

In the course of investigations, it has been found that in general, the widest variations in volatile acids and oleic acid are due to the progress of lactation, the latter increases and the former decrease as the period advances. Individual cows also vary widely from one another in the composition of their butter fat, but with regard to the breeds, no definite conclusions can be made.

The effect of food is greater upon the oleic acid than upon the volatile acids and, in nearly all cases, variations in this constituent of the fat have been closely related to variations in the firmness of the butter. This is to be expected, as oleic acid is an oily liquid at summer temperature, and the butter is softer or harder as this acid is present in greater or less amount.

Many of the foods have been tried in such limited amounts that it is unsafe to draw conclusions, therefore only such foods will be mentioned here as have been used in repeated trials. The most notable effect has been produced by cotton-seed and cotton-seed cake. Whenever it has been fed, the volatile acids and oleic acid have been depressed below the average; the butter is deficient in flavor and often too hard to be easily cut with a knife.

In strong contrast to this action of cotton-seed, is the effect of gluten-meal, a by-product from the manufacture of corn-starch. This food is especially effective in raising the oleic acid above the average, and also produces a butter-fat high in volatile acids. The butter from this food is frequently too soft for an ideal product. Corn-meal, however, has always produced a butter-fat low in oleic acid, but has shown no action on the volatile acids. Clover, dry or green, has produced fat high in volatile acids, and with oleic acid slightly above the average. The same is also true of spring pasturage. Early cut straw generally produces a fat with volatile acids and oleic acid below the average.

The action of clover and pasturage in increasing the volatile acids, and that of corn in lowering the oleic acid, explains the practice of the makers of first-class butter, who rely upon these foods to produce a good flavor and firm grain.

ELECTRICAL NOTES.

THE present Electrical Exhibit at the World's Fair contains much more that is of interest from an engineering standpoint than from a purely scientific one. Magnificent as the engineering display is, there is little that is new. Everything is now thoroughly mechanical, one no longer sees the monuments of tortured ingenuity which used to pervade the former exhibitions; in its place are the results of sound and competent engineering skill.

The multipolar machine has evidently come to stay. Three years ago there was not, I believe, a single large multipolar machine made. Almost the only makers of machines above 100 horse-power were the Edison, Brush, and Westinghouse Companies (we are speaking of America, of course; on the Continent of Europe multipolar machines have been the rule), and their machines were all bipolar. Now there is on exhibit hardly a single machine above 50 horse-power which is not multipolar. Splendid examples of these are the Westinghouse, Thomson-Houston, and Edison direct connected generators.

The general use of the toothed armature is also a new feature. A short time ago the hardy individual who should have proposed designing a large dynamo with toothed armature would have been told that it was impossible to do it, that the consequent increase of self-induction would make it spark so badly that it could not be run, that the only way to make a dynamo whose brushes would not need shifting between full and no load was to have a big air-gap, and all this would have been backed up by alarming mathematical quotations from Ayrton and other writers.

Now we see that the impossible way is the only way, and the designer who neglects the aid of the toothed armature is handicapping himself very much. In passing, one may notice that, if one may judge from several recently-read papers in the English Institute of Electrical Engineers, European designers are not able as yet to design a toothed armature which shall not spark, shall require no shifting of brushes, and shall be highly efficient. Even the machines, which probably furnished the encouragement to American designers to try the toothed armature, i.e., the Brown machines for electro-metallurgy, we learn, recently, had to be sent back to the factory, the armature turned down, and rewound with an exterior winding.

Among the new things in engineering, the large two-phase 1,000 horse-power generators of the Westinghouse Company deserve especial attention. The large amount of work now being done in this line by the various companies is a good augury for the rapid development of the system. If this proves a success, the days of the continuous current will be ended, so far as engineering is concerned. There are three things so far which have hampered the alternating current: (1) Poor all-day efficiency of transformers, (2) noisy arc-lights, and (3) absence of motors. The recent developments in transformer design have resulted in transformers with an all-day efficiency of 94 per cent; the new low-potential arc-lamps give a better light than the continuous-current lamps, and as noiseless; and there only remains the development of the motor system, which now seems to be within sight.

Electric welding is evidently no longer a thing of the future. There are a number of firms making displays, who are using the Thomson process in their business. Several of the wagon-making firms use the welders to make tires and weld axles; wire-making companies use them to join lengths of wire; they are used in making shells for modern machine and quick-firing guns; for joining up lengths of pipe in ammonia ice-machines; and for welding rails together to form a continuous track. This last is a most interesting exhibit, as, if successful in practice, it will lead to a new method of railway construction, for street railways at least. A track has been in operation for some time near the Thomson-Houston factory in Lynn, and the results seem to have been very good. No trouble was experience from expansion or contraction, the friction of the rails in the ground preventing displacement and creeping, and the expansion merely manifesting itself as a stress in the rails, well within the elastic limit.

Among recent practical applications of electricity are the electric chimes and tower-clock system, now on exhibition in the tower in the centre of the Manufactures and Liberal Arts Building. These are the invention of Mr. Attwood, and the chimes have been used for

some time in Grace Church, New York. In this system the hammers of the bells are worked from a key-board, like that of a piano, and the largest sized bells can be played as easily and quickly as a piano itself. The mechanism is very simple, the keys making contacts which actuate relays, and these in turn excite solenoids with iron plungers, to which are attached the bell ropes. Instead of the key-board, a small cylinder, like that of a music-box, can be used, which automatically plays the chimes every hour or quarter.

The most valuable part, however, is the electric tower-clock arrangement. In this, instead of the ordinary cumbersome clock-movement requiring frequent rewindings, an ordinary clock is used, which may be placed anywhere, in an office, for instance. Every minute this clock makes a contact, which actuates a little battery motor, and this turns the hands of the tower-clock one minute ahead. As the impulse is given at the middle of the minute, the tower hands are never more than half a minute out of time. The actuating clock may be synchronized from Washington if desired. This system seems to give a very good tower clock for a fraction of the present price. One advantage is the fact that no winding is required, six or seven Leclanche cells furnishing enough current to run the clock for several years.

Another exhibit which will be gladly hailed by those who have had to do much telephoning will be the automatic telephone exchange in the gallery of the electrical building. In this system, the telephones are the same as usual, but in front of the wooden box which supports the transmitter are placed a number of keys. If a subscriber wishes to call up number 1324, for instance, he presses key number 1, once; key number 2, three times; key 3, twice; and key 4, four times. He then presses another key, and if the subscriber he wishes to communicate with is talking to some one else, it signals him that fact; if the line is open, it puts him in communication. When he is through, he presses the key again, and it disconnects him.

Several central offices have been put in, and are working satisfactorily, and a number of other cities have decided to replace their present central office by this automatic system.

At present there is one disadvantage which the system has, i.e., the need of four wires instead of two; but, from an examination of the machines, there seem to be several ways by which two wires could do all the work, and doubtless this improvement will soon be made. Even with the increased expense, the better service will more than compensate for the increased cost in wiring, and, of course, the central station expenses will be much reduced.

A very complete exhibit is that of the Bell Telephone Company. This includes an interesting historical exhibit of the various forms of telephone receivers and transmitters invented by Mr. Bell. A central station is shown at work, the methods of connecting up the lines, etc.

One of the new things is the use of paper insulation for telephone cables. Seemingly impracticable as this seemed to be a few years ago, it is now a complete success. Of course, it is evident that its low specific inductive capacity gives it marked advantages over any other kind of insulation, and that by its use speech could be made clearer, and transmitted further, but it would at first sight appear that it would be difficult to keep up its insulating qualities. This, however, has been done, and nearly every switchboard observed was wired with this insulation. The operation of putting it on the wire is shown in the Electrical Building. R. A. F.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

Peculiar Nesting of a King-Bird.

A CURIOUS incident, showing a peculiarity of bird-life, came under my notice within the last month (June, 1893). We have been boring an artesian well about five miles south of Beaumont, mound rising out of the great coastal prairie lying between Beaumont and Sabine Pass, in Jefferson County, Texas, and in the course of the operations have built a derrick about seventy-five feet high. After the derrick had been built a few weeks, it was visited by a great number of birds of various kinds, whether with a view of locating or not, I do not know, but one would think a well outfit, with all its noise and wet, a very unfavorable location for bird-life. Among the visitors came a pair of king-birds (*Tyrannus tyrannus*), which, after an apparently careful inspection, became convinced that they had found a satisfactory location for their home. A sheltered point, where two of the cross-beams came together in a corner of the derrick about twelve feet from the ground, was selected and the pair began building a nest. Notwithstanding the noise of the machinery and the continual passing up and down of the man in the derrick (the nest was built in the same corner as the ladder is located on the outside of) the nest was completed and three eggs deposited. Then something occurred that killed the female, and the male, after moping around for a day or two, also disappeared. That, I thought, was the end of that pair's nesting; but apparently not, as in a day or two the same male bird returned, bringing with him another mate. The outlook was again considered, and the pair began building another nest in the same location, resting the new nest on the top of the old one, building, as it were, a second story to it. After the new nest was completed, but before any eggs had been deposited, wondering what could have become of the eggs already laid, I went up the derrick, and, carefully raising the new structure, brought out the old eggs. Replacing the new nest as best I could, the birds continued to occupy it, and the female is now setting upon a full nest of eggs of her own laying, and I am now looking forward with considerable interest to the advent of a young brood to see how they will thrive under the circumstances.

I have asked several of my ornithological friends if such an occurrence has anywhere come under their observations, but have in all cases received a negative answer. WM. KENNEDY.

Austin, Texas, June, 1893.

The Tucumcari Fossils.

IN *Science*, May 26, pp. 282–283, there is an article by Mr. W. F. Cummins of the Texas Geological Survey, entitled "Geology of Tucumcari, New Mexico," in which he says: "Mr. Marcou . . . endeavors to avoid the conclusion (that the beds are Cretaceous) by saying that either the determinations of the fossils found by me were incorrect or that they did not come from that locality, and suggests that the labels on my packages were loosely put on and became mixed with collections made elsewhere; and on this flimsy subterfuge (to give it no harder name) still insists on the correctness of his reference to the Jurassic."

Mr. Cummins tells at length of the good care he took not to have any confusion of labels. So my suggestion cannot stand. I accept fully the explanation.

Now there remain two points, which are the most important: First, the correctness of the determination of the fossils; second, the stratigraphic position of the Jurassic strata of the Tucumcari between the Trias and the lower beds of the Neocomian, at Comet Creek, an affluent of Washita River, and at the great band of the Canadian River.

1. Mr. Cummins says: "myself and my assistants discussed the fossils in the field as we picked them up, and our note-books show that we then determined them as they are now designated." . . . "I made up small suits and sent them to various parties for determination, . . . and there was unanimous agreement as to all the species I have *published*." It is important to add an explanation as regards the species *published*. Only one species has been published by Mr. Cummins, a leaf of a fossil plant; all the invertebrate fossils are only quoted, without descriptions or figures. Here is the list given by Mr. Cummins:—

"*Gryphoa dilatata*, var. Tucumcarii Marcou; *Ostrea marshii*, as determined by Marcou, but in reality *Ostrea subovata*, Shumard; *Gryphoa pitcheri*, Morton; *Exogyra texana*, Romer; *Ostrea quadriplicata*, Shumard; *Trigonia emoryi*, Con.; *Cardium hillanium*, Sow.; *Cytheria leonensis*, Con.; and a single leaf of a dycotyledonous plant, which I described and figured under the name