be always in motion. The gas next flows into the gasometers, those immense bells of riveted sheet iron with whose appearance everyone is familiar. Their lower edges dip into wells of water, and they can move up and down, guided by rollers which press against columns of cast iron. These enormous reservoirs are fed by jointed pipes, and rise to their full height or sink almost into the ground, according to the quantity of gas which they contain. Each of the gasometers at Clichy is 43 feet high and 178 feet in diameter, holds 30,000 cubic meters (108,000 cubic feet) of gas and costs nearly a million francs ($200,000).

From the gasometers, pipes lead to the distributing office (Fig. 6) where there are three small gasometers furnished with manometers, which indicate the pressure on dials. The pressure is regulated according to the demand by the aid of disks of lead placed on these small gasometers. The mains, the valve gear of which is shown in the foreground, conduct the gas to the 1,540 miles of pipes which ramify through the soil of Paris.

In the works of the Paris gas company the coke is disposed of by means of very efficient machinery devised by the engineers Gigot, Louvel, and L. Bertrand, and driven by electricity.

There are cars and automatic dumping carts, but the most interesting devices are the *convoyeurs*, *hectolitres-verseurs*, and *dragues*.

The conveyor (see front page) is used chiefly in piling up bags of coke. It is composed of a chain with buckets, in which the sacks are placed for transportation to a considerable distance and elevation to a height of 60 or 70 feet. The apparatus is supported by iron columns and girders.

The *hectolitre-verseur*, or measuring tub (Fig. 8), is used in measuring and bagging coke. It is placed under the sieve and operated by one man. When the tub is full it is dumped by means of a handle, but it rights itself automatically. The coke is poured into the sacks through an apparatus having the form of a funnel.

The *drague*, or dredge, disposes coke for city delivery. It is a chain with buckets, mounted on an iron arm which can turn about a horizontal axis, and is so arranged that its weight tends to press the lower part of the apparatus against the pile of coke. The buckets discharge their contents into a hopper, from the bottom of which the coke, freed from dust, runs through three spouts into three *hectolitres-verseurs*. The bagging is done on the platform of the apparatus, which is at the height of a wagon, so that the sacks are easily removed.

Finally, the by-products which result from the distillation of coal constitute an important source of revenue to the company. At La Villette there is a special and mysterious factory for the utilization of coal tar. In this sanctuary, jealously screened from profane eyes, the tar is transformed into benzine, phenol, and naphthalene, from which substances other chemists extract brilliant dyes and delicate perfumes. At Clichy the ammoniacal liquor of the gas works is converted into ammonium sulphate, which is largely employed as a fertilizer.

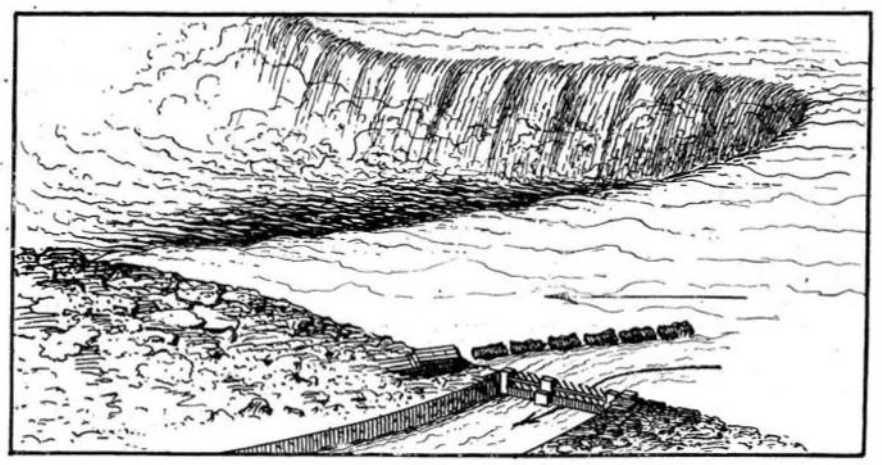
The manufacture of gas, therefore, is now a very successful industry because it involves, so to speak, no waste. The graphite which encrusts the interior of the retorts is used for electric light carbons, crucibles, and lead pencils, and even the ashes of the coke burned in the furnaces are bought by French brickmakers to mix with clay which is too stiff to be used alone.

Nearly all of the best arable land of the country has now been taken up, and those who are most vitally concerned with soil production realize that henceforward the main problem for the man who intends to make cultivation of the soil his occupation will be not so much a question of greater acreage as of greater production from a given acre. If America hopes to continue her phenomenal development, she must be able to produce not only the enormous quantities of food required for her own increasing industrial population, but a large share of the food for other nations as well.

CURIOUS ENGINEERING FEAT AT NIAGARA.

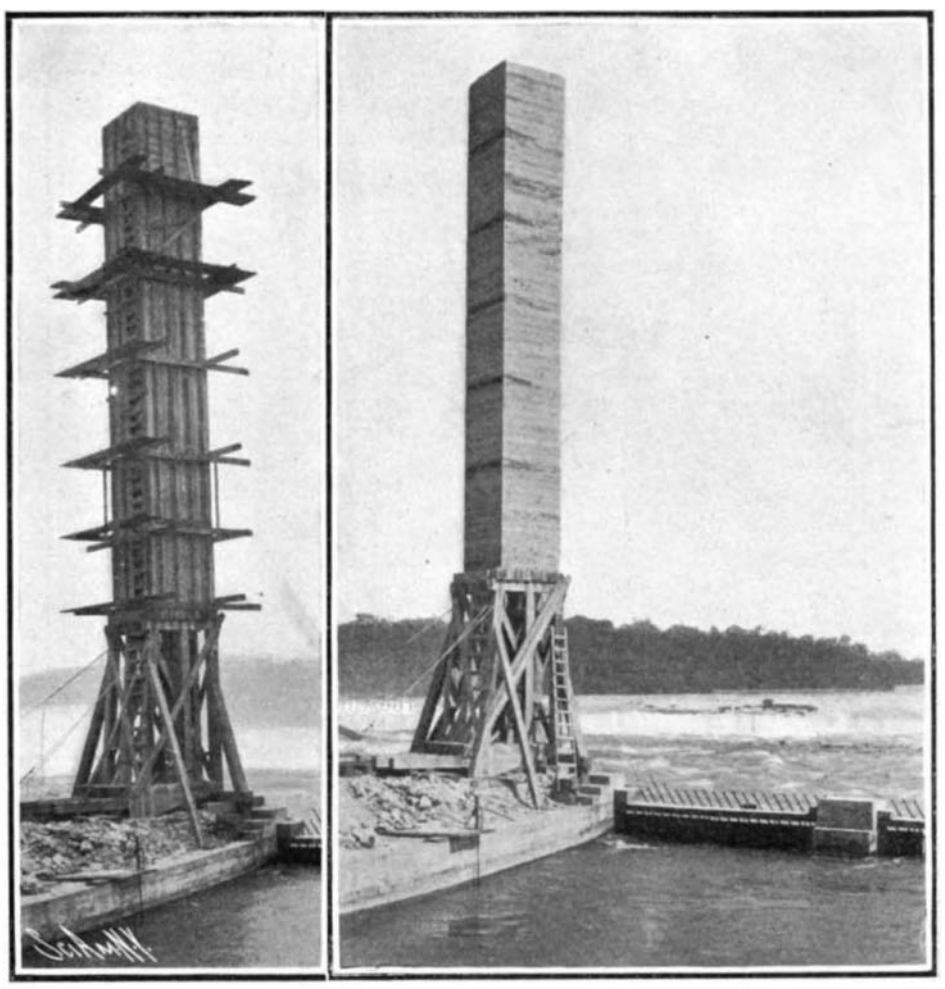
BY ORRIN E. DUNLAP.

The city of Niagara Falls, Ont., has had a great deal of trouble in getting a sufficient supply of water at its intake in Victoria Park. This has been especially true in winter, and several times the Canadian city has had to call upon the city of Niagara Falls, N. Y., to supply it with water for fire and other purposes by means of a line of hose stretched across the lower steel arch bridge. The Niagara Falls Park and River Railway, the electric line that skirts the cliff on the Canadian side at Niagara, and which develops its own power, has also had trouble, the intake being a joint one. Both interests made complaint to the commissioners of Victoria Park, alleging that the water at the joint intake had been lowered by works of construction for power development. The park commissioners held a hearing on the matter, and it was decided to grant a measure of relief. Mr. Isham Randolph, consulting engineer of the Chicago Drainage Canal, was called into consultation by the park commissioners, and he advanced a plan to remedy the alleged trouble.



The Concrete Column After It Has Been Thrown into the Stream.

In carrying out this plan, the park commissioners have constructed a concrete column 50 feet high and 7 feet 4 inches square on top of a trestle that stands 20 feet above the ground level. This column it is proposed to tip over into the river, to form a prostrate column, designed to raise the water level at the intake considerably. The column is made of concrete having proportions of one, three, five, and is reinforced throughout its entire length by a very heavy chain that runs through the center, the chain having a weight of about 800 pounds. The approximate weight of the column is 200 tons. About every eight feet of its height there is a wooden wedge that extends nearly half way through the column, the wedges being about 12 inches thick at the outer edge and tapering to 6 inches toward the center, and the blocks are further separated by strips of tarred paper. The purpose of these several wedges and paper strips is to break the mass in six parts as it falls in order that it may conform to the bottom of the river, while the parts will be held in place by the chain that extends through the center. The scene of the work is only about 600 feet up from the brink of the Horseshoe Fall, but when prostrate the column is not expected to make any difference in the flow of the waterfall. When prostrate, the top of the column will be 20 inches above the level of the ground, and in order that ice may be floated off, an opening will be left between the end of the dam and the river. The column will be tipped by jacks working under timbers at the bottom of the trestle, and when it falls it is expected to tumble slightly up stream. The column will be allowed to dry several weeks before it is tipped into place in the Niagara River.



Column during construction. The concrete column drying out.

Submerged Dam Built on Shore to be Tipped into the River.

CURIOUS ENGINEERING FEAT AT NIAGARA.

Niagara Falls and locality have witnessed many strange feats of engineering, but this construction of a dam up in the air and then tipping it over to the spot desired is certainly very new. However, it well portrays the adaptability of concrete work to peculiar and difficult situations such as those often found at Niagara.

The Bantu.

Roughly speaking, the whole of Africa south of the equator, with the exception of the dwindling Bushman and Hottentot elements, is inhabited by Bantu-speaking peoples, who are extremely heterogeneous, and who exhibit sufficient similarities in physical and cultural characteristics to warrant their being grouped together; the true negro may be regarded as a race; the Bantu are mixed peoples. It will be noticed that as a rule the Bantu approach the Hamites in those physical characters in which they differ from the true negroes, and owing to the fact that the physical characters of Semites in the main resemble those of Hamites, the Semitic mixture that may have taken place will tend in the same direction as that of the Hamitic. The diversity in the physical characters of the Bantu is due to the different proportions of mixture of all the races of Africa. What we now require is a thorough investigation of these several elements in as pure a state as possible, and then by studying the various main groups of Bantu peoples their relative amount of racial mixture can be determined. The physical characteristics of the Bantu vary very considerably. The skin color is said to range from yellowish-brown to dull slaty-brown, a dark chocolate color being the prevalent hue. The character of the hair calls for no special remark, as it is so uniformly of the ordinary negro type. The stature ranges from an average of about 1.640 meters (5 feet 4½ inches) to about 1.715 meters (5 feet 7½ inches). Uniformity rather than diversity of head-form would seem to be the great characteristic of the African black races, but a broad-headed element makes itself felt in the population of the forest zone and of some of the upper waters of the Nile Valley. It appears that the broadening of the head is due to mixture with the brachycephalic Negrillo stock, for, whereas the dolichocephals are mainly of tall stature, some of the brachycephals, especially the Aduma of the Ogowe, with a cephalic index of 80.8, are quite short, 1.594 meters (5 feet 2¾ inches). The character of the nose is often very useful in discriminating between races in a mixed population, but it has not yet been sufficiently studied in Africa, where it will probably prove of considerable value, especially in the determination of amount of Hamitic or Semitic blood. The results already obtained in Uganda are most promising. Steatopypy is not notable among men; fatty deposits are well developed among women, but nothing approaching the extent characteristic of the Hottentots and Bushmen.

The test of a scientific theory lies in the number of facts which it groups into a connected whole; it ought besides to be fruitful in pointing the way to the discovery and co-ordination of new and previously unsuspected facts. Thus a good theory is in effect a cyclopædia of knowledge, susceptible of indefinite extension by the addition of supplementary volumes.