The patent office has recently recognized this principle of using hydrostatic pressure on a concave face to add stability to dams, etc. So far as the writer knows, this is the first recorded recognition of the hydrostatic principle involved. He does know, however, of a mining engineer out West who once built a small concrete dam wrong side to, and with very good results.

The modern inside buttressed reinforced concrete retaining wall employs a similar idea, but the earth pressures are not hydrostatic. In the earthen dam with masonry core wall, the hydrostatic pressure against the core is of course greatly modified (but nobody knows how much) by the presence of the earth fill on the water side. Its design is eminently a matter of guess work.

In conclusion, my contention is that a factor of one against sliding is not enough, and that we should turn the hydrostatic force to our assistance, instead of working entirely against it. We must have weight to secure stability, and there is nothing for that purpose quite so cheap as the water itself which we are undertaking to confine.

If the above observations on dam stability of various new and old sections provoke spirited discussion of the ideas involved, the writer believes that a service will have been rendered the engineering profession.

MUNICIPAL GAS PLANT EXPERIENCES.*

By C. E. Moore, C.E., Santa Clara, Cal.

The town of Santa Clara has one of the two municipal gas plants on the Pacific Coast, so far as known to the writer. There is nothing remarkable about this plant except the fact of its being owned and managed by the municipality. The writer has for several years been acting as consulting engineer for the town, and as such had charge of the construction of the water and electric plants which preceded the gas plant. When gas was taken up it naturally followed that the same arrangement was carried into that. Therefore it will be understood that the engineer as well as the town council had much of the gas business to learn, and that the writer of this does not assume to be an expert in gas matters. However, having been identified with the enterprise since its establishment, and continuing at present to be in touch with it, and since the plant occupies rather a unique position, it has seemed that a brief account of its career may be of interest.

The account will naturally fall somewhat into the lines of a discussion of municipal ownership, but this will not be with the object of establishing any extreme views, but rather with the idea of drawing such inferences as are possible from our experience. Regarding the broader question of general municipal ownership, the writer has come in contact with it in many other places and inevitably his views are somewhat colored by the sum total of all this experience, but the effort will be here to confine deductions as strictly as possible to those following from this case.

To make the situation clear, it will be necessary to first state in a brief way the cause which led up to this particular municipal ownership. Twelve years ago the town of Santa Clara took up the ownership of water supply. For this there were several powerful reasons, the chief one, perhaps, being the necessity for better fire protection. The plant was successful from the start.

There was also a desire for a more extended system of street lighting, and it seemed advisable to take that up in connection with the water plant. This plant was installed ten years ago. It also was satisfactory, and the people came to have considerable pride in the plants. Every town, like an individual, likes to have something to talk about, and the municipal plants came to be the thing to talk about in Santa Clara. The matter now passed beyond the case of necessity, and the later movements along this line have been largely the result of the impetus of the idea. Municipal ownership became a specialty. Commercial electric lighting was taken up by buying the property of the electric lighting company, remodeling and extending the system and combining it with the street lighting.

Current for this purpose was formerly generated by the town, but for several years past has been bought from the San Jose Light & Power Company, and it is supplied by the Standard long-distance transmission lines.

Gas has been supplied by the San Jose Gas Company (later the Light & Power Company), for many years, by a pipe line from their works. The condition of the town has been such that there had been little encouragement for the company to extend their lines. There had been no special effort to push the business, and the consumption was only 10,000 feet per day. However, with the coming of renewed life to the town there began to be felt a desire for more extended service. Chiefly the development of the gas plant may be considered as due to the idea which had taken root. There was no particular dissatisfaction with the company, and the movement was entirely devoid of enmity to it. Accordingly all the property of the company in the town was purchased at a valuation made by an expert agreed upon by both parties. The transaction was amicable and satisfactory throughout.

There has since been considerable consumption (chiefly for fuel purposes), and the output at present is 35,000 per day. The price of gas was at first fixed at $1.75 per thousand, that being the price charged by the gas company. Later for service in San Jose the company made the rate $1.50, but no reduction was then made by the town. Still later the company reduced the rate to $1.25, when the town followed with a reduction to $1.50. That is to say, the town has in the matter of rates made no reduction until virtually forced to do so by the company. Of course there is no direct competition between the two, but inasmuch as they serve adjoining territory, it is in practice difficult to maintain much higher rate in one than in the other. It will perhaps be apparent from the foregoing that an attempt has been made to manage the plant on business principles, and not to be carried away by any popular idea that something could be got for nothing.

About 10,000 feet of pipe was taken over from the company. Since that time there has been laid about 50,000 feet.

It has been necessary to do the work largely with unskilled labor. At the beginning the work done in remodeling the distribution system was from necessity advertised. The contractor who took the work was not accustomed to laying the pipe. The blocks in many cases have very little fall, barely enough for surface drainage. Under these circumstances the writer put in force a system of laying to grades previously established by levels, and this system has been followed for extensions. This is done so simply, with so little trouble, and with such good results from entirely unskilled labor in grading the trench, that it would seem good policy for any company working in a flat country to follow the same system. In the old pipes, laid in the old way, with a spirit level, there have been frequent stops and stoppages. In the new mains there have not been any at all. The number of drips is by this system kept small, and these are located at convenitent points. It may be that some gas

* A paper before the California Gas Association.