naturally anxious that the works shall meet the requirements at the minimum expense for operation, additions and renewals.

"It may be assumed, therefore, as an axiomatic statement, that for the good of the commonwealth, the municipalities and private owners, any procedure which will accomplish the above conditions is worthy of careful study and adoption."

EXPLOSIVES.

Nitro-glycerine is a limpid oil formed by the action of a mixture of nitric and sulphuric acid upon ordinary glycerine. This chemical action is a violent one unless carefully controlled. After it has taken place, the nitro-glycerine is washed repeatedly to remove any trace of acid that might remain. The presence of acid is dangerous in the finished explosive because it may produce a chemical action of disastrous results. For practical use, the liquid nitro-glycerine is so sensitive to percussion and friction that it is dangerous to transport it or attempt to employ it alone. However, when nitro-glycerine was first introduced for driving the Hoosac tunnel in Massachusetts, and for springing oil-wells in Pennsylvania, it was used alone, being carried in copper cans and loaded in tin tubes. In the oil-well region, men made an occupation of driving a horse and light wagon through the country for carrying the pure nitro-glycerine to the consumers. Many accidents were reported, and a carrier's position was scarcely to be envied.

Later it was learned to mix the nitro-glycerine with a quantity of kieselguhr, an infusorial earth composed of the silicious skeletons of minute diatoms, and therefore called diatomaceous earth. The nitro-glycerine is absorbed by the earth, which is itself inert and simply forms a plastic mass that can be more safely handled than the nitro-glycerine. Another advance came when it was found that nitro-cellulose, or gun-cotton, could be dissolved in the nitro-glycerine to form a nearly uniform jelly. This mixture constitutes blasting gelatine. The gun-cotton is made by the action upon cotton fibres of the same acids as are used in the manufacture of nitro-glycerine, great care being taken to wash away all trace of excess acid. When gun-cotton, or nitro-cellulose, is incorporated with the nitro-glycerine, it shares in the explosion, instead of acting as an inert base like kieselguhr. Thus additional power is gained. Blasting gelatine, then, is a mixture of two complex compounds, which fact increases the possibility of chemical change with consequent deterioration and danger. Blasting gelatine contains 92% nitro-glycerine and 8% nitro-cellulose. There are, also, various intermediate mixtures of nitro-glycerine and nitro-cellulose with a proportion of wood meal and potassium nitrate, the object being to produce effects intermediate between straight dynamite and blasting gelatine. When such a complex mixture was attempted, it was at first difficult for any mechanical method to render a perfectly homogeneous mass, but later methods of manufacture have improved this.

The initial pressure of the different explosives when detonated in their own volume are as follows: Straight dynamite (nitro-glycerine mixed with an inert base) 80 tons per square inch; blasting gelatine, 113 tons; gun-cotton, 71 tons; black powder, 21 tons. It is evident that blasting gelatine is the most powerful. Likewise it has the highest rate of detonation, 25,262 ft. per second, as against 22,368 for straight dynamite and 984 for black powder.

CONSTRUCTION COSTS OF CERTAIN RAPID SAND FILTER PLANTS.

In reporting recently on a new water supply for Sacramento, Cal., the engineers, Messrs. Hyde, Wilhelm and Miller, presented a tabulation to permit a comparison between the estimated cost of the proposed purification works outlined in their report and the cost of similar structures of the same character built elsewhere in the United States. The comparisons, of course, are rough, since no two plants have identical conditions to meet and therefore are not exactly alike. The figures, however, are of interest as showing the general investment requirements in plants of this character. In the table that follows the cost figures are given per 1,000,000 gallons nominal daily capacity of filters, and are supposed to include coagulation basins, filters, head and filter houses and filtered water basins:—

Name of place.	Nominal capacity of filters 1,000,000 gallons per day.	Capacity of coagulant basins 1,000,000 gallons.	Capacity of filtered water basins 1,000,000 gallons.	Construction cost per 1,000,000 gallons nominal daily capacity.
1. New York (proposed)	320	88	365	$16,100
2. Baltimore, Md.	128	16	17.8	10,900
3. Cincinnati, O.	112	22.5	19.5	11,400
4. New Orleans, La. ..	40	42.2	15.4	30,200
5. Minneapolis, Minn. .	39	5.6	50	.....
6. Toledo, O.	39	10	26	14,500
7. Little Falls, N.J. ...	32	.7	3.5	15,000
8. Columbus, O.	30	15	10	15,200
9. Trenton, N.J.	30	3.8	1.2	12,000
10. New Milford, N.J. .	24	11.5	2.0	11,000
11. Grand Rapids, Mich.	16	2.6	2.8	16,300
12. Niagara Falls, N.Y..	16	2.0	0.5	16,000
13. Harrisburg, Pa.	15	0.33	0.62	10,300
14. Dallas, Texas	15	....	...	13,000
15. Evanston, Ill.	12	0.83	2.0	17,000
16. Flint, Mich.	8	1.25	2.0	18,000
17. Watertown, N.Y. ..	8	....	...	11,300
18. Lorain, O.	6	0.58	0.29	14,000
19. Steubenville, O.	6	....	...	22,000
20. Jackson, Miss.	4	....	...	17,000
Straight averages ..	45	14.3	32.4	$15,330
Weighted averages .	..	....	...	13,700
Sacramento proposed	30	11.0	5.0	$13,800

In the case of the Sacramento estimates land or low-lift pumping equipment are not included.

Authorities: Journal of the American Waterworks Association, 1914; (1) G. A. Johnson, p. 512; (2) Including low-lift pumping station, J. W. Armstrong, p. 497; (3) G. A. Johnson, p. 69; (4) Including very expensive foundations, etc., J. H. Gregory, p. 473; (5) Not available at this date; (6) J. H. Gregory, p. 472; (7) G. A. Johnson, p. 69; (8) Excluding softening works, G. A. Johnson, p. 511; (9) G. A. Johnson, p. 521; (10) G. A. Johnson, p. 69; (11) J. H. Gregory, p. 472; (12) C. B. Buerger, p. 492; (13) G. A. Johnson, p. 69; (14) G. A. Johnson, p. 69; (15) C. B. Buerger, p. 492; (16) C. B. Buerger, p. 492; (17) G. A. Johnson, p. 69; (18) G. A. Johnson, p. 69; (19) C. B. Buerger, p. 492; (20) C. B. Buerger, p. 492.

It is said that Boston's new drydock, which will be 1,200 feet long, will be the largest in North or South America.