an account of the diurnal variation of pressure, which is so important in the tropics. The only reference to this phenomenon is contained, incidentally, in an article on rules for handling the ship in hurricanes, given on the back of the chart for December.

The remaining space on the backs of the charts is utilised to the full. On several of them detailed information is given of the systems of storm signals used in the area covered by the charts. Others give particulars of the time-signal stations. Numerous fully illustrated articles give particulars of meteorological events of special interest, such as the Hong Kong typhoon of September 18, 1906, and other famous hurricanes. In addition, we have a number of monographs on all manner of subjects of interest to the sailor and the meteorologist. Among them we mention specially one on the prevalence of easterly winds to the south of latitude 50° S.

We congratulate the Seewarte on the completion of so important and arduous a piece of work, which is sure to prove of the utmost value both to sailors and students.

THE FILTRATION AND PURIFICATION OF WATER FOR PUBLIC SUPPLY.[1]

GREAT progress has been made in recent times in the appliances for purifying water. It is no longer necessary to go to distant uplands for a pure and palatable supply. By the methods of treating ordinary river water, carrying possibly hundreds of objectionable germs per c.c., drinking water is now being prepared from the lower reaches of the Thames and of many Continental rivers as wholesome as can be obtained from the mountains of Wales or of Scotland. So great has been the activity of scientific workers in this field that a new and complex branch of technology may be said to have come into existence.

With reference to sources of supply, water companies should not place too much reliance on the innocuousness of supplies drawn from country districts. Water-courses and reservoirs should be protected from the intrusion of harmful matters, and the adjacent ground should be fenced off and planted. Special precautions are needful for preventing the ingress of impurities to wells and bore-holes, and where pollution occurs the origin of the same may be detected by suitable experiments. Storage reservoirs are a useful adjunct to a purifying plant, even when not required for conserving the supply, and it has been proved by the researches of Dr. Houston that the bacteria of enteric practically all disappear from impounded water in two or three days. Still, as it appears that even here the survival of the fittest holds good, and that a few germs live on for weeks, water undertakers are not relieved from the duty of further treating the supply. Sedimentation proceeds more or less rapidly in stagnant reservoirs, but it has been found at the Paris installations that effective precipitation can be secured by running the water in channels, with frequent changes of direction. Thus space is economised.

Discussing the retention of bacteria in filter beds, the lecturer directed particular attention to the functions of the filtering skin. It appears that in the finishing filter at Bedford, which is fed by a sprinkler, no skin is formed at the surface, because the water does not rest there. It sinks at once into the sand, and at a depth of about an inch and a half a slimy growth is easily perceptible on the grains, and this possibly serves the same purpose as the network of algoid growths bedecking the open sand beds. There are five distinct ways in which the sand bed operates in eliminating impurities, but what is most important in the operation of these beds is the circumstance that, after cleaning, a considerable time must elapse before the purifying agencies come into effective action. Water managers should have the means of finding out when the effluent is pure, and in order to do this they must rely on bacteriological analyses. This is the method adopted on the Continent. Unfortunately, it is generally neglected here, and it is a matter of chance in too many cases whether there may or may not be dangerous germs passing through. Chemical analyses alone cannot reveal whether the filtrate is wholesome or not. The amount of nitrogen present as nitrate and nitrite is important enough, but analysts should not rely on this as the chief criterion for determining the purity of a sample.

[1] Abstract of a paper by Mr. John Don selected by the Council of the Institution of Mechanical Engineers for the first award of the "Water Arbitration Prize," 1908, and read before the Institution on January 15.

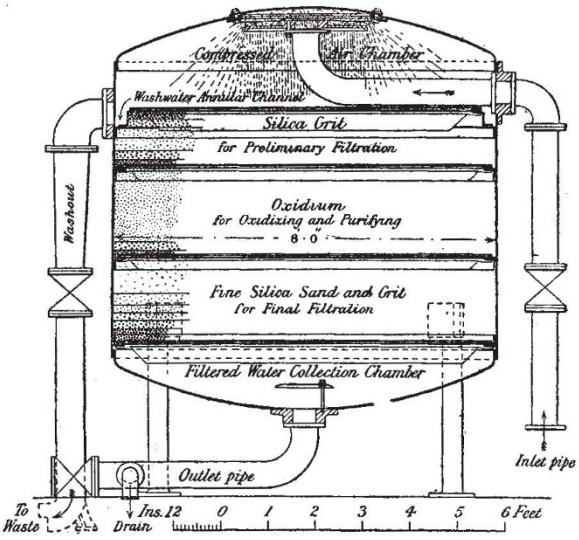

FIG. 1.—Compressed Air and Oxidising Waterworks Filter (Candy).

Recently many mechanical appliances have been brought into use for the purification of water, and among these the Jewell filter is largely used in America. A precipitate of sulphate of alumina forms an efficient skin within a short time after cleaning, and thus there is a great saving of time. The water also passes through the filtering layers forty times more quickly than it does in the open sand filter, but the effluent, subjected to every test, proves to be of a high degree of purity. In Britain, Mather and Platt's and Bell's filters are of similar construction, and

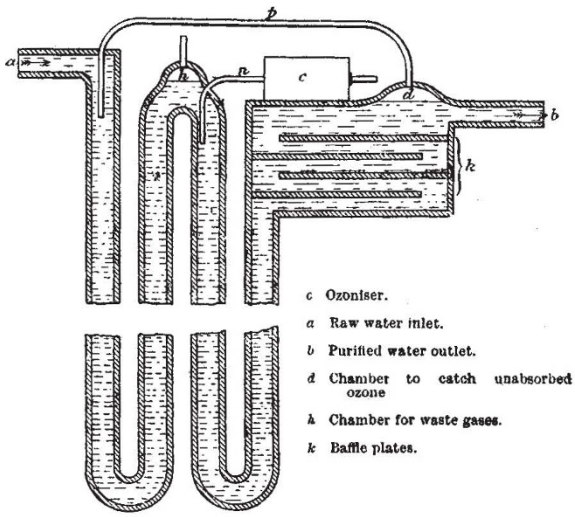

FIG. 2.—Sketch of Ozonising Apparatus (Howard-Bridge) Scale about $\frac{1}{8}$. Action of the Apparatus:—As the raw water passes down the pipe *a* it draws the unabsorbed ozone by way of the tube *p* from the chamber *d*. Freshly ozonised air is also drawn into the current from the ozoniser through the pipe *n*. After traversing the vertical pipes, the water is caused to pass round a series of baffle plates *k*, and finally flowing under the recess at *d* it reaches the outlet.

have like advantages. Very fine work is done by the Candy filter, which dispenses with precipitants, and owes its efficiency to oxidium, a substance with properties akin to those of spongy platinum. Cheapness in working is a feature of this installation (Fig. 1), and the effluent is certified by the highest authority to be excellent.

Great interest has been taken of late in the ozone purification processes, which are in operation at Wiesbaden, Nice, Philadelphia, and elsewhere. The chief difficulty in the meantime is to reduce the cost of working to something approaching the outlay for mechanical filtration by other means. Of the efficiency of ozone treatment there can be no question. The bacteria are practically eradicated. The filtrate is sparkling and palatable, even when the raw water is very bad. Progress has been made in reducing costs, and in particular the Howard-Bridge system effects a saving by collecting the unused ozone (see Fig. 2, *d*) and returning it to the incoming stream.

Many appliances are being tested at Paris for the purification of river water, and notable results are being obtained from the Anderson system. The precipitant in this case is iron oxide. So much as 3 grams per cubic metre is taken up by the raw water in traversing cylinders charged with scrap iron, and the oxide serves to precipitate fine silt and plankton, and finally to form a filtering *couche* on the sand beds (Fig. 3). It is here that the sedimentation by tortuous movements, and by conducting the flow over and under baffles, has been found to give such admirable results.

Another remarkable system which is doing good work in the *banlieue* of Paris is the Puech-Chabal. Here the raw water is first passed through the roughing filters, *dégrossisseurs*, so called, in which it leaves a large part of the suspended matters. The *dégrossisseurs* are composed of grits and pebbles graded from about walnut size to gravel in the last of the series. The rough filtration enables the finishing filter to continue in operation for a much longer period, and there is considerable saving of space and of working expenses.

A necessary adjunct to all filtering appliances is a regulator to control the speed of the flow. Filters in which precipitants are employed also require a regulator for adjusting the dosage to the amount of water passing, and various attempts have been made to perfect an appliance for this end. Variations in the state of the raw water have also to be considered.

In the course of distribution of the filtered water to consumers, impurities creep into the mains and service pipes, the chief being iron oxide and filaments of crenothrix, and in special cases lead and its compounds; but by suitable means all these can be eliminated, and without much outlay. On the whole, the application of scientific method and research to the technicalities of water purification have brought about many valuable improvements, and it may be expected that the future has much in store for the water engineer.

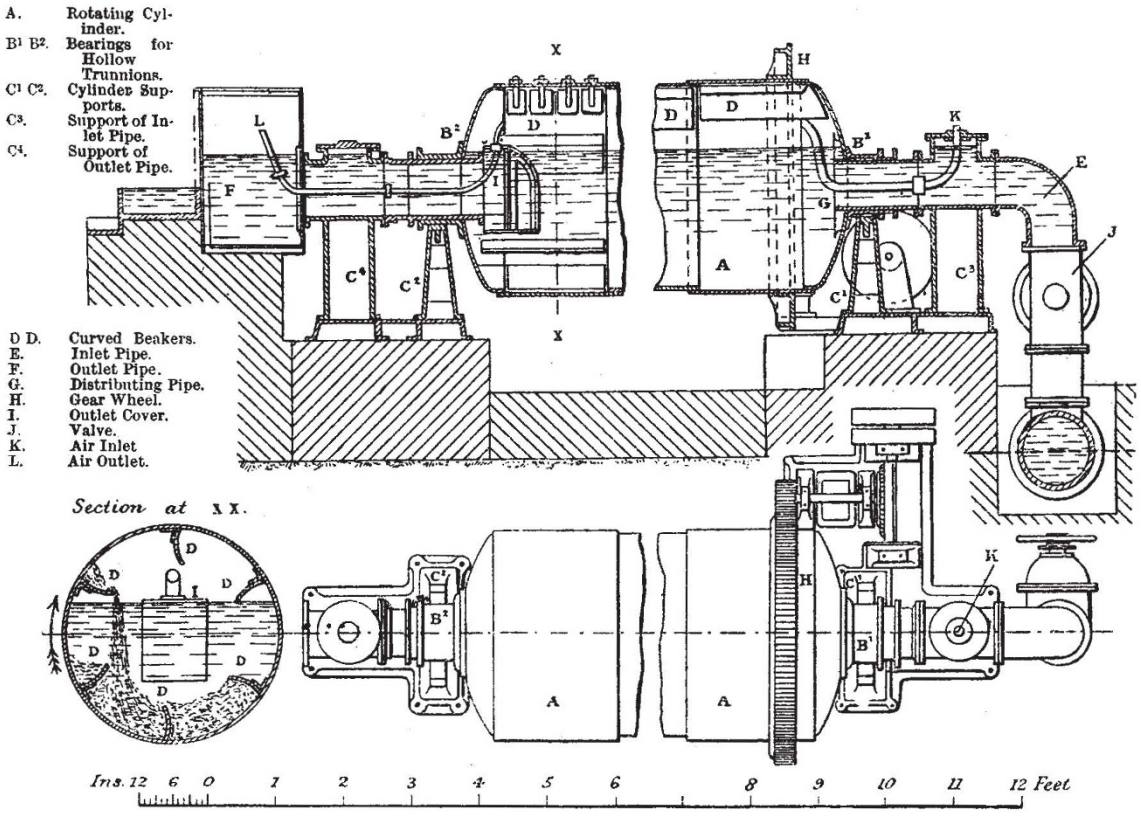

FIG. 3.—Rotating Cylinder containing fragments of Iron (Anderson).

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The following have been nominated to serve, for eight years from February 20, on the board of electors to the professorship mentioned before their names:—*Chemistry*, Prof. Wood; *Plumian*, Mr. Mollison; *Anatomy*, Dr. Langley; *Botany*, Prof. I. B. Balfour; *Geology*, Dr. A. S. Woodward; *Jacksonian*, Prof. Larmor; *Medicine* (*Downing*), Dr. Fletcher; *Mineralogy*, Dr. Marr; *Political Economy*, Dr. Marshall; *Zoology and Comparative Anatomy*, Mr. F. Darwin; *Experimental Physics*, Sir W. D. Niven; *Mechanism and Applied Sciences*, Dr. Forsyth; *Physiology*, Prof. Starling; *Surgery*, Dr. Gaskell; *Pathology*, Sir T. Clifford Allbutt; and *Agriculture* (*Drapers*), Prof. Biffen.