proposed is very briefly this: to lift the vessel by an ordinary lifting-dock, distributing and equalizing completely the weight of the vessel by a system of hydraulic presses before the weight is brought upon the carriage which is to transport it. This is all done under the water, as the vessel rises out of it, and in such a manner as to be perfectly safe and easy for the vessel. The weight is finally placed upon the carriage in such a way that there is no more weight upon one wheel, or upon one part of the carriage in its length or width, than upon another. The weight upon no wheel will be over eight or nine tons, although they will be tested to twenty tons when manufactured. The whole load is transferred to the wheels by means of powerful springs, which will also be tested to twenty tons, and none of which will have imposed upon them in practice a weight of over eight and a half or nine tons. These springs not only give a perfect cushion for the vessel and carriage while being transported, but also serve to take up any slight irregularities there may be in the track. The system of supports designed, and shown in the working model, gives an area of support under the vessel from fifty to seventy-five times as great as that in the best lifting-dock in the world; and, moreover, these supports completely adjust themselves to the model of the vessel in each case. As it has been said frequently by practical experts in designing and building docks, and handling vessels in them, the *desideratum* is to have a sufficient number of adjustable supports, and this has been sought for in the plans for the work as shown in the model.

The railway road-bed will be about 50 feet in width; the width between the outer rails, about 30 feet. There will be six of these rails, weighing from 100 to 125 pounds per lineal yard. All six rails will be connected by a long steel-plated tie, set into two feet of broken stone ballast or concrete, as the case may be. The locomotive power as designed is to consist of engines of from 75 to 100 tons, each of which will haul at least 3,000 tons on a grade of as much as 40 feet to the mile; so that two, or at the most three, such locomotives will haul the maximum load. The grades are very light. Much of the line of railway is practically level. The maximum gradient, of which there is only one length of about 12 miles, is one per cent, or 52.8 feet per mile. The change between grades will be made by the ordinary vertical curve, but a very flat one, — one that will change from a straight line two inches in 400 feet. The railway is practically straight, the minimum radius being 20 miles. The line as laid down on the isthmus has curves of from 20 to 53 miles radius. At five points on the line, in order to avoid heavy mountain cuttings or very high embankments, a change of direction will be made by floating turntables, — a simple and economical device in first cost and operation, on which the vessels will be turned about while resting on a cushion of water. The whole line has been very carefully surveyed, and is practically located. Careful examinations have been made to ascertain the character of the foundations, both for the road-bed and for the masonry structures. The result of these examinations shows that there is no bad or even questionable ground anywhere between the two termini. The accompanying map shows the topography of the country and the route of the railway, the river to be navigated and the harbors on the two sides.

It will be seen from the foregoing that the vessel, when lifted out of the water, is really water-borne on a system of columns of water under pressure, and that, in the position given by this hydraulic system, she is transported across the isthmus. It will also be seen and appreciated by every person who is accustomed to travel on the ocean, that the strain to the vessel by the methods proposed can never be so great as that which she must undergo every time she goes to sea. E. L. CORTHELL.

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## *THE WATER-SUPPLY OF BRESLAU.*

THE results of Hulwa's numerous examinations of the waters of Breslau made during the years 1876–81, and which, up to that time, had appeared only in fragmentary official reports hardly obtainable even by specialists, were brought together into a single paper on the occasion of the German health exhibition in 1882–83. This paper, recently published, is of great value to all interested in water-supply.

As far as the well-waters are concerned, the numerical results are given only in selections and averages, and are, indeed, mainly of local interest. The story is essentially the same as may be told of any compactly built city, especially of the older parts, where the same houses have been occupied for hundreds of years. Of a hundred and fifty wells examined, less than ten per cent furnished water really good enough to use, and only two or three water which was above all suspicion.

Since the year 1871, Breslau has enjoyed a supply of water from the river Oder. The works are situated above the city, and the water is subjected to a thorough filtration through beds of sand and gravel.

*Beiträge zur schwemmkanalisation und wasserversorgung der stadt Breslau.* Von Dr. FRANZ HULWA. (Ergänzungshefte zum Centralblatt für allg. gesundheitspflege, I. ii. Bonn, 1884.)

From numerous examinations of the Oder water before and after filtration, Hulwa concludes, that, with the exception of occasional disturbances at times of high water, the impurities of the river-water are so far removed by the process of filtration as to furnish a drinking-water almost above suspicion. In order to remove the fine particles of clay which give to the water, in times of flood, an opalescent appearance which filtration will not remove, Hulwa recommended treating the water, before filtration, with alum in the proportion of from one to ten parts of alum to a hundred thousand parts of water (by weight), according to the degree of turbidity of the water. This use of alum, which is becoming very common on a smaller scale, has not been adopted at Breslau. At the time of Hulwa's examinations, the sewage of Breslau all ran into the Oder opposite and below the city, in anticipation of the completion of the sewage-farms now in use. The study of the effect of this discharge upon the stream is perhaps the most interesting part of the document. Although the volume of sewage is, on the average, only $\frac{1}{148}$ of the volume of river-water, and in times of flood only $\frac{1}{637}$, the river opposite and just below the city gives abundant evidence of pollution, — pollution which becomes less and less marked as the stream flows. Thirty-two kilometres below the city neither chemical nor microscopical examination was able to show any evidence that the water was not quite as suitable for water-supply (after filtration) as the water from the same stream above the city at the present pumping-works. Hulwa is of the opinion that the natural purifying agencies are quite sufficient to take care of the amount of sewage which was then discharged into the river, and that, *a fortiori*, the effluent from the sewage-farms may be safely disposed of in that way. He is careful, however, to admit the possibility of overloading this or any other stream, and of calling upon the natural agencies to do more than they are capable of doing. He thus agrees with most experts who have studied this matter, that the discharge of sewage or other polluting matters into a stream is not to be decided in all cases by an absolute prohibition, but that the size of the stream, the proportion of polluting matters, and other circumstances, must be taken into consideration.

## *THE CONSUMPTIVE PERIOD.*

HIPPOCRATES declared that consumption gathers the greatest number of victims between the ages of 25 and 35 years, and the same observation holds true to-day.

As a first and natural deduction from this fact, the opinion has obtained, that men are more susceptible to consumption between 20 and 35, and that, passing this period, they gradually acquire an immunity from the disease.

A more careful study of the statistics, however, reveals a fallacy in this reasoning. Hitherto it has been the custom to reckon the mortality of each period of life as a fraction of the entire mortality of all ages. By this method it is shown merely that during certain decades of life more individuals die of phthisis than during other decades. This amounts, however, simply to saying that within these periods of life a greater number of people are living. The total number of deaths from any disease, at any given age, must be greater or less, according to the number of people existing at that age; and a large proportion of mankind are from 20 to 35 years old. In order, therefore, to determine the individual risk of consumption at any specified time of life, it is necessary to know the whole number of persons living at that age, and then compute the percentage of them who die of consumption.

Figuring in this manner, Würzburg estimated the annual percentage of mortality from phthisis at different periods of life in Prussia, and he found the following table for every 10,000 persons living at each period: —

| AGE. | MEN. | WOMEN. | AGE. | MEN. | WOMEN. |
|---|---|---|---|---|---|
| 0-1 | 24.95 | 21.92 | 25-30 | 40.04 | 33.58 |
| 1-2 | 20.27 | 20.55 | 30-40 | 44.25 | 38.12 |
| 2-3 | 12.09 | 12.94 | 40-50 | 57.10 | 40.10 |
| 3-5 | 6.49 | 7.18 | 50-60 | 82.38 | 54.48 |
| 5-10 | 4.07 | 5.26 | 60-70 | 112.25 | 76.09 |
| 10-15 | 4.35 | 7.38 | 70-80 | 75.23 | 50.03 |
| 15-20 | 17.87 | 18.87 | Over 80 | 31.71 | 21.01 |
| 20-25 | 34.77 | 25.93 | | | |

From this table it is seen that a large phthisis mortality prevails during the first year of life; thence it descends to a minimum between 5 and 15 years of age; from this point it increases with rapid strides, until, between 60 and 70 years, it reaches the high figures of 112.25 per every 10,000 living beings of that age: in other words, these figures mean that a man's liability to death by consumption increases from puberty till 70 years of age.

The companion column of the phthisis mortality of women shows that they are more frequent victims during childhood, but during the third decade and thereafter their relative liability is diminished.

These figures of Würzburg are confirmed in their main features by the investigations of Lehmann in Copenhagen, and of Schmitz in Bonn. Lehmann also extended his query to the relative duration of phthisis at different ages, and found that under 20 years of age more than 75% of phthisis patients die within a year. This rapid progress of the disease diminishes with increasing years until at least one-half of the cases terminating after 55 years of age present a record from three to many years' duration. It follows from this that a portion of the increased phthisis mortality of advanced years is due to cases which have lasted over from the earlier decades.

*Die schwindsuchtssterblichkeit in den dänischen städten im verhältniss zu der lebenden bevölkerung in den verschiedenen altersklassen und geschlechtern.* Von Dr. JULIUS LEHMANN. (Ergänzungshefte zum Centralbl. allg. gesundh., 18 p., pl. 8°. Bonn, 1884.)

*Ueber den einfluss des geschlectes und des lebensalters auf die schwindsuchtssterblichkeit.* Von Dr. JACOB SCHMITZ. Bonn, 1884.