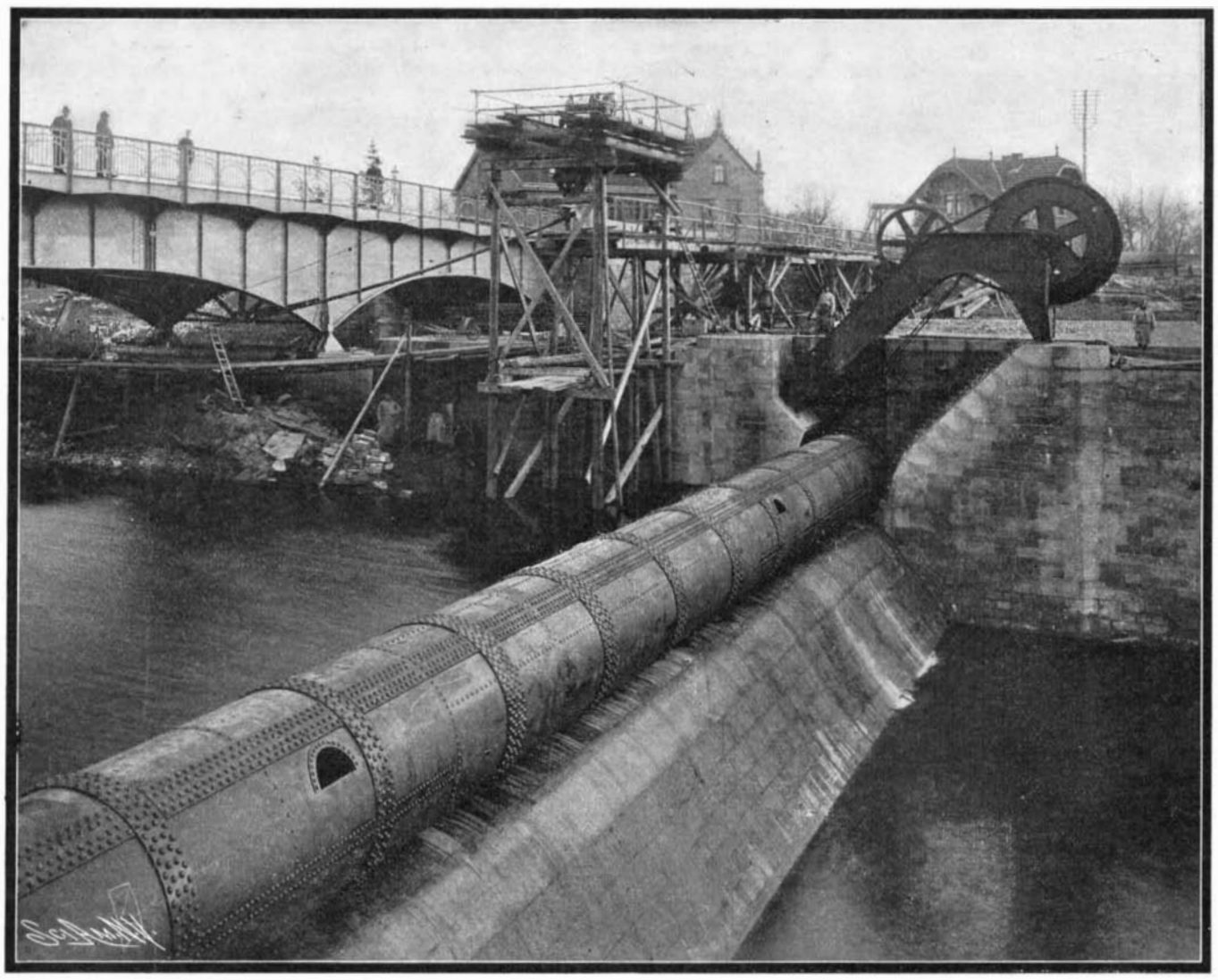
THE CYLINDRICAL MOVABLE DAMS AT SCHWEINFURT, GERMANY.

BY A. STEENS.

The city of Schweinfurt, on the river Main, can boast of a type of dam which must surely present to engineers features of construction and operation that are undoubtedly novel. Two dams have been constructed, both cylindrical in form and arranged to be lifted bodily above the water. They were built partly to render the stream above them navigable and partly to divert the water for power utilization. As the river is one subject to heavy floods, a type of dam that would permit a very rapid discharge of the freshet water had to be designed, and the cylindrical form, arranged to roll upward above the flood level, was adopted. To demonstrate fully its practicability, the first dam was constructed across a secondary branch of the river at Schweinfurt, with a total length of 59 feet and a diameter of 13.58 feet. The satisfactory operation of this led to the construction, across the main branch, of the dam shown in the engraving. This is 115 feet long and 6.56 feet in diameter. Briefly, it is a hollow cylinder of sheet steel, on each end of which is fixed a toothed wheel which meshes with an inclined rack built in each abutment.

The dam as a whole consists first of a sill upon which the cylinder in its lowermost position rests. This cylinder is 6.56 feet in diameter and extends from shore to shore, a distance of about 35 meters (116 feet). When lowered, this enormous cylinder effects a rise in the river of 6½ feet.

Among the conditions first established, and under which the dam was to be constructed, we find a section declaring that there were to be erected in the stream no piers or other supports that might interfere with the free movement of the ice in the spring. Not even temporary supports that could be removed upon the general breaking up of the ice or even at the close of navigation, were allowed, simply because in order to insure their stability, foundations, or the like, would have been necessary to sustain them, and these would become permanent obstructions likely to be damaged by freshets.



CYLINDRICAL DAM ACROSS THE RIVER MAIN, SCHWEINFURT, GERMANY.

The first dam designed differed materially from the second in the method of raising the cylinder. It was designed to be hauled upward from its lowest position by cables on each end. In the second, later dam, the driving mechanism is all located at one end. Our illustrations clearly show this. When the downstream level of the water rises, the pressure would have a tendency to lift the gate. The cylinder itself is watertight, to prevent the freezing of the water which might otherwise collect in it. Still an interior pipe is provided in the smaller dam open at each end of the dam, but shielded by its interior location from the cold. This pipe is filled with water to secure greater stability. The racks in the case of the second larger dam are placed at an angle of 45 degrees. The cylinder, in its lowest position, rests on a sill of oak and the tightness of the dam at each end is provided for by a band of leather around the periphery. The pressure of the water holds the leather against the sill. The weight of the movable cylinder of the first dam is 158,400 pounds. To bring it above the level of the highest flood it is necessary to raise it a distance of 16.4 feet. It is arranged for hand working, with six men on each side. Assuming that each man can perform work equivalent to 57.75 foot-pounds per second (8 kilogrammeters), and allowing for an efficiency of 35 per cent in the hoisting mechanism, the time required to lift the cylinder the given distance is determined as follows, remembering that twelve men are engaged all told: $158,400 \times 16.4 \div (57.75 \times 12 \times 0.35) = 10,710$ (seconds), or 3 hours. To lift the cylinder above ordinary freshets, only about half this time is consumed.

The larger dam was begun in May, 1903, and was put in service in December. Its rollway length is 114.8 feet, but its actual length is 121.3 feet, 3.28 feet of each end extending into the masonry of the abutment. The steel is 1.1 inches thick, built in sections 9.84 feet long with a single longitudinal joint. The transverse joints are butt joints, each section being reinforced in the middle by a brace contributing to its rigidity. This cylinder is watertight except in two chambers in the upper part at each extremity. When the downstream water level does not rise more than 3 feet or so above the bottom of the dam the weight of the cylinder is sufficient to counterbalance the pressure; but when the water level rises above this limit, the water enters the two chambers, giving the cylinder added stability. The racks in the case of this dam are inclined at an angle of 45 degrees only along the upper part. Toward the bottom, the pitch is increased, attaining 4 to 1. This increase in pitch is made on a radius of 10.46 feet. The steepness of the bottom part of these racks gives the dam better bearing against water pressure tending to raise it. The weight of the cylinder is 193,600 pounds.

The operating apparatus includes two steel cables of 1.8 inches diameter, each formed of six strands. The two cables are rolled on drums, and to raise the cylinder above high water, that is to say, 13.12 feet, an electric motor of 18 horse-power is employed, and the operation takes less than a quarter of an hour. The mechanism is also provided with four cranks, by means of which the dam can be lifted by hand. The cranks drive a worm gearing through chains, and this, in turn, meshes with a train of gears and a chain to the hoisting drums.

A special commission selected by the French naval authorities, after prolonged investigations and experiments with the turret guns of the battleship "Henri IV.," has condemned the existing arrangement of the turrets, owing to the fact that the firing of these particular guns constitutes a serious menace during discharge to the crew attending to the guns in the lower turret beneath them. In one experiment four sheep were tied to the lower turret in the places that would be occupied by gunners in action. Ten rounds were then fired from the upper turret guns, and when the animals were subsequently examined, three were found dead as the result of the concussion, while the fourth had broken loose and sought refuge in the captain's cabin. Even allowing for the fact that men are able to resist shock to a far greater degree than sheep, such a result proved that the upper turret guns would exercise a dangerous, if not entirely fatal effect, upon the gunners in the turret immediately below.

British Ship "Discovery" Back After Two Years in the Ice.

The steamer "Discovery," which conveyed a British exploring expedition to the Antarctic Ocean, sailing from London in July, 1901, arrived at Lyttleton on April 1 after having been in the ice for two years.

The "Discovery" was accompanied by the relief ships "Morning" and "Terra Nova." The relievers found the "Discovery" on February 14. The crew is well.

Among the results of the expedition is the discovery of a new route to the westward. Parties from the vessel climbed to the summit of Victoria Land, which they describe as a vast plain 9,000 feet above the sea level. Their observations show that the great ice barrier is stationary. The expedition obtained much new scientific knowledge.

The Daily Mail's correspondent at Christchurch, New Zealand, says that in an interview Capt. Scott, the commander of the "Discovery," gave an interesting narrative of the experiences of the expedition, but disclosed nothing of a remarkable nature. In instancing the severity of the Antarctic weather he said that records of 100 degrees of frost were obtained in May, 1902.

Detailed information was obtained of the exact point of the junction of the barrier ice and the land. A depot was established there, and members of the expedition who visited it twelve months later found that it had moved a quarter of a mile to the northward. Capt. Scott described the glacier valley in South Victoria Land as presenting magnificent scenery. Some plant remains were discovered.

The relieving parties arrived at the edge of the ice on January 1, but although the ice began to weaken soon after, it was not until February 14, with the help of dynamite, that the "Discovery" reached open water and joined them. While subsequently traversing the coast line it was ascertained that Balleny Islands and Russell Islands were identical.

The islands reported to be in the meridian of about 156 proved to be non-existent. A shortage of coal compelled the expedition to return earlier than was intended. The "Discovery" reached Auckland Island on March 15 with only ten tons of coal in her bunkers.

Capt. Scott describes the results of the expedition as eminently satisfactory. Everybody is in perfect health.

The Recent Earthquake at Lima.*

The earthquake occurred on the 4th of March, at 5.20 A. M. If it had lasted a few seconds more it would have completely ruined the city. It was a terrible earthquake, lasting fifty seconds, and it produced a general panic. Three or four lives were lost, and a great many wounded, and it is estimated that in Lima the loss amounted to one million *soles* (about $500,000).

Aged persons cannot recollect having felt a similar commotion, and it is a wonder it has not caused a great deal of damage. It was felt with greater intensity at Chorrillos, in which the walls of summer residences have been rent almost generally, and some have become uninhabitable. In Callao, too, a great number of houses and public buildings are in bad condition.

In Lima the churches suffered considerably, and many private houses were rent, the corners being split apart. Public edifices did not suffer. The citizens of Lima are anticipating a worse shock for September.

* Translation of a private letter from Lima, Peru, under date of March 14, 1904, to Mrs. A. F. Bandelier.