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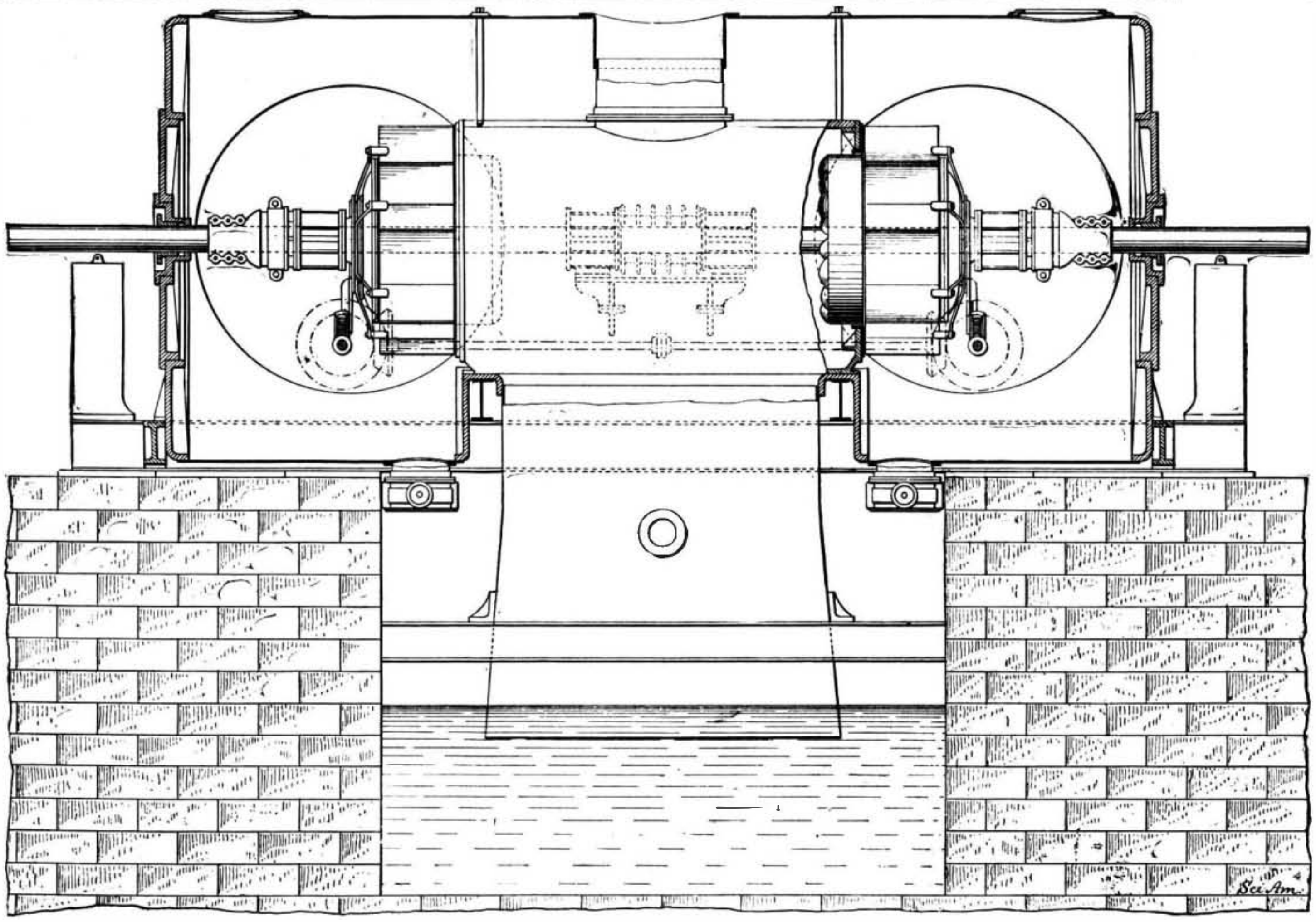
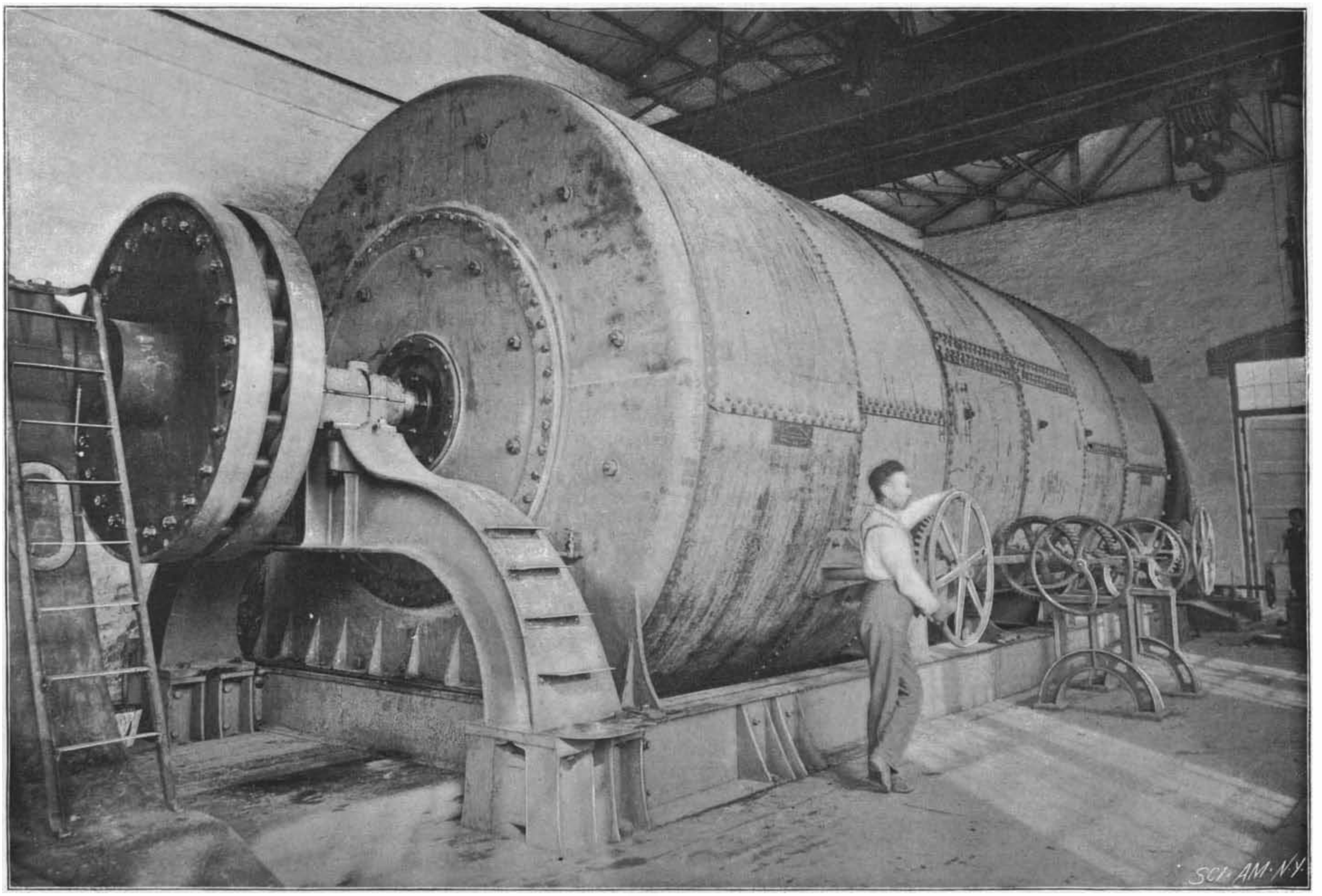
A NOTABLE PAIR OF HORIZONTAL TURBINES.

What is probably the largest and most powerful pair of horizontal turbines, for the head of water under which they will operate, that has ever been built, has recently been erected by the Dayton Globe Iron Works Company, for the Boston and Montana Consolidated Copper and Silver Mining Company, of Great Falls, Montana.

These turbines, of which the leading details are shown in the accompanying illustrations, are of what is known as the new American pattern, and they differ from other machines of the same design merely in the great size and mass of their parts. The two turbines, which are each 57 inches in diameter, are placed horizontally at the ends of a cast iron draught chest, and discharge centrally through a plate iron draught tube 10 feet in diameter. The turbines and the draught chest are inclosed within a huge cylindrical flume, 14 feet 4 inches in diameter and 32 feet 6 inches long. The body of the flume is built of ½ inch tank (Continued on page 198.)



VERTICAL SECTION SHOWING FLUME, DRAUGHT CHEST AND 57 INCH TURBINES.



THE STEEL FLUME, 14 FEET 4 INCHES DIAMETER, 32 FEET 6 INCHES LENGTH.

POWERFUL HORIZONTAL TURBINES AT GREAT FALLS, MONTANA.

A NOTABLE PAIR OF HORIZONTAL TURBINES.

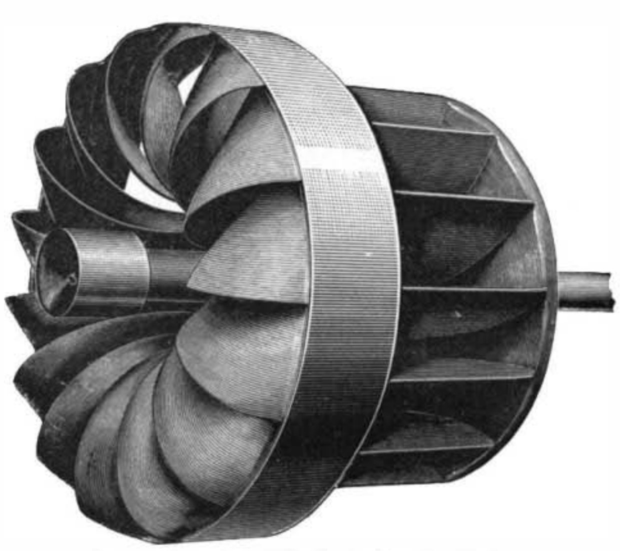
(Continued from first page.)

steel and the ends are closed by massive cast iron covers, the turbines and draught chest being thus entirely inclosed, as shown in the front page engraving. The great weight of the flume, turbines and contained water is carried by two pairs of double I-beams, 20 inches deep and 38 feet long, which extend the full length of the flume, a pair on each side. The load is transferred to these by bracket extensions of the end covers and by transverse I-beams on each side of the central draught tube.

The shaft in the wheels, which is made in two sections, is 10 inches diameter, 42 feet 2 inches long, and its weight is over five tons. The massive clamp coupling which connects these two sections of shafting in the center of the draught chest, shown in dotted lines in the accompanying diagram, weighs considerably more than a ton. Just outside the flume at each end are stands weighing 8,000 pounds, which carry the journal boxes for this shaft. The two turbines with their complete outfits weigh approximately 250,000 pounds.

The wheel case (see accompanying illustration), which contains a number of graduated chutes, and consists of an upper and lower plate connected by fenders or gate guards, is cast in one piece. The chutes are hinged at a point near the inside of the case, and as the gates are opened or closed the chutes move with them. This provides an evenly distributed flow of the water around the wheel, which is delivered in gradually expanding or contracting veins. The guards behind the gates relieve them from hydrostatic pressure, and the gates are easily opened or closed by means of a revolving ring and a series of levers which are operated by a segment and pinion. The hand wheels for controlling these gates are located at the front of the large flume. The case is closed by a dome or crown plate, which carries the ring, levers and segment for operating the gates.

The wheel for this type of turbine was formerly made with steel buckets which were set in the mould and the rims cast to them. It was found, however, that wheels so constructed were deficient in strength for high heads. Sooner or later, the buckets became detached from the rims. The new method is to make the whole piece in one solid casting, formed by dry sand cores, and this system has been adopted in building the present 57 inch turbines. After the wheel was bored and fitted to its shaft, it was placed in the lathe, the rims were turned off, the shaft serving as the axis, and the whole piece was accurately balanced.



THE WHEEL REMOVED FROM CASE.

VERTICAL SECTION OF CASE.

These turbines operate two 1000 horse power Westinghouse electric generators, coupled directly to each end of the shaft. They run at from 144 to 160 revolutions per minute, and the current is used for electrolytic refining. The varying speed of revolution is necessary in order to increase or diminish the current as conditions may require.

The power of these wheels is also utilized for driving an arc light dynamo and the two 50 horse power exciters for the large generators, the power being transmitted from wheel shaft to dynamo by means of a 20 inch double leather belt; and there still remains a surplus power in the wheels which is not being utilized at present.

It is estimated that if a pair of these 57 inch new American turbines of this design and capacity were placed in operation on the new water power at Niagara Falls under 140 feet head, they would develop 18,494 horse power, and would require a shaft 15 inches diameter to safely transmit the power, estimating the power to be taken off at each end of the shaft, as is the case at Great Falls, Montana.

Before shipping these wheels to Great Falls, the builders had them tested at the testing flume of the Holyoke Water Power Company, Holyoke, Mass., and both the right hand and left hand turbine showed an average efficiency from three-quarters to whole gate inclusive of 81¼ per cent, which is an excellent performance. In consequence of the turbines being required to stand the great strain due to 50 feet head, the buckets were necessarily made very thick. Had they been made of the ordinary thickness, the percentage of useful effect would have been increased to at least 83½ to 84 per cent. This was the judgment of a number of engineers who made an examination of the turbines. They were tested with the ordinary cylinder below the wheel, as all tests of this make of turbines have been made. Flaring draught tubes or diffusers would have increased the percentage. The wheels were guaranteed to show an average efficiency of 80 per cent from three-quarters to whole gate and develop 2,800 horse power under 40 feet head, and they exceeded the guarantee both in horse power and efficiency.

Information About Alaska.

The continued interest manifested by the public in everything connected with our great territory at the north, since the commencement of the gold mining fever on the Klondike, has led to the recent publication of a handbook on Alaska, by the Bureau of American Republics, at Washington, D. C. The book treats of the geography and topography of the country, its climate and agricultural resources, its forests and fisheries, and its mineral resources. The picture drawn is not a very agreeable one for the intending prospector. It is said that the country outside of the mountains is a great expanse of bog, and large and small lakes with thousands of channels between them, and it is claimed that the Yukon discharges a volume of water one-third greater than that which empties from the mouth of the Mississippi. Near its mouth one is most struck with "the mournful, desolate appearance of the country, which is scarcely above the level of the tide, and covered with a monotonous cloak of scrubby willows and rank grasses. For hundreds of miles up, through an intricate labyrinth of tides, blind and misleading channels, sloughs and swamps, there is to be seen the same dreary, desolate region. It is watered here, there and everywhere, and impresses one with the idea of a vast inland sea as far up as 700 or 800 miles, where there are many points at which the river spans a breadth of twenty miles from shore to shore. It seems as though the land drained by the river on either side were a sponge into which all rain and moisture from the heavens and melting snow were absorbed, never finding their release by evaporation, but conserved to drain, by myriads of rivulets, the great watery highway of the Yukon, which is formed by the junction of the Lewis and the Pelly Rivers. During the brief summer the whole population flocks to the river, attracted by the myriads of salmon, the banks being lined with camps of fishermen, who build their basket traps far out into the eddies and bends of the stream, and lay up their store of dried fish for the long Arctic winter. To fully appreciate how much moisture in the form of fog and rain settles upon the land, one can do no better than take a walk through one of the narrow valleys to the summit of a lofty peak. Stepping upon what appeared in the distance to be a firm greensward, the venturesome tourist will sink waist deep in a sinking, tremulous bog."

As to the climate, a series of six months' observations on the Yukon, not far from the present gold discoveries, showed that the daily mean temperature, in 1889-90, fell and remained below the freezing point from November 4 to April 21, the lowest temperatures being 59° F. below zero in January and 55° F. below in February. Snow fell about one-third of the days in winter, and snowstorms of great severity may occur in any month from September to May. In June the sun rises at about 3 A. M. and sets at 10:30 P. M., giving more than twenty hours of daylight, and diffuse twilight the remainder of the time. The mean summer temperature rises to between 60° and 70° F., and in the vast network of slough and swamp, indescribably numerous clouds of mosquitoes are bred, which cause the greatest misery and annoyance to the explorer.

Of the mineral resources of the country it appears, from a report made to the United States Geological Survey by Prof. Spurr, that not only gold, but silver, copper, and lead are found in Alaska, the Yukon districts lying in a broad belt of gold-producing rocks, having a considerable width and extending in a general east and west direction for several hundred miles. Throughout this belt occur quartz veins which carry gold, but so far as yet found out, the ore is of low grade, and a large proportion of the veins have been so broken by movements in the rocks that they cannot be followed. For this reason, the mines in the bed rock cannot be worked, except on a large scale with improved machinery, and even such operations are impossible until the general conditions of the country in reference to transportation and supplies are improved. Through the gold-bearing rocks the streams have cut deep gullies and canyons, and in their beds the gold which was contained in the rocks which have been worn away is concentrated, so that from a large amount of very low grade rock there may be found in places a gravel sufficiently rich in gold to repay washing. All the mining which is done in this country, therefore, consists in the washing out of these gravels. In each gulch, prospectors are at liberty to stake out claims not already taken. In prospecting, the elementary method of panning is used to discover the presence of gold in gravel, but after a claim is staked and systematic work begun, long sluice boxes are built of boards, the miners being obliged to fell the trees themselves and saw out the lumber with whipsaws, a very laborious kind of work. The depth of gravel in the bottom of the gulches varies from a foot up to 20 or 30 feet, and when it is deeper than the latter figure, it cannot be worked. The upper part of the gravel is barren, and the pay dirt lies directly upon the rock beneath, and is generally very thin. To get at this pay dirt all the upper gravel must be shoveled off, and this preliminary work often requires an entire season, even in a very small claim. When the gravel is deeper than a certain amount, say 10 feet, the task of removing it becomes formidable. In this case, the pay dirt can sometimes be got at in the winter season, when the gravel is frozen hard, by sinking shafts through the gravel and drifting along the pay dirt.

Prospecting is very difficult owing to the character of the surface, the general formation being soft, the hills having been worn smooth by glacial action, which left a layer of drift over the whole country to a depth of from 5 to 15 ft. This is frozen the whole year, with the exception of a few inches on the surface. After a creek has been prospected, the glacial drift must be removed. The trees and roots are taken away and a stream of water turned on, which, with the help of the sun, in time bares the pay streak. The course of the water is then turned along the hillside, a dam built and sluice boxes erected. These are made with corrugated bottoms, which catch and retain the gold. They are given a grade regulated by the coarseness of the gold; if the gold is fine, the grade is slight; if coarse, a greater pitch can be given, which is preferable, as more dirt can be handled. The lack of water in these gulches proves a great hindrance in many cases. The seasons are dry, and only the glacial drip of the hills can be depended upon. A method lately adopted by which mining can be done in winter has proved profitable, besides doing away with the long period of idleness. This is called burning, and is done by drifting, melting away the frost by fire and taking out only the pay dirt, leaving the glacial drift and surface intact. The pay dirt thus removed is easily washed in the spring when water is plenty.

Curious Obstruction to Pile Driving.

After the great Boston fire, according to the Shoe and Leather Reporter, the clearers and the cleaners dumped tons of burned, sodden, acid-eaten leather at the foot of Summer Street. It has all been found. Deep down below dirt and stone it has remained ever since, solidifying more and more each year by its own weight and added pressure from the top. The pile drivers who were at work on the foundations of the new union station were the first to locate the leather beds. When the pile struck this mass, it stopped. No amount of hammering could budge it an inch. The pile emerged from the encounter with its head battered to pieces. The Italian workmen dug down to the mass and hacked at it with pick and shovel, but could not even scratch it. They tried adzes, axes and crowbars on it, but could not dent it. They tried to blow it up with dynamite, but the blast caromed around it. Finally the steam derricks managed to pull the stuff out of the mud.

THE horse car lines at Mayence, Germany, are to be replaced within a short time by a system of trolleys.—Uhland's Wochenschrift.