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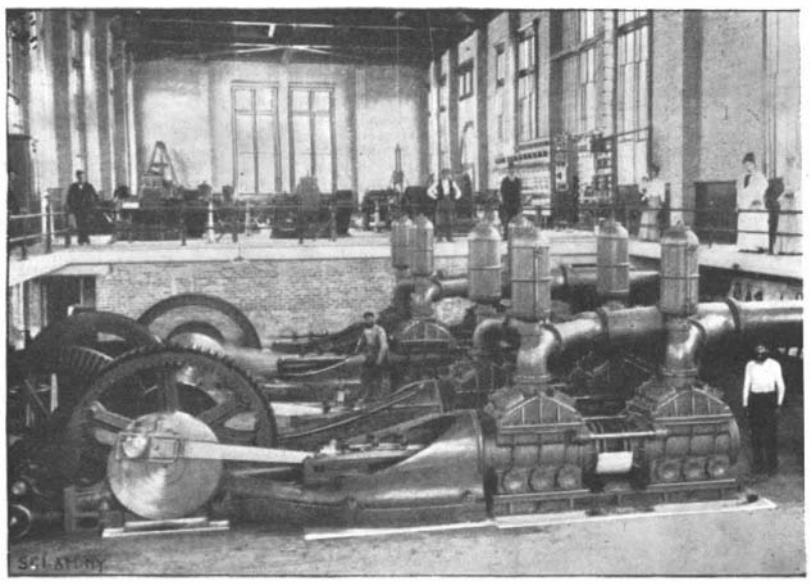
THE AUSTIN DAM.

BY H. H. CHILDERS.

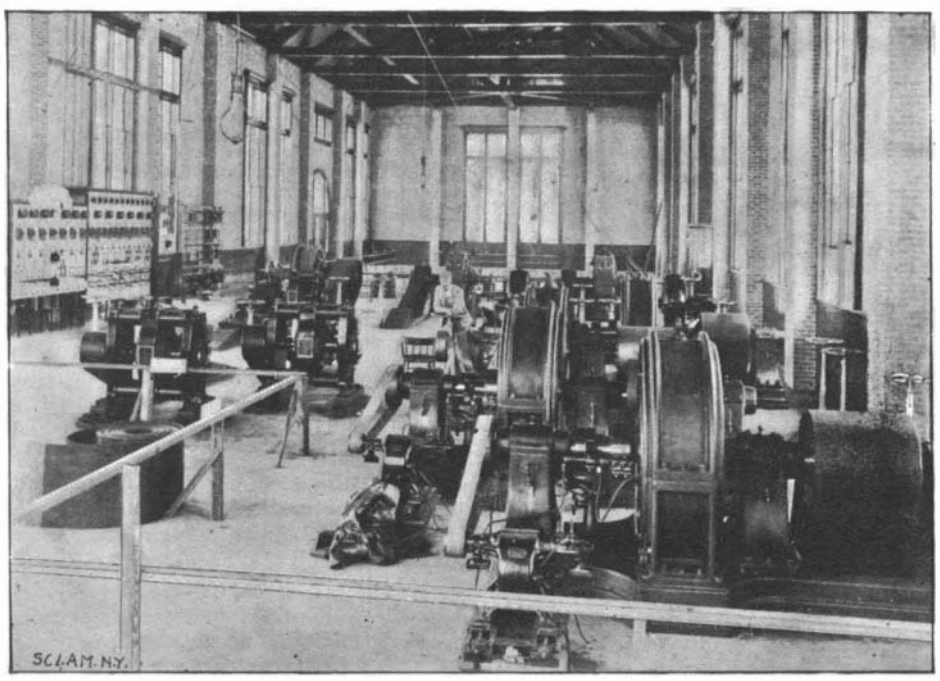
Long before the scientific mind, with the aid of capital, had determined to utilize the vast volume of water that is precipitated with such tremendous force at Niagara, the citizens of Austin, Texas, had begun the construction of a great dam across the Colorado River, two and a half miles above the city limits. Its purpose was to furnish light and water for the city and incidentally a considerable surplus power for other uses. The idea was not a new one. Examples can be found in many places.

J. T. Fanning, of Minneapolis, a well-known hydraulic engineer, who was consulted on the feasibility of the plan, said in his report: "On inspection of the new dam in progress, in company with the board, I was impressed with the magnitude of the engineering work, and especially with the exceeding great responsibility which the city has committed to the Board. I find that the dam which you have projected will raise the water of the river 60 feet above the former low water level, that it will have a maximum height to its crest of 70 feet and that its crest overfall will be about 1,125 feet long, and that the dam will flow the water twenty-five or thirty miles up the valley, creating an extensive lake. This dam is being constructed of solid masonry and is faced on each side with large blocks of excellent granite. Not for its length alone or its great area of flowage is the dam remarkable, for in France we observe three longer masonry dams—at Bouzey, Chazilla and Gros Bais, 1,545, 1,759 and 1,805 feet long respectively, and in Wales the Vyrnwy dam,

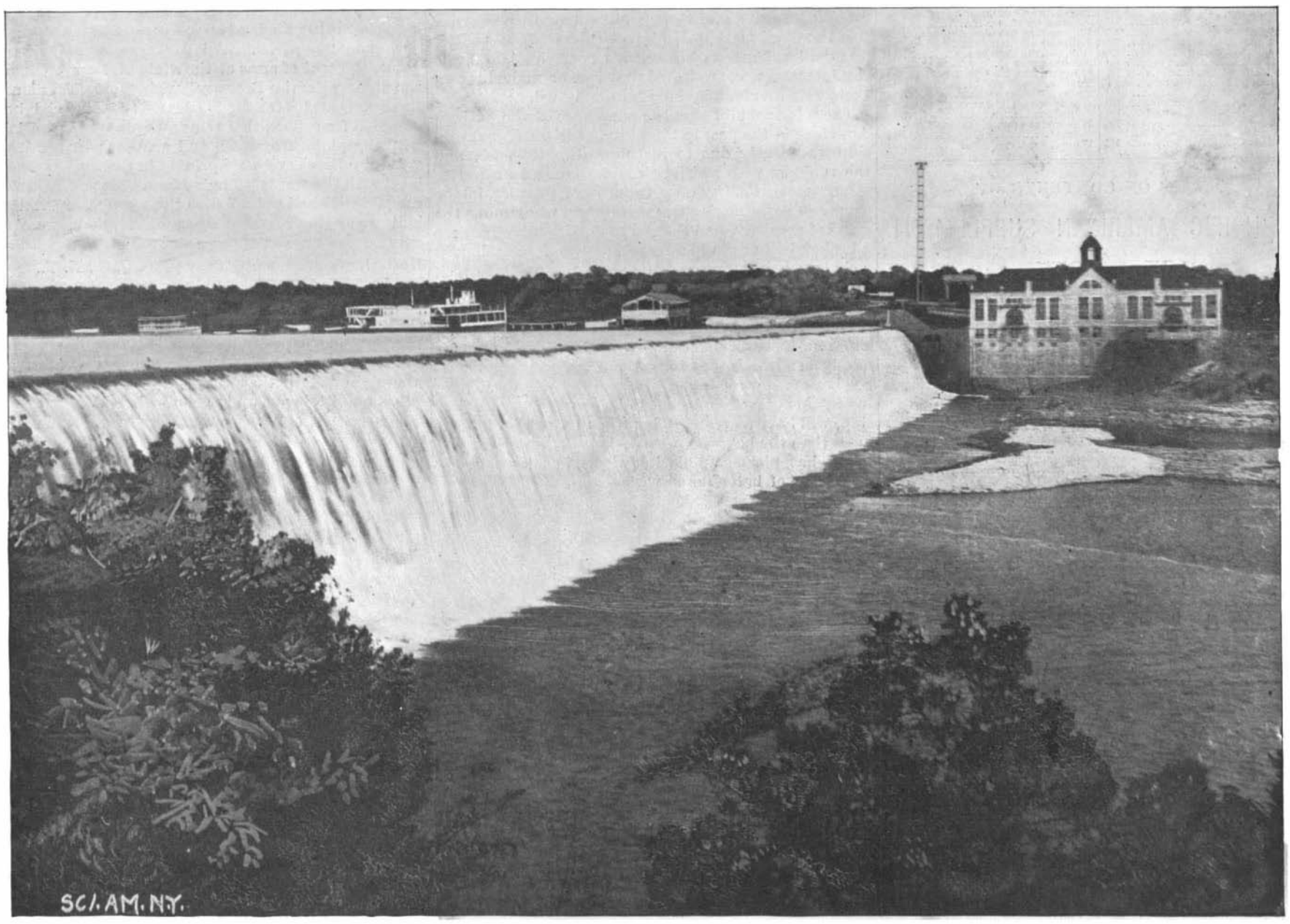
(Continued on page 137.)



AUSTIN WATER WORKS—PUMPS 4 000 000 GALLONS CAPACITY DAILY.



ELECTRIC PLANT FOR POWER AND ELECTRIC LIGHTING.



Height, 60 feet; length, 1,150 feet; width at base, 66 feet; at the top, 18 feet; maximum power, 14,637 horse power.

GREAT DAM ACROSS THE COLORADO RIVER AT AUSTIN, TEXAS.

THE AUSTIN DAM.

(Continued from first page.)

1,350 feet long, the latter being for the storage reservoir of the Liverpool water supply. Not in the height alone, for in France there are three dams, in Spain two, in Belgium one, and in California one masonry dam exceeding 150 feet in height. There are fourteen other notable masonry dams having heights exceeding 100 feet. But none of these dams are upon great rivers, and very few of them have the water passing over their crests."

There is one example of greater water power, but obtained under different conditions. The following is a list of the other great water powers of the United States:

Minneapolis	25,000	horse power.
Holyoke	12,000	" "
Manchester	12,000	" "
Lowell	11,000	" "
Cohoes	6,500	" "
Watertown	4,675	" "
Oswego	2,500	" "

The maximum force of the Austin dam is 14,639 horse power, or 224 mill power, according to another unit of measurement. The measurement of the Austin dam, 1,150 feet in length, 60 feet high above low water line, 66 feet in width at base, and 18 feet in width at the top.

As early as January 4, 1839, when Austin was mentioned in an act of Congress as the probable seat of government for the Republic of Texas, attention was called to the possibilities of a large supply of water power from the Colorado River. In 1871 and 1873, the question of erecting a dam across the Colorado River at Austin was seriously discussed and the plans partially matured.

The actual construction of this dam began in 1890, after the city of Austin had voted a municipal tax that was expected to realize a sum equal to $1,400,000. On the 24th of June, 1895, the city voted for an additional issue of bonds to the amount of $200,000 to complete the work already begun, and which was then incomplete as to reservoir, settling basin and water pipe. The dam proper was completed May 2, 1893. In 1895 every part of the structure was finished except the reservoir and additional piping. The contract has already been let for the construction of the former.

The Colorado River at Austin drains, approximately, an area of 40,000 square miles, and at the highest floods furnishes a flow of 200,000 cubic feet per second and a mean flow of 1,000 feet per second. The river in this section flows between high hills without alluvial valleys and between bowlders and deposits of lime rock, supplied largely by springs in dry seasons.

The artificial lake that the erection of the dam has created extends up the Colorado River 30 miles, has a water surface of 8 square miles and a total volume of 2,800,000,000 cubic feet of water. The widest point on the lake does not exceed a quarter of a mile and the maximum depth is 60 feet. It is called Lake McDonald, in honor of John McDonald, who was Mayor of Austin during the period of the construction of the dam.

Mr. Ellison Saunders was president of the Board of Trade of Austin immediately prior to the inauguration of the movement that contemplated this great engineering feat, and it was largely through his untiring effort, assisted by a few other public spirited citizens, that the enterprise assumed a substantial shape.

The material used in the body of the dam is the best quality of red granite, obtained in Burnet County, Texas, 60 miles distant, the same out of which the Capitol is built, limestone, found in the immediate vicinity in inexhaustible quantities, and hydraulic cement. The original contract for masonry, material, etc., was $611,313.39.

The power house was erected at a cost of $45,917.98. The remaining expenditure, that in the aggregate reached the sum of $1,600,000, was or machinery, penstocks, turbine wheels, pumps, sluice pipes, water pipes, electric towers, etc.

The turbine wheels in use are of the "Victor" pattern except one, the "American," that is used to operate the 3,000,000 gallon Goulds pumps, made in Chicago. Another pump of a capacity of 4,000,000 gallons daily is also in use. This part of the machinery was furnished under contract by the Stillwell-Bierce & Smith-Vaile Company, of Dayton, Ohio, amounting to $47,954.00.

The electrical distribution system was furnished by the Fort Wayne (Ind.) Electric Corporation at a cost of $115,678.29, which included towers, poling, wiring, etc., and did not include dynamos furnished by them at a cost of $7,700.55.

The power for street car service is developed by two 125 H. P. Multipolar Generators, Thomson-Houston type, manufactured by the General Electric Company, of Schenectady, N. Y.

The incandescent lighting is from Wood alternators; the total number of 16 C. P. lights is 15,000. The arc lights of the city are 189, and are suspended from 31 iron towers 150 feet high. Under the contract the light emanating from one of the towers with six arc lights was to be sufficiently bright to see the time of night by an ordinary watch, within a radius of 3,000 feet. The arc light machines are of the "Wood" make, three in number, with a total capacity of 240-2,000 C. P. lights. The power for industrial purposes is produced on a three-phase (Wood) 250 H. P. generator.

The four governors regulating the speed of the waterwheels, which furnish the current of electricity for the street car service, were furnished by the Replogle Governor Works of Akron, Ohio.

The cast-iron water pipes and special castings cost the city $107,582.15, and for laying the same $31,205.07.

When the subject of owning and operating its own water and light plant was first suggested to the people of Austin (which has about 25,000 inhabitants), they were confronted by strong opposition from the private corporation that was then furnishing light and water to the city. This corporation claimed to have vested rights and an unexpired contract. After a protracted litigation, annoying and expensive to both, a compromise was effected that has put an end to further contention.

The argument that decided the city of Austin to adopt the public plan of watering and lighting the city was the great reduction in cost to individual consumers and the advantage to be derived from a large surplus power for future commercial use, and for this use it can lease at least 12,000 horse power.

A disposition upon the part of municipalities to run and operate large plants has shown itself in many countries, particularly in Switzerland and in parts of Scotland, and the city of Austin claims to have already realized the wisdom of its departure from the old plan. Anterior to the construction of the Austin dam a private corporation, operated by aliens, furnished the water supply with the Holly system, and it had not only proven itself inadequate to supply the demands of the growing city, but the service was inferior, on account, in part, of the absence of a reservoir and other essentials of more modern use.

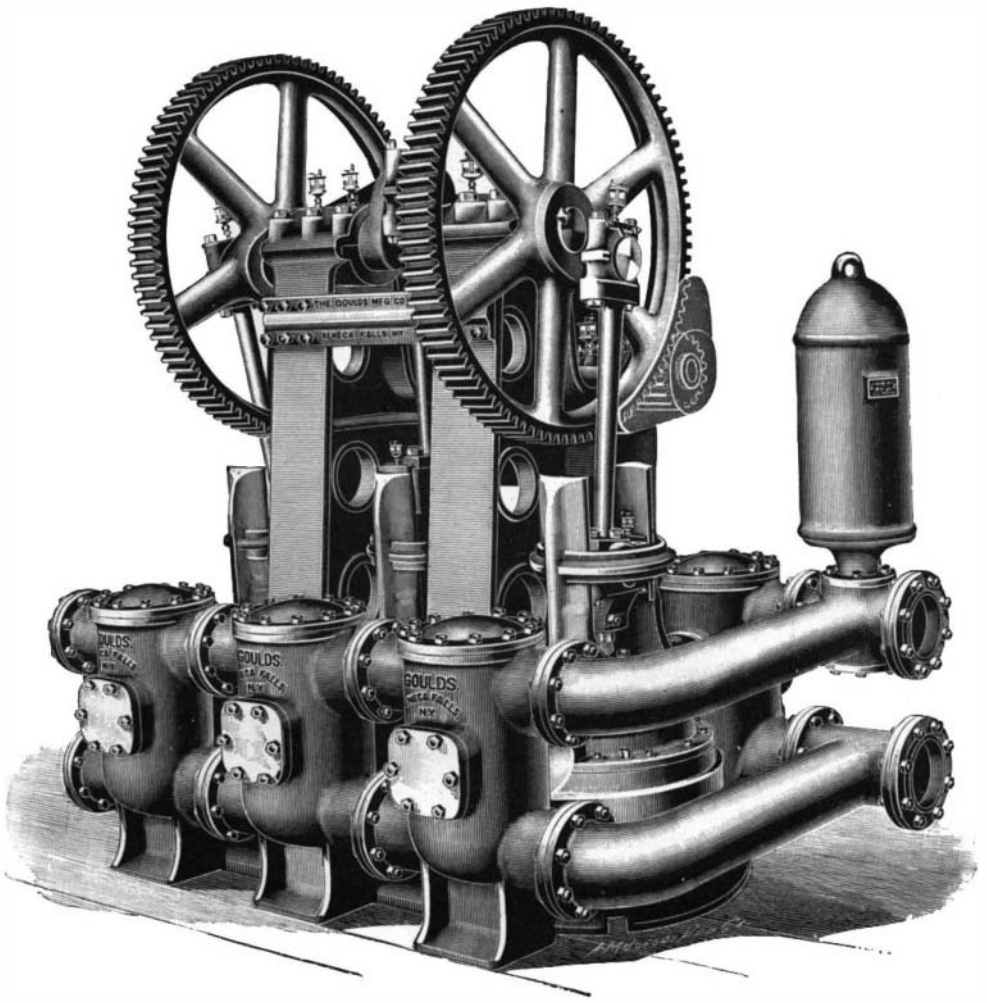
The city of Austin has not received benefits alone from the larger and cheaper supply of water, better and cheaper lights, and additional power for commercial use, by the construction of the dam, but it has at its door one of the most beautiful inland lakes in the world, the delight of the angler and those fond of aquatic diversion.

Steamers ply in these waters, and during the summer seasons give life and activity to the landscape and exhilarating amusement to the pleasure seekers by making delightful cruises up and down the lake for twenty miles.

Two of the most celebrated international regattas of the last decade have been held on these waters, and the cracks of the two hemispheres were there for the prizes that the management offered for the encouragement of the sport.

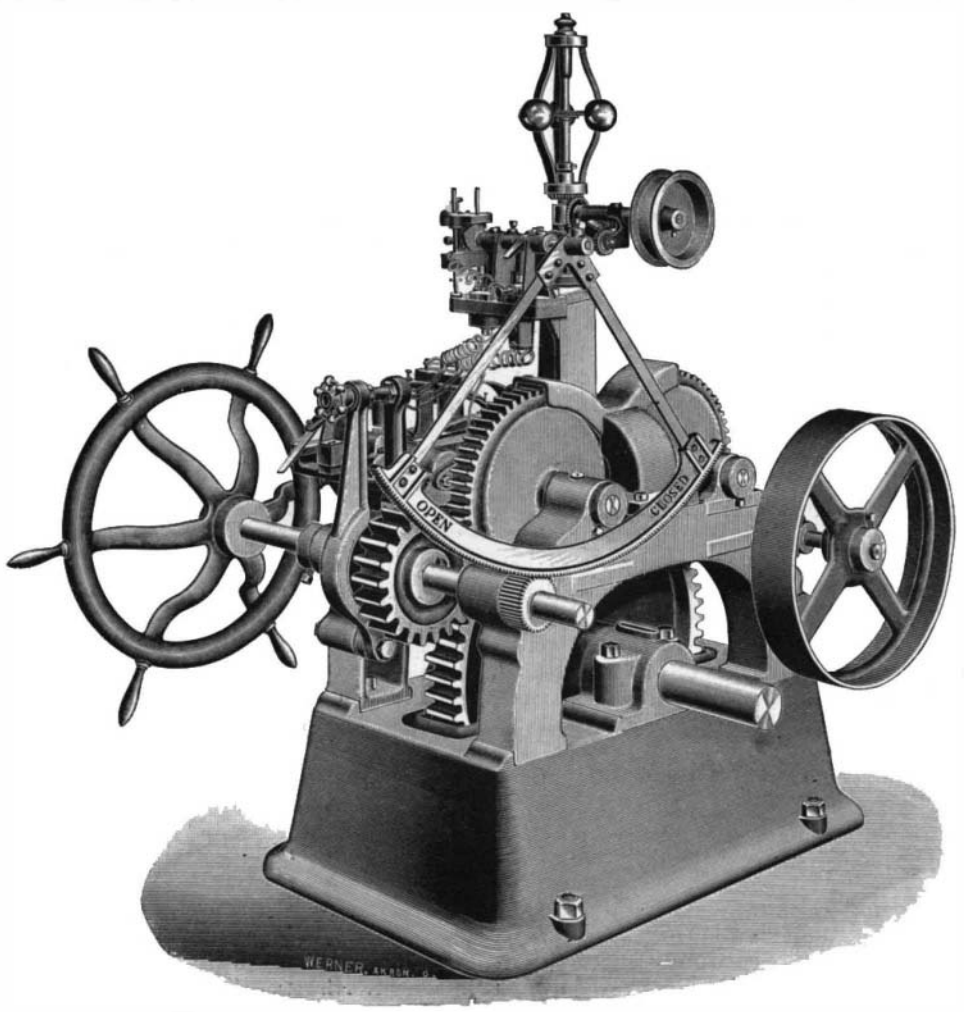
John F. Pope, a local engineer, after a careful examination, reported favorably upon the practicability of the dam, but Joseph P. Frizille, of Boston, was the first civil engineer whose able report gave the first substantial impetus to the movement. He was made chief engineer of construction, and after his retirement, some months later, a number of engineers successively occupied the same position, and a strange fatality seemed to attach to the office. Gorham P. Low, of Gloucester, Mass., one of the engineers, was stricken with paralysis, and died January 8, 1894. Joseph Kepferle, another, died suddenly December 7, 1894. G. W. Sublette, of Minneapolis, was the last in charge, and remained at his post until the services of an engineer were no longer required.

A company, with a capital stock



GOULDS TRIPLEX WATERWORKS PUMP.

Two in use. Combined capacity, 3,000,000 gallons daily.



REPLOGLE'S ROTARY WATER WHEEL GOVERNOR.

of $100,000, has been organized, and are now taking the initiative in the erection of a cotton mill at the dam,

COMPARATIVE STATEMENT OF COST PER LIGHT IN CITIES HAVING PUBLIC AND PRIVATE PLANTS.

PUBLIC PLANTS.

Cities.	Population.	Cost per Light.
Ashtabula	8,000	$77.00
Little Rock	25,000	70.00
Elgin	22,000	62.00
West Troy	13,000	60.00
Marquette	9,000	60.00
Frederick	8,000	60.00
Aurora	20,000	58.00
Madison	9,000	58.00
Alexandria	14,000	55.00
Lewiston	22,000	55.00
Bloomington	20,000	51.00
Decatur	17,000	50.00
Hannibal	13,000	50.00
Bay City	28,000	49.00
Jamestown	18,000	44.00

PRIVATE PLANTS.

Cities.	Population.	Cost per Light.
Kalamazoo	24,000	$170.52
Houston	27,500	150.00
Springfield, Ill	25,000	137.00
Peublo	34,000	132.00
Waterbury	24,000	121.00
Springfield, Mo	22,000	114.00
Wichita	24,000	108.00
Joliet	23,000	100.00
Cleveland	340,000	88.00
Auburn	26,000	87.50

and similar enterprises are likely to follow, until all the remaining surplus water power is utilized.

The author of this article is largely indebted to Mr. John T. Smith, a civil engineer, of Austin, for facts, figures and pictures.

The Psychology of Crowd Panics.

The recent crowd panic on the Hodynsky Plain, in Russia, with its frightful loss of life, emphasizes the danger in all large gatherings of sudden explosions of fear and demonstrates the impossibility of controlling a thoroughly frightened multitude, says the Medical Record. It is the history of every crowd under like circumstances, although the damage done in the present instance outweighs that of any similar occurrence in history. The latest estimate of the number of the dead is three thousand six hundred, that of the wounded being over twelve hundred. It is also stated that over five hundred thousand peasants were gathered on the plain in question, with a very inadequate police force and with all the elements which might tend to make the mass of humanity irritable and excitable. The lesson of results is one which the world at large will not easily forget. The horror of the situation passes the power of description, even by the alert and graphic newspaper correspondents. It was a tidal wave of unreasoning brutality forced against the comparatively weak barrier of human resistance. To such as look upon a crowd as an aggregation of human force, a multiplication of personal energy, and an ever-present consciousness of individual weakness, it is surprising that such calamities are not of more frequent occurrence, and that the law of accidents does not swell its statistics to frightful proportions.

If we study a crowd as we would an individual, there are many interesting phenomena to note which may serve to explain the reasons for panics and the most rational means for their prevention. The very gathering of a large number of people implies a concentration of interest in a given and definite direction. There is an individual as well as a general aspect of the condition. The individual is so small a part of the whole that he becomes overawed by the impression of the latent and implied power of accumulated mental and bodily interests. It means stage fright to the one who faces it on the one hand, and on the other hand becoming respect by the one who merely forms a part of it. There is always a something about a crowd which manifests a strained and tense degree of mental activity, a hyperexcitability to casual impressions and a corresponding lack of control of ordinary individual emotions. Thus the flattest joke oftentimes produces an applause which is proportionate to the size of the audience rather than to its supposed intelligence. Contrariwise, the most trivial mishap awakens the most foolish terror. Excitement, irritability and then fear rapidly follow each other on the slightest provocation. What would be trivial to an individual is terrible to a crowd. It is a question of degree merely, and is proportionate to the power behind. The mental tension, stupendous and formidable at best, is apt to give way with a sudden and dreadful snap. It is the spark to the magazine. The slightest exciting cause may start the train of the most unreasonable apprehension, which become intensified in proportion to the demonstrated difficulty of escape.

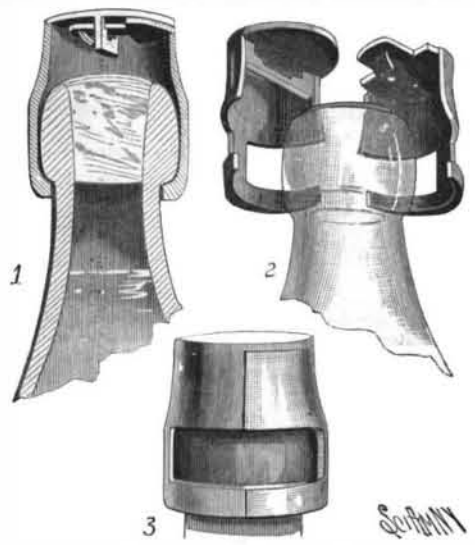
The insanity of fear is both individual and general. The instinct of self preservation becomes the one and only factor in the equation of desperate chances. It gathers strength from resistance, until its own exhaustion and despair strike the balance with death.

All these factors were present in the recent lamentable disaster. The crowd was worn out by excitement, irritated by strained expectation, ignorant of possible danger, hungry, tired and impatient; every selfish interest was intensified by the promise of food and gifts, the struggle for preferment was pronounced, and threatening, the terrible combination of lower human interests was charged to the full and awaited the signal for the inevitable explosion.

It is lamentable to think, in view of subsequent facts, that much might have been done to lessen the magnitude of the disaster, if not to prevent it altogether. As a large crowd is always a dangerous one, the gathering should not have been allowed to attain a magnitude beyond possible control. With sections properly guarded a general and widespread panic would hardly have been possible. There should have been no single point of interest, no distinct focal direction of effort, but rather a judicious distribution of attractions. From all accounts the plain was seemingly large enough to allow space for tables, barbecue fashion, in properly separated places, with a well organized system of rotation feeding and gift distribution, and a consequent prevention of a closely packed and dangerously sensitive mass of struggling humanity. As it is, the deplorable experience in Russia may serve as a useful lesson for the more careful management of all crowds wherever assembled, and not only teach the authorities the urgent necessity for extraordinary alertness in properly preventing panics, but in promptly arresting them by the quickest possible methods of diversion and dispersion.

A NEW NON-REFILLABLE BOTTLE.

A cap designed to be readily placed upon a filled bottle, retaining the cork in such manner that the latter cannot be removed without breaking the cap, is shown in the accompanying illustration, the improvement enabling the manufacturer of a liquor or beverage to protect his bottle from being refilled by others and sold



COLEMAN'S BOTTLE CAP.

again in the original form. A patent has been granted for this invention to Dr. Francis W. Coleman, of Rodney, Miss. Fig. 1 is a view in section and Fig. 3 is a side view of the cap applied to a bottle head, Fig. 2 showing the two parts of the cap before it is applied. The cap is made in two similar parts, each having a flat circular top plate, a pendent semicircular body portion, and jaws or clasps formed on a narrow downward extension of the body. The cap is made of some easily breakable but not readily melted material, and when applied to a bottle head the flat circular top plates overlap each other and lie above the cork, the jaws or clasps embracing the bottle neck just below the head. In order to secure the parts together upon a bottle, one of the parts is made with a downwardly extending thin spring plate, or catch, on the under side of the top plate, adapted to engage a cut out portion of a bar on the under side of the other top plate, by which the parts are locked together automatically on a bottle. This lock is wholly inaccessible from the outside, making it impossible to remove the cork without breaking the cap, and rendering it unfit for further use.

SPITZBERGEN will have a brilliant season this year. The Andree expedition will be followed by a German steamer from Hamburg, which will reach the islands in time to see the balloon start. A Norwegian steamship company will run steamers regularly while the season permits and will put up a temporary hotel on the Eis Fiord. Mr. J. Russell Jeaffreson, of the Geographical Society, will explore the interior of the western island, and if the ice will permit, will try to visit the islands between Spitzbergen and Franz Josef land. Another English expedition, with which went Mr. Trevor Battye, who explored Kolgner, started recently for Spitzbergen. The relieving vessel for the Jackson-Harmsworth expedition, the steam yacht Windward, has just started for Franz Josef land, with provisions and sledges. It will embark live sheep and reindeer in Norway and convey them north. The North Atlantic will be more lively beyond the Arctic circle this year than ever before.

Science Notes.

Earthquake experts propose to establish a number of stations for seismological observations around the earth. Starting from Japan, where is the most complete system for studying earthquakes in the world, the stations will be Shanghai, Hong-Kong, Calcutta, Sydney, Rome, Tacubaya, in Mexico, Port Natal, Cape of Good Hope, Santiago, in Chile, and Rio de Janeiro, all communicating with a central station at Strassburg.

Darwin's suggestion that the composition of subsoils might be ascertained from the examination of the piles of earth brought up by earthworms from their holes is said to have been utilized in Australia by a miner who was led to digging for a coal vein which he found from seeing traces of coal in the accumulations of land crabs: and by another, who, acting upon a hint given him by the wombats, found tin ore in the mountains.

Interviewed on the X rays by a Daily News representative on his return from South Africa, Prof. Crookes said: "The whole of the Roentgen X ray discoveries were made during my absence from England, and although I, owing to my previous work in the same direction, was able to receive the accounts of them without incredulity, yet I assure you that the announcement was as much a surprise to me as to the general public. With regard to the results since published by various British and Continental investigators, you will find that many so-called 'novel effects' and 'discoveries' have been already published by me."

The metallic colored feathers of humming birds and sun birds have been supposed to play some part in the economy of these birds aside from flight; but Miss Newbigin combats this view, pointing out in a paper presented to the Zoological Society of London that in the first place the older view did not apply to all humming birds, as in the metallic feathers of some of them the barbules were often connected by cilia. She held that the very perfection of the flight of humming birds led to correlated variations in feather structure productive of their especially brilliant metallic tints. "The difficulty of the plain colored swifts—possibly near allies of the humming birds—was met by the suggestion that the latter have fewer enemies, and had, therefore, had greater scope of possible color variation."

Dr. Lewy has just made a communication to the Berlin Physiological Society regarding the latest application of the Roentgen rays, says the European editor of the Herald. It has now become possible, he declared, to obtain a complete picture of the internal organs, as regards their situation, size and mechanism. This is accomplished by means of the fluorescent screen. The whole body is lighted up so that the shadow of the various parts and organs is thrown on the screen. Dr. du Bois-Reymond and Prof. Grummach, who had aided Dr. Lewy in his investigations, further reported that they had succeeded in seeing the organs of the throat, the larynx, the tongue and the stomach. Prof. Grummach has further succeeded in making pathological studies of the human body. He examined a man who had formerly suffered from consumption and hemorrhage of the lungs. He noticed that in the part of the body where the lungs lie (the lungs are too transparent to be visible by means of the Roentgen rays) there were a number of opaque spots. These were places where ossification of the tuberculous parts of the lungs had set in. In another case he saw small black lines in the heart of a patient just where the main arteries lie. These showed that the ossification of this part of the heart had set in, although it could not be diagnosed by any of the usual means. The correctness of these observations was confirmed by the fact that the pulse in the wrist was hard to the touch, and signs of ossification could be observed near the elbow and in the forearm.

Some time ago H. Moissan pointed out that zirconium could easily be obtained in the metallic state on reducing zirconia by means of carbon in the electric furnace, and at the same meeting of the Academy of Sciences, Troost described the formation of a carbide of zirconium, ZrC_2. Later experiments by Moissan and Lengfeld have resulted in the discovery of another compound of the same metal with carbon. This carbide, ZrC, was obtained by heating its components in the now celebrated electric furnace, and is described as crystalline and nondecomposable by the action of water up to 100° C. This great stability is in marked contrast to the behavior when exposed to the action of water, of the metallic carbides previously formed, and seems especially curious when it is considered that carbide of thorium—a metal very near to zirconium in Mendeleeff's classification — decomposes readily when acted upon by cold water, acetylene, ethylene, methane, and hydrogen being evolved. Zirconium carbide has a grayish color and metallic appearance, and remains unaltered in both dry and moist air. It scratches glass and quartz easily, but does not affect the ruby. The hydracids attack it readily—hydrofluoric in the cold, hydrochloric at 250°, hydrobromic at 300°, and hydriodic near 400°. At a red heat the carbide burns in oxygen, and in the presence of sulphur vapor a small quantity of sulphide is formed. Ammonia and hydrochloric acid are without action on the new compound, but it is decomposed by nitric and sulphuric acids, while strong oxidizing agents attack it energetically.—Comp. Rend.