A GUIDE TO THE

CHICAGO DRAINAGE CANAL

MONUMENT TO FATHER MARQUETTE,
ERECTED BY THE CHICAGO & ALTON RAILROAD COMPANY, AT SUMMIT, ILLINOIS.

PUBLISHED BY

The Chicago & Alton Railroad Co.

PRICE, 10 CENTS.

Perfect Passenger Service.

Chicago & Alton R.R.

America's Most Popular Railroad.

THE BEST LINE

By which to reach the most interesting geological features, and most wonderful and instructive mechanical features of the Chicago Drainage Canal, makes

ROUND TRIP REDUCED RATES.

In response to a popular demand for reduced rates from Chicago to the territory where work on the Drainage Canal is now in progress, the Chicago & Alton Railroad Company has placed on sale excursion tickets from Chicago to Brighton Park, Summit, Mount Forest, Willow Springs, Sag Bridge, and Lemont, at rate of one regular standard fare for the round trip, which is as follows: Summit, 40 cents; Mount Forest, 50 cents; Willow Springs, 55 cents; Sag Bridge, 65 cents; and Lemont, 75 cents. These tickets are on sale on Saturdays and Sundays for all trains stopping at the stations named. They are good going and returning on date of sale.

Saturdays and Sundays.

The territory thus covered by the reduced rates embraces the entire length of the most interesting portions of the Drainage Canal, as well as a number of places along the beautiful Desplaines River, particularly suited for family and party picnics, fishing excursions, and individual summer outings.

Regular Commutation Rates Between Chicago and Points on the Canal.

BETWEEN CHICAGO AND	Distance.	Single-Trip Fares, Limited to one day after date of issue.	Round-Trip Fares, limited for going passage to day following date of issue, and for return to ten days from date of issue.	Ten Rides, Bearer, Limited to one year.	Twenty-five Rides, Bearer, Limited to one year.	Sixty Rides, Individual, Limited to calendar month.
Brighton Park	5.1	$ .15	$ .25	$ 1.00	$ 2.50	$ 4.00
Summit	11.9	.36	.67	3.00	4.75	6.00
Mt. Forest	16.8	.50	.90	3.50	5.50	6.50
Willow Springs	17.5	.53	1.00	3.75	5.50	7.00
Sag Bridge	21.7	.65	1.20	4.60	7.50	8.50
Lemont	25.3	.71	1.35	5.00	8.00	9.00
Lockport	32.9	.93	1.75	7.25	10.00	9.50
Joliet	37.2	1.06	1.90	9.00	13.00	10.00

Commutation Rates quoted above apply to all persons five years of age and over. No reduction from such rates will be made for children.

No stop-over will be allowed at any intermediate point on tickets of any kind, except special tickets which are sold for the special Saturday personally conducted excursions leaving Chicago about 9.00 a. m.

Chicago & Alton Chicago Ticket Offices.

For tickets and full particulars call on or address:

101 Adams Street, Marquette Building; Room 328 Monadnock Building; Union Passenger Station on Canal Street, between Madison and Adams streets; and 23d Street Station.

All Chicago & Alton trains leave from and arrive in the Union Passenger Station on Canal Street, between Madison and Adams streets, Chicago.

ROBERT SOMERVILLE,
General Agent Passenger Department.
101 Adams Street, CHICAGO, ILL.

JAMES CHARLTON,
General Passenger and Ticket Agent,
CHICAGO, ILL.

THE URGENT IMPORTANCE OF NOT DELAYING YOUR INSPECTION OF THE CHICAGO DRAINAGE CANAL.

In importance, the warning not to delay inspection of the Chicago Drainage Canal, can only be compared with the universal alarm which was sounded by the daily press throughout the country when the World's Columbian Exposition was about to close forever. Like the World's Fair, the day will come, indeed, comparatively speaking, it is not far distant, when the "big ditch" will be no more. In the place of the most stupendous and miraculous example of canal construction and channeling which the world has ever known, we shall see but a tranquilly flowing inland waterway, the bed and sides of which, with their transcendently interesting geological features, will be hidden from the human gaze forever and forever

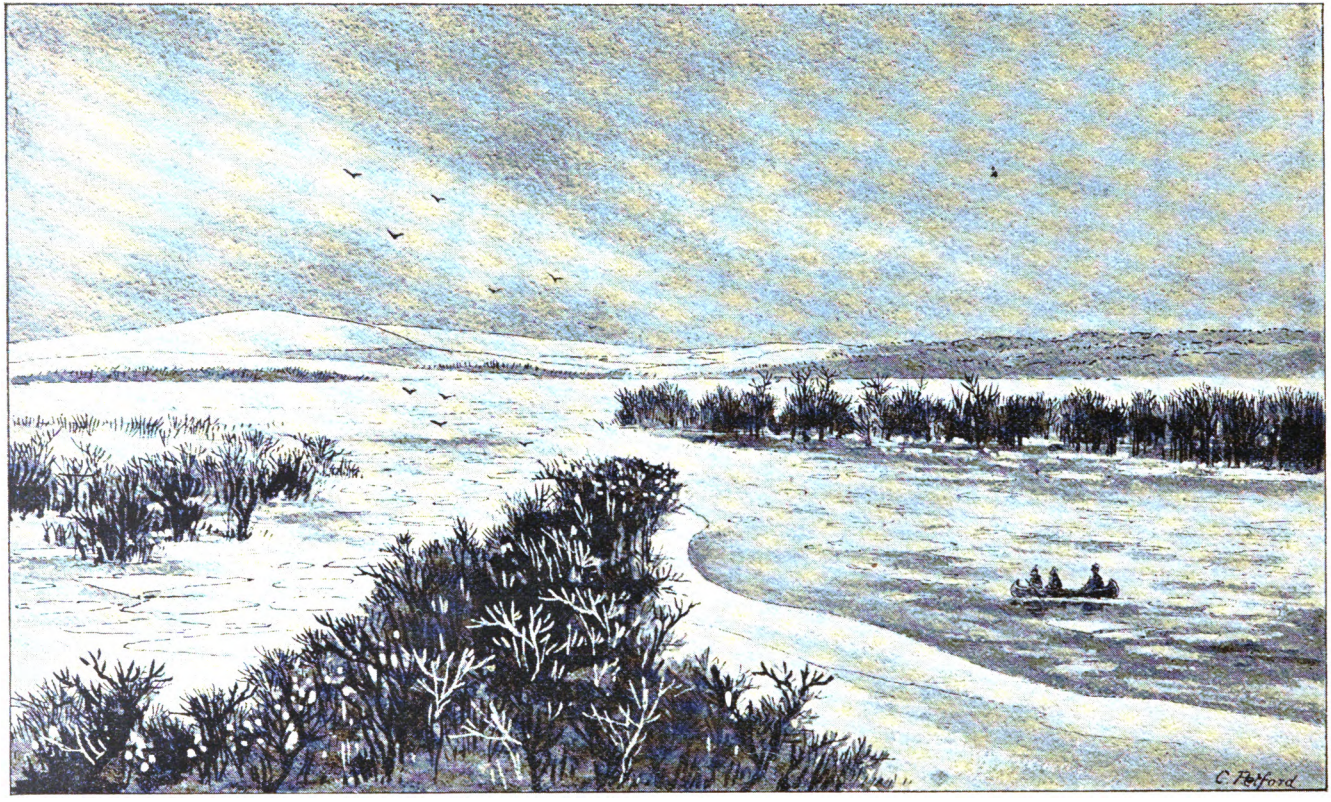
A GUIDE

TO THE

CHICAGO DRAINAGE CANAL

WITH

Geological and Historical Notes
to Accompany the Tourist
via the Chicago & Alton Railroad.



LANDING OF MARQUETTE AT SUMMIT, 1675.

For view of same locality at present time, see page 4.

WHAT IS THE CHICAGO DRAINAGE CANAL?

FIRST.—A channel for the removal of Chicago's sewage in so diluted a form as not to annoy the towns along its course, while it relieves Lake Michigan of the burden of filth which now flows into it and pollutes the drinking water of this great city. A sewage channel.

Incidentally, it will relieve the river towns of the concentrated sewage now flowing through the Illinois and Michigan Canal.

SECOND.—It is one of the greatest engineering projects of the century, thus far within immediate view of successful accomplishment, and the greatest undertaken by a single municipality. A magnificent engineering project.

The Suez Canal, for instance, about which so much has been said for a generation, is excavated in sand, and is 82 feet wide at the bottom of the channel, while the Chicago Canal is excavated in solid rock, is 160 feet wide, with perpendicular walls, and 30 to 35 feet deep. Where it is full earth-cut, the bottom of the channel is 202 feet wide.

THIRD.—It is probably one of the most interesting places in the world for the study of glacial geology. An interesting field for geological study.

FOURTH.—And greatest of all, it is a link in the chain of great waterways which will, some day, connect the entire inland commerce of this Republic with that of South America, Asia, and the isles of the Pacific, and make the world pay commercial tribute to the genius and enterprise of the city which could, in the same decade, carry on a World's Fair and execute so stupendous a sanitary and commercial project as this. A link in a great chain of waterways.

HOW TO SEE THE DRAINAGE CANAL.

FIRST.—Take the CHICAGO & ALTON RAILROAD, which is the best and most convenient line by which to reach the interesting geological features, and the instructive engineering and mechanical features of the Drainage Canal. General suggestions.

SECOND.—Read carefully the description of the history and work of the Canal, as described in this pamphlet.

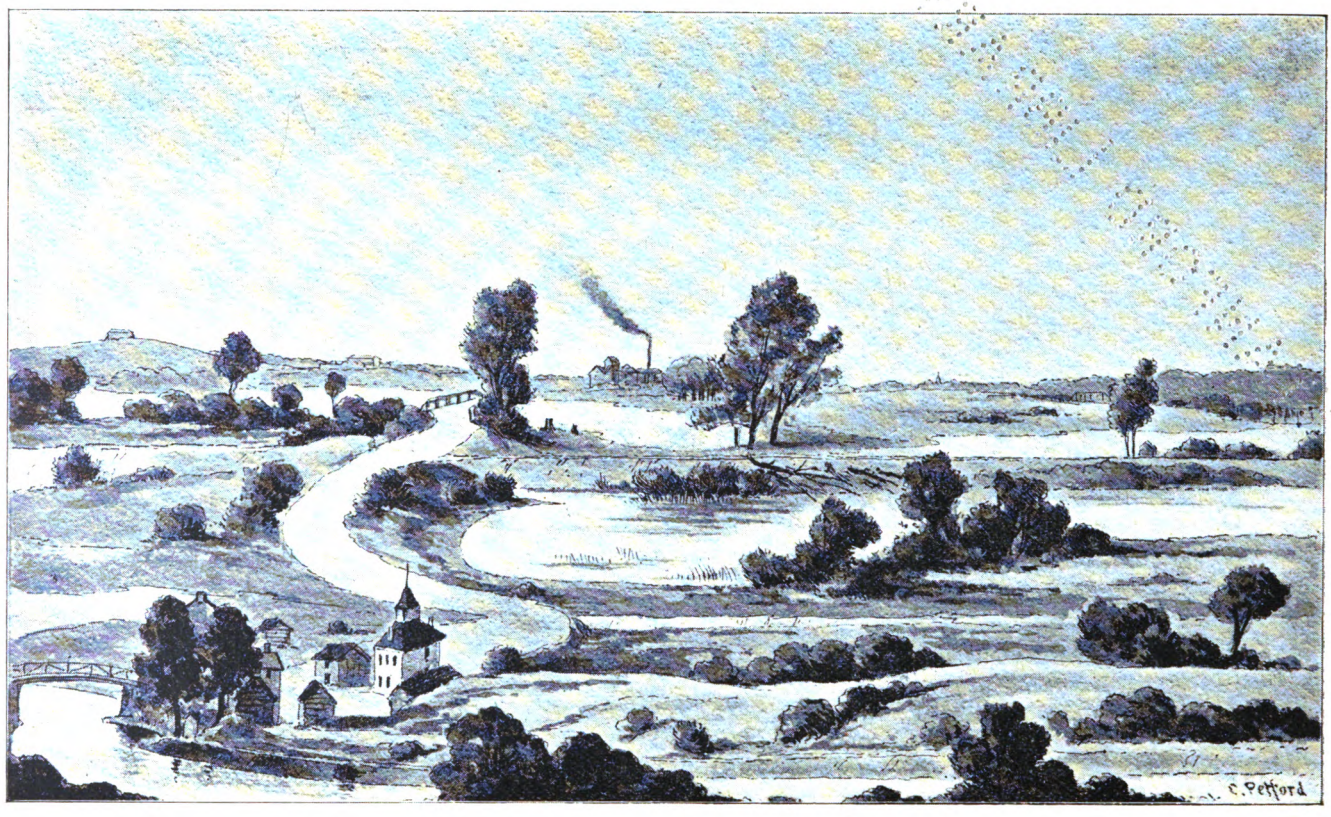
THIRD.—Follow carefully the directions given for seeing the various features of the work in progress.

FOURTH.—When practicable, go in company with someone who is familiar with the work and with the ground.

FIFTH.—Do not be afraid to ask for information, at any time. Contractors, foremen, and laborers are ready and willing to answer questions regarding the work upon which they are engaged.

To make a visit to this gigantic work intelligible, it will be necessary to first glance at the geological history of the valley through which it passes. A brief statement of the scientific theory of the valley will serve to indicate the points of interest to the student and ordinary observer. The Canal explained by geology.

It is supposed that various arms of the great ice-cap or glacier, which many thousands of years ago covered the northern part of this hemisphere, fitted the depressions in the valley of the Great Lakes, varying in breadth and having a thickness estimated at from half a mile to a mile, following (1) the present upper Desplaines Valley, (2) the North



PRESENT VIEW OF MARQUETTE'S LANDING PLACE, 1895.

From site of Marquette Monument, opposite Chicago & Alton Depot, Summit, Illinois.

Branch of the Chicago River, (3) the main Chicago River and South Branch, southwestward, (4) past Stony Island, through the Calumet Lake region, also southwestward, and (5) from the southern end of Lake Michigan westward and then northwestward, joining No. 4, and at Sag, uniting with No. 3, and moving on southwestward, but with interrupted effective force until after the united stream left Lockport.

Glacial arms from Lake Michigan.

These glacial streams brought with them from the Lake Superior region and intermediate parts of their course stones of various sizes, from pebbles up to boulders weighing 100 tons, and made up of granite, sandstone, quartzite, and conglomerate, of scores of varieties. They also plowed the limestone rock of this region to a varying, but often considerable depth. The material thus hewn out was rolled over and ground by the movement of the glacier and deposited in the lower parts of the course, so that clay, sand, gravel — coarse and fine — and boulders from Lake Superior and Chicago are *dumped* in promiscuous profusion and confusion all along the valley. The rocks which remained, as they are now laid bare of the deposit left behind by the melting glacier, show scorings from $\frac{1}{8}$ of an inch to 2 feet in depth, made by the sand, gravel, and boulders which the glacier carried in its bottom and sides.

Foreign material brought by the glacier.

Evidences of glacial action.

As intimated above, the glacier left uncompleted the channel it had cut out of the rock at Lemont, so that at that point, and for several miles, the rock comes to the present surface of the ground. It also left at Summit a bank of boulder gravel of great strength and of equal height with the rock at Lemont, although even at this point it had been cut at least 30 feet in depth. Between these two dams was enclosed a post-glacial lake 12 miles long and $\frac{3}{4}$ of a mile or more in width, in the bottom of which was deposited a layer of peat from 1 or 2 to 10 or 20 feet in thickness. In time of flood this lake emptied indifferently into the Mississippi Valley from the western end, or through the Chicago River into Lake Michigan and the St. Lawrence from the eastern end.

Post-glacial lake between Summit and Lemont.

At that time the Desplaines River emptied into Lake Michigan, but in time it built up, of its own sediment, near Kedzie Avenue, a dam of silt that eventually turned the ordinary waters of the river westward across the divide at Summit. Between this dam and the divide was left a small lake, later known as "Mud Lake," in wet weather an outlet for the flood waters of the Desplaines, connecting with the Chicago River, and in dry weather a marsh. West of the divide, the river then cut a partial outlet at the two ends of the lake, slightly lowering it and creating the present Desplaines channel, which carries off the ordinary and part of the flood waters of the upper Desplaines, while the excess of flood water goes east through the Chicago River into Lake Michigan, constituting one source of danger to Chicago's water supply.

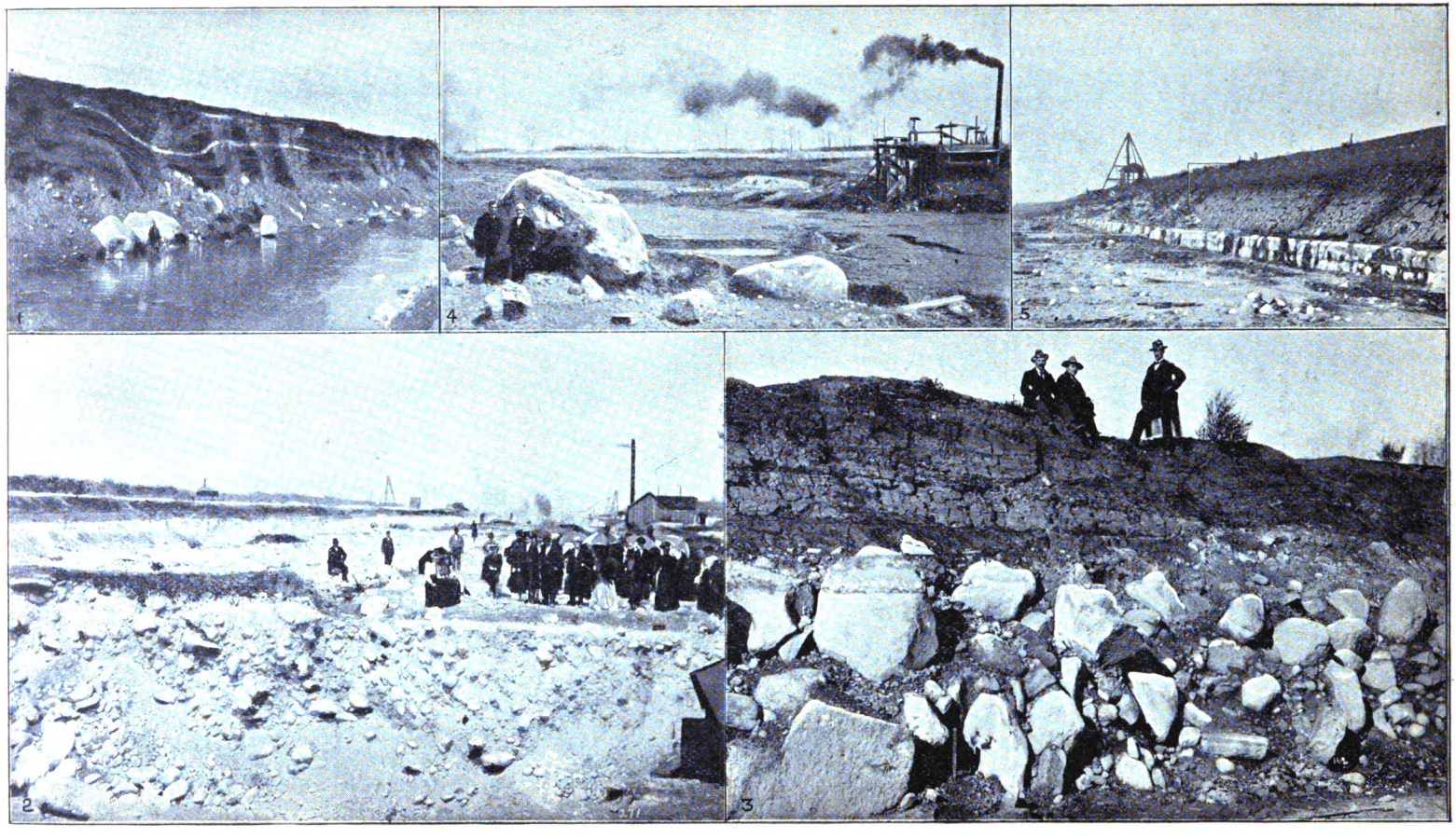
Mud Lake is east of the divide at Summit.

A break in the history, measured by many thousands of years — how many cannot be even approximately known — brings us to the year 1673, A. D. In this year, Joliet, the noted French pioneer, and Marquette, the equally noted and zealous missionary, floated down the Fox and Wisconsin rivers to the Mississippi, returning the same year up the Illinois and Desplaines, finding a portage at the divide at Summit, of which we have spoken, and, carrying their boats across to the Chicago River, passed north on Lake Michigan to headquarters at Mackinac.

Joliet and Marquette find the portage at Summit.

December 4, of the next year, Marquette and two companions, coasting south on Lake Michigan, and entering the mouth of the Chicago River, at that time covered with six inches of ice, hauled his boat "two leagues" to the intersection of what is now Robey Street with the Chicago

Marquette returns to Chicago, and winters at Robey Street.



1. Gravel, sand, and boulders left by glacier—typical.

2. Surface and sectional views of bed of boulders after removing soil.

3. Boulders between bed rock and peat.

4. Giant boulders.

5. Strata of rock crushed by glacier.

River. Here was a rise of land later known as "Lee's Place," upon which they "cabined" for the winter.

March 30, 1675, the country was flooded, and Marquette and his companions were obliged to take to the trees for safety. In the morning, the party took canoes, paddled up the river "three leagues," and rested upon a point of land where the town of Summit now stands. Here Marquette observed, to his surprise, that the river *up* which he had just come appeared to have another outlet to the westward. A study of the ground, by the aid of engineers' levels and the memory of those who remember the country as it was before the hand of man had changed its appearance, makes it practically certain that the place where Marquette landed was just opposite the present Chicago & Alton depot at Summit. Here the Chicago & Alton Railroad Company has erected a monument to commemorate this event, so interesting in the early history of the region about Chicago. This monument consists of granite boulders of various kinds, brought from the Lake Superior region by the glacial stream, and deposited in this valley. The monument is, therefore, of great geological as well as historical interest.

He is flooded out, and discovers the Desplaines at Summit.

His landing place located.

Alton road builds a monument to Marquette at Summit.

From Summit, Marquette followed this new "outlet" which he had discovered, and traversed the post-glacial lake at flood height, encountering some difficulty in navigating the rapids between Romeo and Joliet.

Marquette finds rapids below Romeo.

On these journeys of discovery and missionary labor, Joliet and Marquette were thus the first white men to navigate this great natural highway which commerce was later to utilize.

First white men to follow this water course.

A shorter gap in the history brings us to the year 1822, when the legislature of Illinois authorized, for commercial purposes purely, the building of the Illinois and Michigan Canal, which was completed in 1848 (there being at that time no railroads in this part of the State), at a cost of about $7,000,000.

Illinois and Michigan Canal.

By this time the City of Chicago, with its rapid growth, began to feel the necessity of some protection against the flow of sewage into the lake, which contaminated the city's water supply.

Sewage problem puts in an appearance.

The discussion of needs and methods of relief culminated in an act of the Legislature to provide for deepening the canal 8 feet, which was completed in July, 1871, at a cost of $3,400,000.

Old canal is deepened.

This expected relief, however, was inadequate and of short duration, as Mr. Ossian Guthrie had demonstrated, from his knowledge of the physical conditions, would be the case; so that before long the agitation for a pure water supply was renewed with varying intensity and the adoption of various expedients for relief.

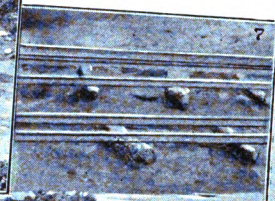
Relief only temporary.

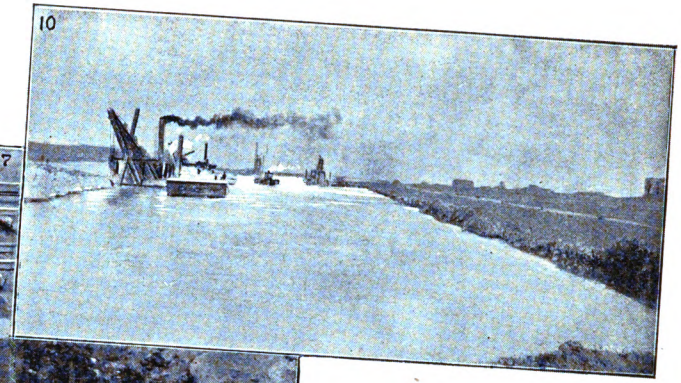
At last, in August, 1885, a rainfall of 6¼ inches in about twenty-four hours sent the flood waters of the Desplaines and the Chicago rivers rushing out to, around, and beyond the crib, two miles out in Lake Michigan, from which the water supply of Chicago starts by tunnel to the city, so that the imperative need of a full and permanent relief was no longer a matter of dispute. The Citizens' Association appointed a committee, composed of Messrs. Ossian Guthrie, L. E. Cooley, and Dr. F. W. Reilley, as experts, and William Rutherford, Chas. A. MacDonald, David Bradley, J. J. Glessner, and Edwin Lee Brown as special representatives of the Association. The report of this committee, based upon data furnished by Mr. Guthrie, resulted at last in an act of the Legislature in 1889 authorizing the organization of a Sanitary District, and in 1890 the Trustees elected by the people of Chicago in 1889 organized the Sanitary District of Chicago.

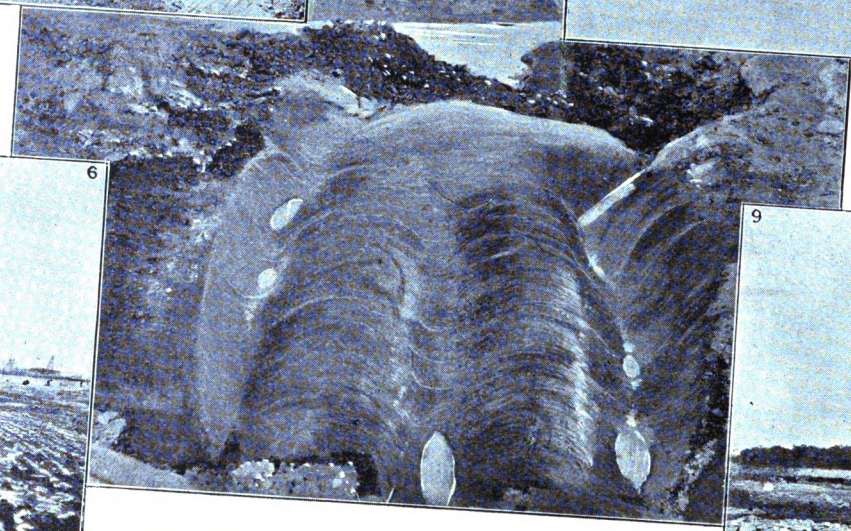
The great flood of August, 1885.

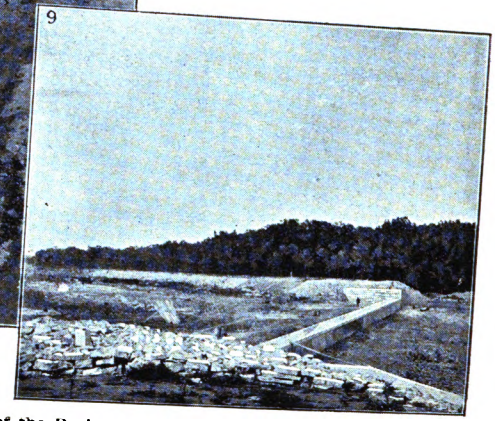
Citizens' association appoints a committee.

Sanitary district organized.









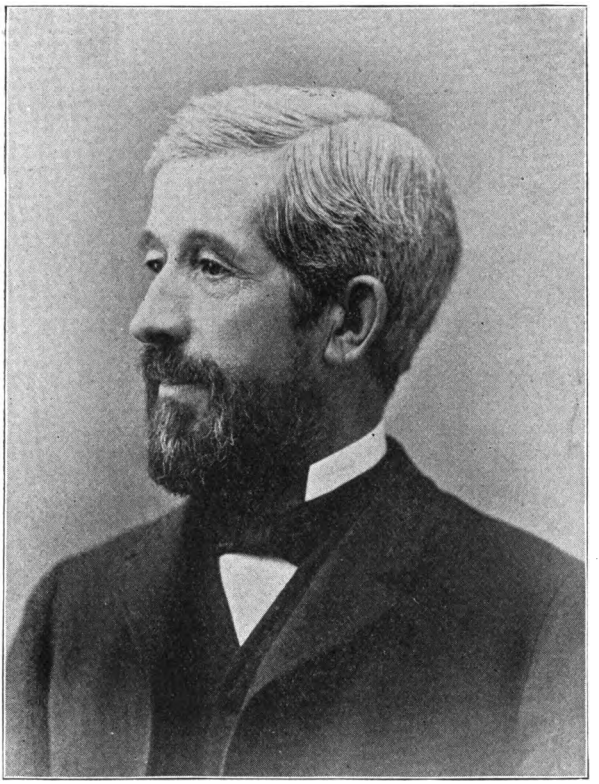
8. Glacial smoothed rock with fine scorings.

6. Glacial grooves showing effect of decomposing water action.

7. Glacial grooves at junction of two glaciers.

10. Eastern terminus of the Drainage Canal—Robey Street, Chicago.

9. Spillway, between Desplaines River and Mud Lake.



OSSIAN GUTHRIE.

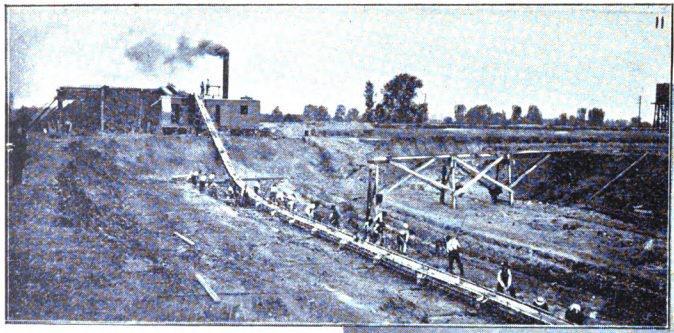
It seems very proper to present here a portrait of Mr. Guthrie, who may be justly termed the "Father of the Drainage Canal."

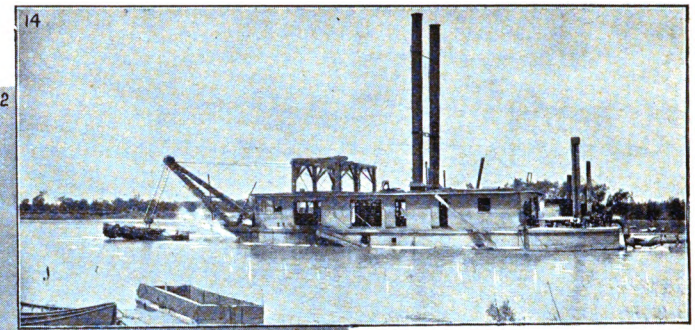
It was at Mr. Guthrie's suggestion, on the Monday morning of August 3, 1885, after the excessive rain of Sunday, August 2, 1885, above-mentioned, that the appointment of the Committee of the Citizens' Association was made. It was his familiarity with the topography of this region and his natural qualifications as an investigator that led him to oppose the deepening of the old canal on the ground of inadequacy. It was his active and persistent interest that secured the appointment of this Committee to investigate the effects of the great flood. It was the data which he had gathered during years of study and investigation which led the Committee to say in their report — which laid down the lines along which, without material change, this stupendous work has been carried on: "To Mr. Guthrie especial acknowledgement is due, his large personal experience and knowledge of conditions having contributed materially to the mass of details collected in the brief time at the disposal of the Committee." This report was made twenty-one days after the appointment of the Committee.

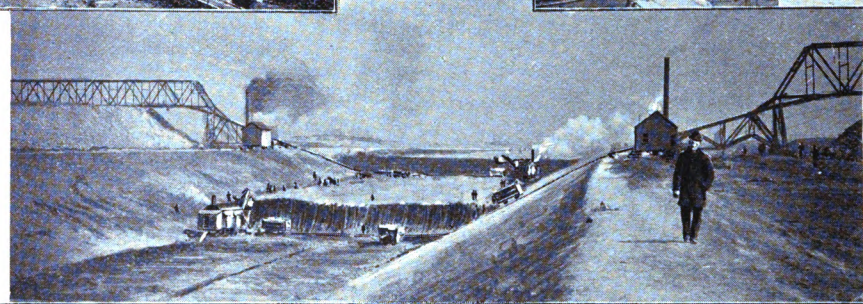
Mr. Guthrie also predicted the conditions of glacial drift and boulders which, four years later, the actual excavation of the channel laid bare, demonstrating the accuracy of his predictions.

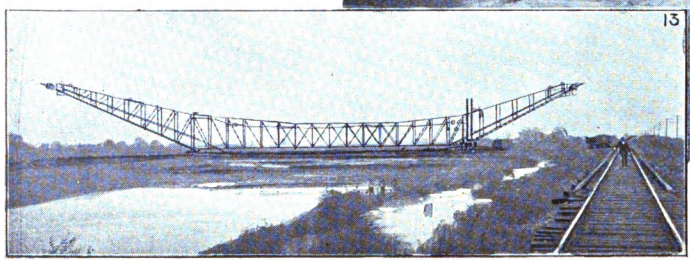
These predictions were made repeatedly in writing and before the various high schools of this city, and were based upon data collected by him in the valley.

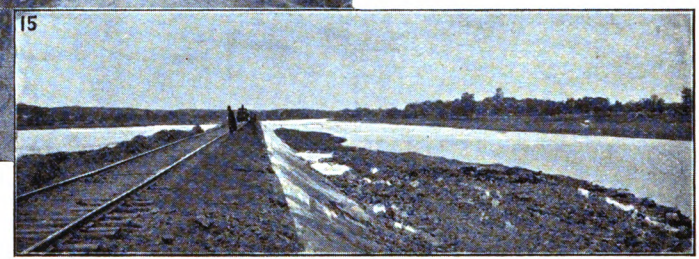
Mr. Guthrie was also the first engineer to propose the diversion of the flood waters of the Desplaines, a measure which is undoubtedly a fundamental feature in the solution of Chicago's drainage problem.











11. Endless rubber belt conveyer.

12. Bridge dumps, with full earth cut.

13. Cantilever endless chain dump.

14. Hydraulic dredge.

15. Levee between diversion and drainage channels.

In 1892 was dug the first spadeful of earth in a work that is destined to be known in the future as an important link in what will undoubtedly be the greatest system of internal waterways in the world — the Chicago Drainage Canal.

The great project begun.

Thus, after these centuries and ages, the people of Chicago are utilizing the work of the prehistoric glacier. If now the government of the United States fulfills the demands which the age and the people are making upon it, and assumes control of this waterway and of the Nicaragua Canal yet to be constructed, this generation may hope to see, with a liberal system of commercial enactments, the commerce of China and Japan brought to the feet of Chicago.

What the United States Government should do.

We will now proceed with our itinerary.

Itinerary.

Leaving the city on the Chicago & Alton train from the Union Passenger Station, Canal and Adams streets, we pass at Robey Street the eastern end of the canal, which is being dredged from the Chicago River at that point, north of the Illinois and Michigan Canal.

Eastern end at Robey Street.

The dredging at this end of the canal is now completed for a short distance, but the work beyond has progressed but slowly, owing to the necessity for settlement with the various railroads that cross the right of way.

At Summit, immediately opposite the Chicago & Alton Depot, is the site of the landing of Marquette, above described. Half a mile northwest of the depot is the bridge over the Desplaines River at the point which marks the so-called "Continental Divide," though, as its waters empty from both ends into the same ocean, the name is only partially applicable. This is the place where Joliet and Marquette found their portage in 1673, and where the glacier had left the gravel bank which constituted the east end of the post-glacial lake.

Site of Marquette's Landing.

"Continental Divide."

To the east from this bridge is the beginning of the Diversion Channel, the name given to the artificial bed made for the Desplaines River by the Sanitary District at an expense of nearly $1,000,000.

Eastern end of river diversion.

The visitor will observe, to the northeast as he stands on the bridge, a long line of timber, which marks the upper course of the Desplaines and its change of course as it turns to the southwest, where it becomes of practical interest to Chicago.

Upper course of the Desplaines.

As stated on page 5, the gravel bank under this bridge formerly deflected the waters of the Desplaines eastward to Lake Michigan, while later the dam at Kedzie Avenue turned their course westward over the divide, whence they followed the present channel through and beyond the lake, as indicated on the map. Mud Lake was therefore merely the eastern outlet for the extra flood waters of the Desplaines.

Eastern end of Post-glacial Lake.

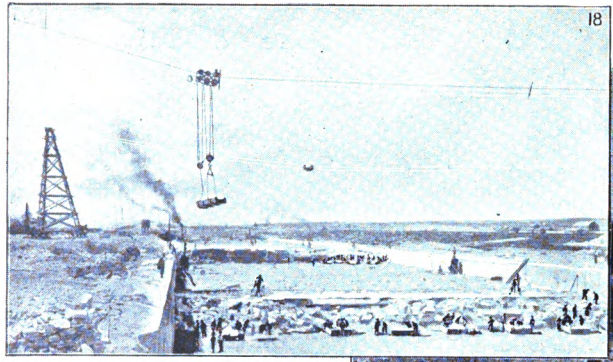
These flood waters have been a very important element in the problem of Chicago's water supply. In very dry weather the Desplaines can be emptied, so it is said, by a six-inch pipe. In very wet weather it may pour down a majestic flood of over 800,000 cubic feet of water per minute! This flood-water can not be safely carried down the valley to the Illinois River, on account of the destruction to property that would follow. In the natural course of events, the excess of water flows easily through the Chicago River to Lake Michigan — too easily for Chicago. A compromise has therefore been effected by which a dam, called the Spillway, has been built northeast of Summit, to prevent the Desplaines from flowing eastward until the flood waters exceed 300,000 cubic feet per minute, when the excess may flow over the Spillway to the lake. What permanent disposition to make of this troublesome excess flow is still an unsolved problem; for it must be kept separate from the waters and bed of the Drainage Canal.

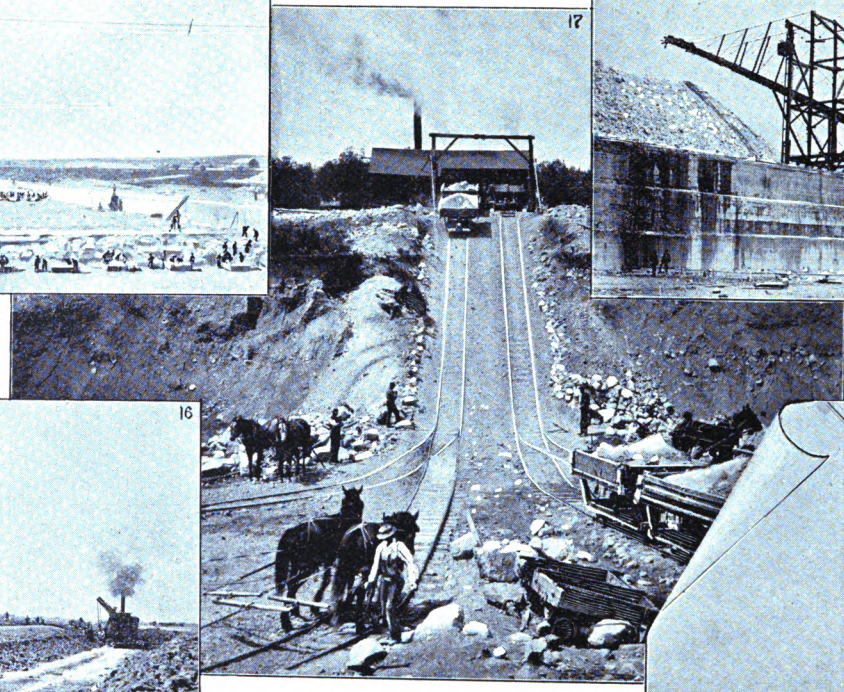
The Desplaines a very variable stream.

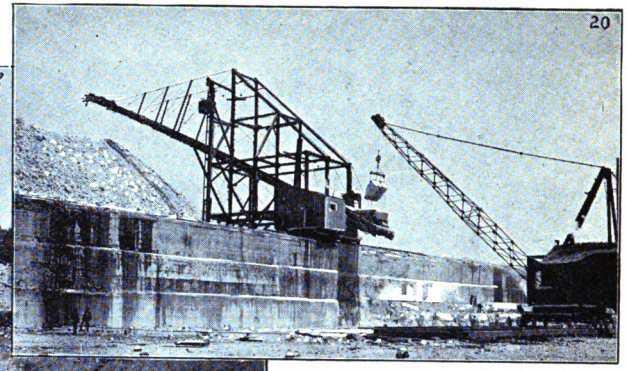
Excess of water flows ast to detri of Chic

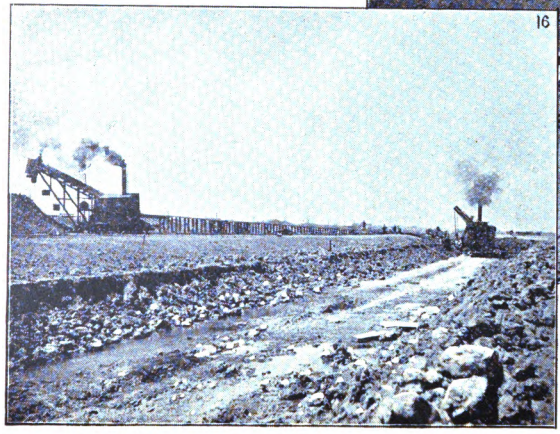
Spill a comp nise between Chicago and the Illinois Valley.

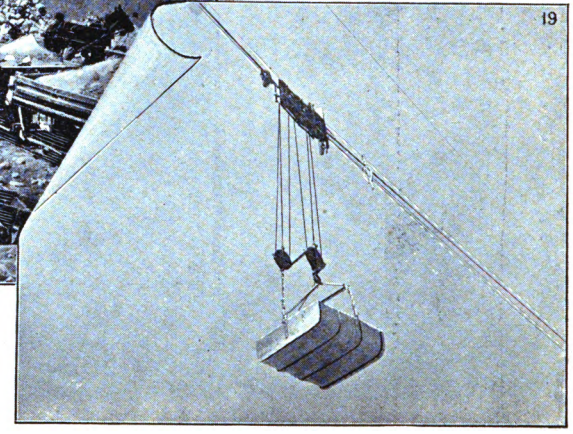
An unsolved problem.











18. Cable conveyer.

16. Cable incline.

17. Horse and cable power.

20. Derrick hoist and cantilever incline.

19. Hoisting five-ton load

In the view of the Desplaines at Summit, given on page 2, the water is represented at flood tide. Just beyond the trees on the left is the bed of the river, which turns sharply at the end of the timber toward the observer at Summit and curves away again quite abruptly, making a Ω-shaped bend, which is now partially destroyed by the River Diversion and the levee, which is built for 19 miles between the River Diversion and Drainage Channels. Cutting off the nose, or tip, of the ridge upon which we suppose Marquette to have landed, is the Illinois and Michigan Canal. Just beyond this is the Drainage Channel, then the levee, then the River Diversion, all at right angles to the observer. To the far right, in the background, is the Spillway, while Mud Lake is to the extreme right, and the Upper Desplaines disappears in the dim distance beyond. All this is now under water, in the view, and illustrates the need of a provision to separate the two channels.

Marquette's Desplaines compared with ordinary water to-day.

Geography of Summit and vicinity.

From Robey Street to Summit the channel is not being cut full width, the bottom being only 110 feet wide, with the slope as in other earth cuts.

The capacity of this channel is intended for 1,500,000 inhabitants, inasmuch as the law provides that the channel shall have a capacity of not less than 20,000 cubic feet per minute for each 100,000 inhabitants. Being in clay, it can be easily dredged to any required capacity, even if full of water.

Eastern end of the Canal must be enlarged.

The view on page 4 is a bird's-eye sketch of the same region in its present condition, with the Illinois and Michigan Canal in the immediate foreground, the uncompleted Drainage Channel beyond it, and still beyond that, the levee, which separates the Drainage and Diversion channels. This levee, as is shown, has been built across the old bed of the river.

In the left background is the bridge which crosses the so-called "Continental Divide."

In the right background is the belt of woods which indicates the upper course of the Desplaines, upon the western edge of which is the Spillway, hidden from view.

In this view, the standpoint is on the site of the Chicago & Alton's Marquette Monument, looking northwestward.

As far west as Summit, the deposits found along the route are only boulder clay. Between Summit and Willow Springs their character changes. Pebbles and gravel, with small and large boulders, many of them bearing the unmistakable marks of glacial action, appear with increasing frequency.

Change in the character of deposits west of Summit.

On Sections E and F there develops a curious deposit, in the form of a gray quicksand which has hardened into a rock-like material that must be blasted before it can be taken out, even with a powerful steam shovel, and yet so tenacious that it cannot be blasted with a quick explosive like dynamite. The application of water turns this refractory material into a live quicksand.

Quicksand that requires blasting.

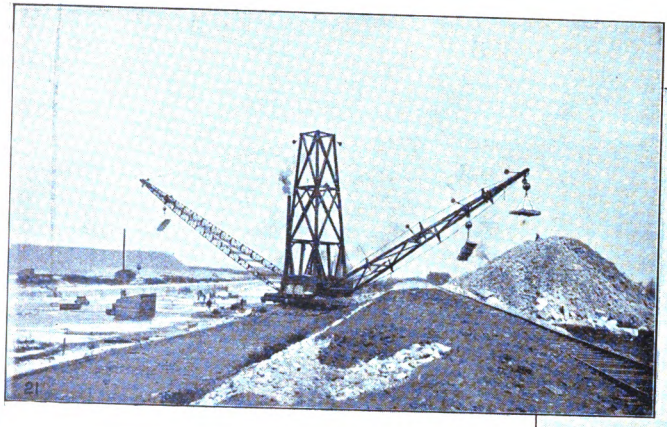
On Section 1, the character of the work in progress, and of the completed channel, changes from full earthwork and wide channel, whose sloping sides are lined with stone, to a rock bottom, of uniform width of 160 feet, and, wherever needed for the upper part of the sides, a retaining wall, built up to the required height, and backed by a filling of broken stone as shown on the map at the back of this book. Where this retaining wall in its completed stage shows narrow holes at irregular intervals, it is not necessary to criticise the work of the contractors. It is a space left to permit the water which filters on the land side of the wall to escape into the channel.

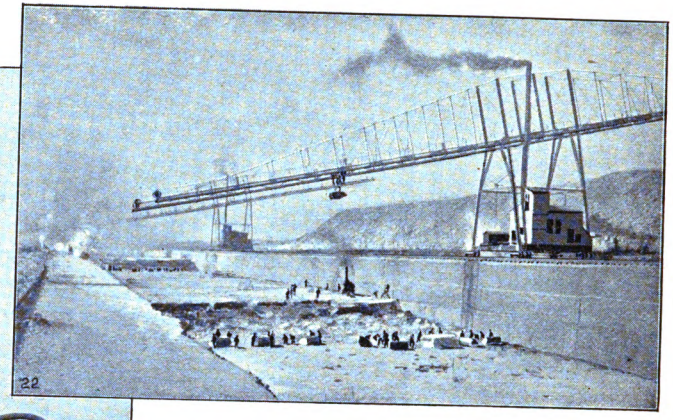
Change in bottom and sides of channel from Willow Springs.

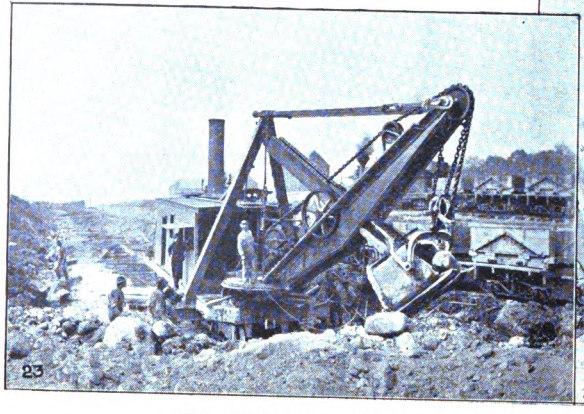
Retaining wall.

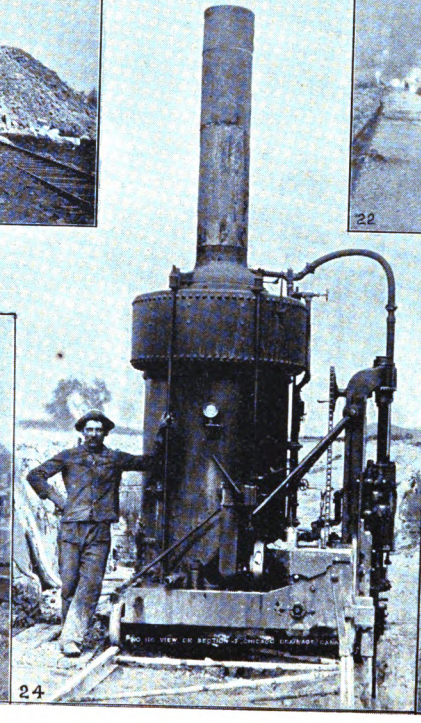
This section is called the Gold Section, because here was found a frag-

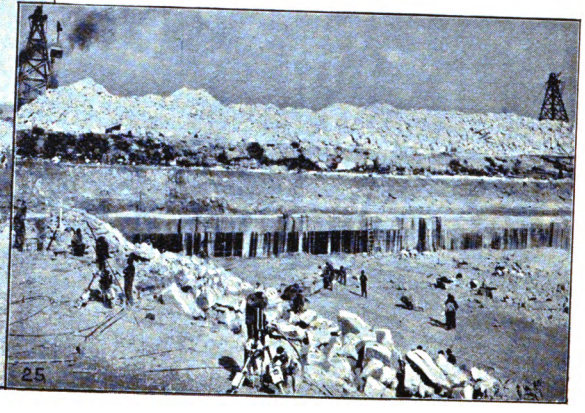
The gold section.











21. Revolving derrick.

22. Giant cantilevers.

23. Steam shovel in boulder drift.

24. Channeling machine.

25. Drilling preparatory to blasting.

ment of gold-bearing quartz, which the glacier had brought from the Lake Superior region.

Glacial-marked copper. Other metals.

Copper has been found in considerable quantities in various portions of the valley, in many cases showing very clearly the effects of glacial action. Silver has also been found, and Lake Superior iron ore.

Artesian wells.

On Sections 2 and 3 have been found some artesian wells in the stratum which forms the bottom of the channel, and the water which issues from them is unexcelled in quality.

Channeling machines.

As soon as rock work begins, when the earth and drift have been cleared off from the surface of the rock, the channeling machines begin their work of cutting a groove about three inches wide and ten feet deep, more or less, which insures a smooth wall for the channel after the blasting is over. When these grooves have been cut, and the drills, which are worked with either compressed air or steam, have done their work, the charges of dynamite are put into the holes and the blast is fired by electricity. In this way, a layer of rock equal in thickness to the depth of the grooves and drill holes is removed from the channel. In a full rock cut there are three such layers of work called "stopes," as will be seen in Fig. 22. (See page 14.)

Preparing for a blast.

Steam shovel work in boulder drift.

On Sections 1 to 6, but most accessible on 4 and 5, from Sag Bridge Station, the steam shovel work is most interesting, and visitors will find it hard to leave these machines as they work, now in a pocket of sand, now in fine or coarse gravel, and now in a bed of boulders from six inches to five or six feet in diameter, with occasional strangers ten to twelve feet across.

Curious bed of boulders.

On the upper part of Section 5 there is a curious exhibition of boulders, as shown in Fig. 2, in which we have a view of a section at right angles to the channel, as cut for a pumping station. In this view are shown the distance and depth of a deposit of large boulders where the soil has been removed from the deposit of glacial drift.

Boulders pitted as if with smallpox.

Here, and in many other places, is seen a very peculiar appearance of the limestone boulders — as if pitted with smallpox. A careful observation will show that where these boulders have been partially buried in the drift and have remained undisturbed they are largely free from this marking except on the exposed surface. This is supposed to be due to the action of chemicals (carbonic acid, probably) in the water of the post-glacial lake, eating out the softer parts of the rock when they are not protected by being buried. In many cases the line of demarcation is very clearly drawn.

Tenacious boulder drift.

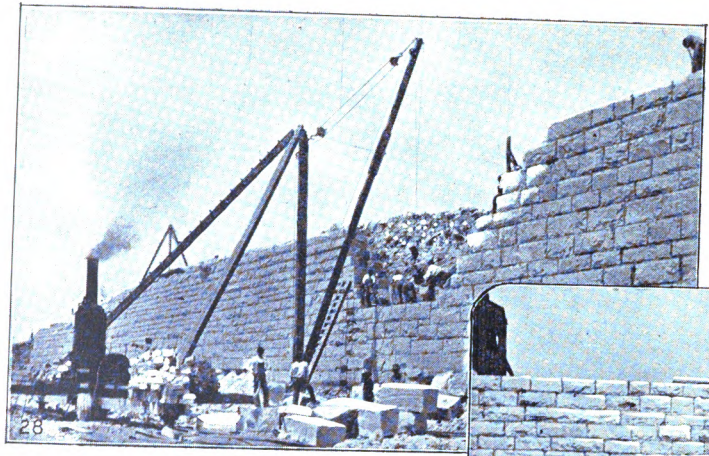
The tenacity of this boulder drift is worthy of note. It looks coarse and as if it could be easily disintegrated, but in fact has very often to be blasted before it can be worked with a steam shovel.

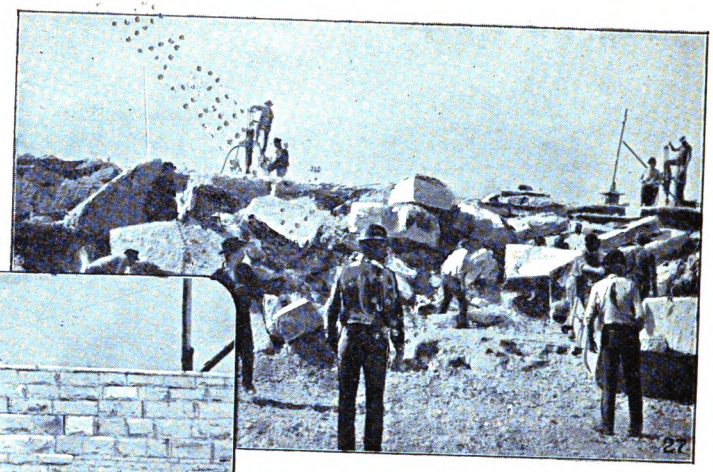
Bunches of flint in the limestone.

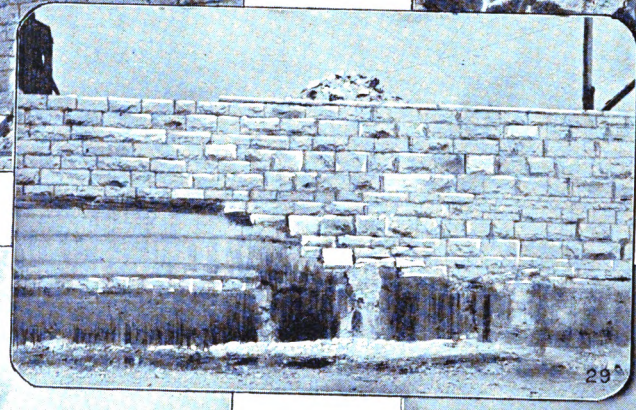
Another interesting peculiarity of many of the limestone boulders is that they are filled with bunches of flint in a manner not unlike the chalk beds.

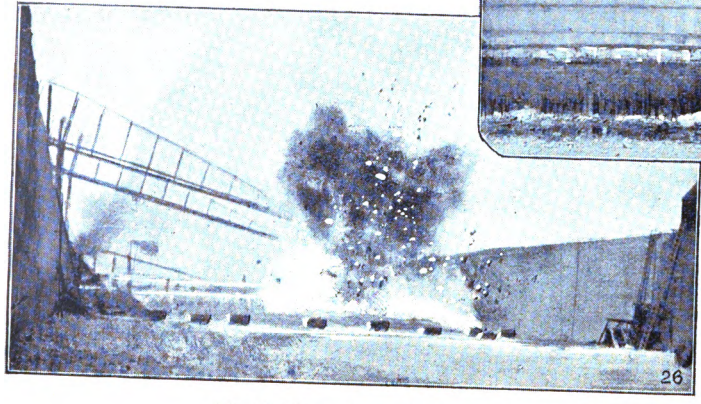
Silurian fossils to be obtained on Sections 5 and 6.

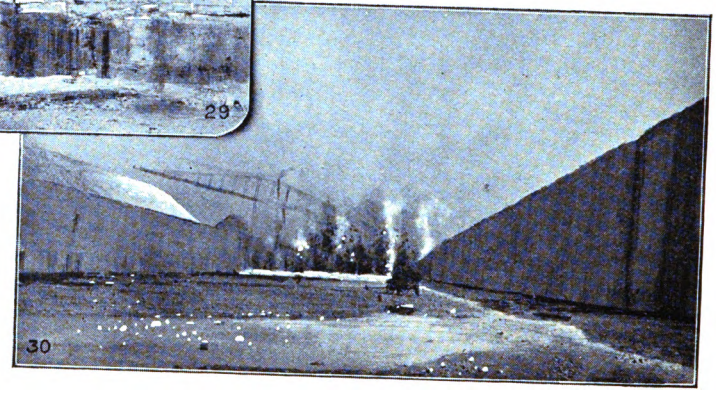
On Sections 5 and 6 may be observed the process of quarrying the lower layers of rock, which are here solid enough to use in the retaining wall. On these sections and No. 7 there are also to be found some very fine specimens of trilobites, brachiopods and crinoids. Occasionally an orthoceras, or straight-shelled nautilus, comes to view among the boulders and in the bed rock. Very often these specimens can be purchased for a small sum from the workmen who have found them in the rock upon which they have been working. In many cases may also be seen what are probably the tracks of ancient worms, printed between the layers of limestone as they are taken out of their bed.











28. Building the retaining wall.

26. A blast.

29. Retaining and rock wall showing break in rock layers.

27. After a blast.

30. Full depth and width of channel in rock c

On these sections the glacial scorings, which have been more or less apparent on all the surface of the rock whenever laid bare, are very marked, and rendered peculiarly interesting from the fact that on these sections is shown the point of junction of the glacier which came down the main channel and the one which came down the Sag Valley. Upon the same bed of rock the two glaciers had, apparently with alternating force, plowed deep furrows from 4 to 24 inches in depth, and left smaller striæ or scratches upon the smoothed surface. These markings seem to show that the predominant force was at one time from one glacier and again from the other, while, anon, the two combined, as the scorings seemed to be a resultant of the two forces exerted in the two valleys.

The point of junction of two glaciers.

Both glaciers left their marks.

On the upper part of Section 7 is added a curious feature to these scorings. The rock has been deeply grooved, and then subjected to water action (probably for the most part chemical), somewhat similar to that described on the previous page, and present the appearance of a series of parallel mountain ranges whose crest has not yet been divided into peaks.

Glacial scorings eaten by water into curious forms.

On the sections (1 to 6) where the channel is cut through rock overlaid with drift, may be seen sudden disappearances of strata, as in Fig. 29. These strata seem to indicate a variation in the effective force of the glacier within the limited range of these manifestations.

Strata skipped by the glacier.

In other places, for a thickness of from two to seven feet, the surface strata are crushed as if they had been gone over with a heavy roller, the weight of the superincumbent mass being apparently sufficient to crush the rock, while the efficient force of the stream was not sufficient to do more than, perhaps, slide the strata over the lower layers for a short distance, and then leave them.

Strata crushed by the glacier.

On these sections, also, are to be seen the irregular, mixed up masses of drift mentioned on page 5, which were apparently *dumped* promiscuously by the glacier in various parts of its course as it was retiring from business.

Irregular dumps of glacial drift.

It may not be out of place, at this point, to emphasize the fact, without making invidious comparisons, that most of the geological features and many of the mechanical features described in the account of these sections (particularly 2 to 7 and B to F) are accessible *only by the Chicago & Alton Railroad*, or by carriages.

These interesting features seen only by those who go on the Alton or by private conveyance.

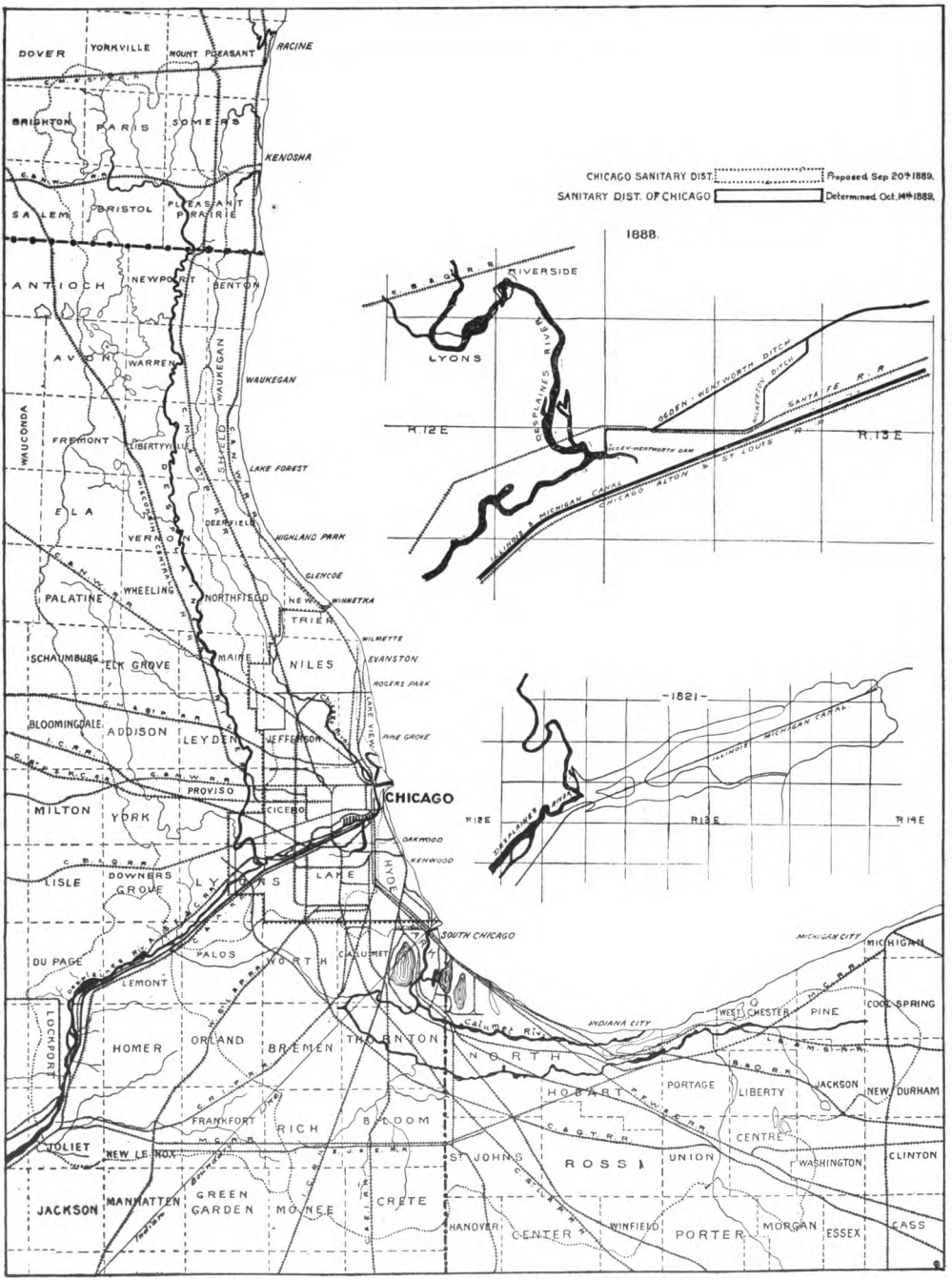
To the thoughtful observer there is great interest in even the passing view of the records left by these stupendous prehistoric forces to show what they did, and how.

In the upper part of Section 8, where the rock comes to the surface, the channel crosses the old river bed and shows numerous "pot holes," where pebbles and stones have dropped into cavities in the rocky bed, and, being whirled about, have worn deep round holes in the rock. These pot holes are quite numerous in the margin of the channel at this point.

From here the entire work of the channel is in rock and has been prosecuted so vigorously that this portion of the canal is likely to be the earliest completed. On sections 10 to 14 the interesting feature of the work is the giant cantilevers or conveyors which remove the material from the channel with a marvelous facility.

In reading this description of the interesting things to be seen along the canal it may be well to remember that no one can possibly *see* this canal in one day, or in two, but if one visit only can be made, that visit should without fail include the geological features between Sections 4 and 6, reached only from Sag Bridge Station on the Chicago & Alton Railroad, an intelligent survey of the like of which has never before been possible within such limits of space and time, and (as soon as the canal is completed) probably never again will be.

Canal too great an enterprise to see in one day.



DRAINAGE BASINS OF THE DESPLAINES, CHICAGO, AND CALUMET RIVERS.

The two smaller maps are fully explained in the text

It would be unjust to close this account of the canal without paying more definite tribute to the energy, sagacity, and fidelity of the Trustees of the Sanitary District.

Tribute to the Drainage Board.

Whatever differences of opinion may exist as to matters of policy—and it is impossible, in an undertaking of this character and magnitude, that differences should not occur—these men, as a body, have done their duty well, supported by a corps of well-selected assistants, and deserve the thanks and approval of the community. Especially, also, should the people express hearty approval of all measures tending to establish upon a solid footing, and with the broadest scope, that double project, the Sanitary District of Chicago and the Great Waterway from the Lakes to the Gulf.

SPECIAL EXPLANATION OF SOME OF THE VIEWS OF THE DRAINAGE CANAL.

For views 2, 3, 7, 12, 17, and 24, we are indebted to Mr. John F. Geiger, photographer, of Lemont, Ill., who makes a specialty of views of the Drainage Canal, and whose later views are copyrighted.

For the other views we owe hearty acknowledgment to the courtesy of the Trustees of the Sanitary District, from whom, through Ex-President Wenter, we were able to secure the interesting assortment here presented.

Thanks are also due to the members of the engineering department for many courtesies, and especially to Assistant Engineer T. T. Johnston, who has kindly furnished his criticisms upon the maps and description here presented.

Fig. 1. Shows the irregularity of the deposits left by the glacier. The layers of sand, gravel, and boulders are much confused, large boulders being often found in the midst of a bed of fine sand.

Fig. 2. The same conclusions are reached from this view. The surface and section of this bed of boulders, which extends an equal distance in the rear of the observer and down to bed-rock, just as it has been uncovered of 2 feet of soil, contrasts strongly with the section seen at the left, in which are very few boulders.

Fig. 3. These boulders, lying upon bed-rock and covered with a water deposit of clay-peat, thinly overlaid with soil, give evidence, by their sharp angles, that they have been carried a comparatively short distance.

Fig. 4. Of these two boulders the larger is of native limestone 12 feet in length and weighing, probably, 25 or 30 tons (the boulders were surrounded by a layer of peat in the bed of the post glacial lake), and is very much water-eaten. The background shows a section of this peat layer which was 10 or 15 feet thick.

The smaller boulder is of granite, weighing 7 or 8 tons, smoothed and scored by glacial action (also somewhat affected by water), and now forms the capstone of the Alton's Marquette Monument at Summit. These boulders are only two of many equally large in the same locality.

Fig. 5. The two upper strata of bed-rock, about 2½ feet in thickness, give evidence, by their crushed condition, of the enormous weight that passed over them. In other places these crushed strata are over 7 feet thick.

Fig. 6. In this view is shown the parallel grooving of the glacier supplemented by the action of the water and the peat-bed, which overlay the surface of the rock. In some places these ridges are so much eaten as to resemble a chain of mountains whose ridge has not yet been broken into peaks.

Fig. 7. A portion of the bed-rock on Section 5, just laid bare and washed (several little pools of water are still visible in the hollows), to show three deep glacial grooves. The rock is very smooth throughout, with scratches on the surface that do not appear in the picture. The observer is looking up the valley of the channel, while the grooves come from the direction of the Sag Valley, making a turn just at the point of exposure. On some rocks which have been preserved, the marks of both glaciers are plainly visible. Unfortunately, the cracks made by the previous blast (one of them showing in the view) prevented the preservation of the rock.

Fig. 8. Bed-rock showing fine glacial scratches upon the smoothed surface of the limestone rock. To the left are the remains of a still higher layer of rock, which had been only partially removed by the glacier. In the background is the irregular glacial drift.

Fig. 9. The Spillway. It faces east, and is just off the main channel of the Upper Desplaines. In the extreme left is the river. To the right, below the dam, is the channel to Mud Lake.

Fig. 11. The endless rubber belt is connected with a pulverizing apparatus, into which the steam shovel dumps the lumps of clay, while workmen also load the belt along its course across the channel.

Fig. 12. A pair of dump bridges on a section east of Summit. One section of the channel is excavated, and the cars filled by the shovel are hauled onto the bridge and dumped. The next section is treated likewise with the other bridge. The channel here, as all the way east of Summit, is 110 feet wide at the bottom.

The bridges, like all the other apparatus for conveying out of the channel, rest upon trucks which move upon parallel tracks along the bank, rendering the whole apparatus adjustable to the work in the channel.

Fig. 13. Shows an immense steel frame, over which passes an endless chain of iron pans across the bed of the channel. A plow, pulled by cable and controlled by ropes, cuts off the clay above the pans. This falls or is pushed into them and is carried to the end of the framework, where it is dumped.

Fig. 14, represents a mud pumping apparatus called the hydraulic dredge. The rapidly revolving screw, shown in the left, is let down into the water, and stirs up the mud (in this case the peat of the post glacial lake) pumping it through the pipes to the other end of the boat and into scows, or through long pipes on to the surrounding country, for a distance of 3,000 feet. A farm of 160 acres has been made by the Sanitary District out of this material.

Fig. 15. Levee between the two channels, in process of erection, the material dumped along this levee, sinking by its great weight into the soft peat, was forced out laterally into the soft peat and then upward until it appeared, boulders and all, in the middle of the river channel.

Fig. 16. The material taken out by the steam shovel is here placed in a car at the bottom of the incline. This is hauled to the top of the incline by a cable, and dumped by a frame as shown in the cut.

Fig. 17. In this case, the cars are brought by horse power along the bottom of the channel to the foot of the dump where they are drawn up by cable and removed to the "spoil bank," or oftener to the levee between the two channels.

Fig. 18. A strong wire cable is stretched across the channel from two frame towers which are heavily ballasted with rock, and arranged on movable trucks along the bank. By means of pulleys which run along the main cable, and are controlled by the smaller cables, a large pan, or skip, is lowered into the channel and loaded.

Fig. 19. Shows the "skip" of the cable conveyor, the pulleys by which it is hoisted and controlled, and the "carriers" on the main cable. The "skip" will carry a load of 5 tons.

The whole apparatus is controlled by cables wound over a series of "drums" in the engine house, each one giving a certain motion to the "skip." A man in the channel gives electric signals to the engineer, and he operates the whole machinery without seeing any of the work. The "carriers" along the main cable are to hold the smaller ones in place.

Fig. 20. The "spoil" is here hoisted by a derrick, and emptied into a car on the incline which is hauled up by cable and dumped automatically.

Fig. 21. The revolving derrick is peculiar in having a double arrangement by which one load is being taken on while the other is being dumped.

Fig. 22. These expensive and interesting pieces of apparatus are made of steel, the two largest costing $28,000 each.

They are operated on the same general principles as the cable conveyors, the

chief difference being, that this is a more expensive structure of steel, with a track on which the pulleys move instead of a suspended cable.

Fig. 23. One of the most interesting pieces of machinery to be seen on the canal is the steam shovel, and the best place to see this is in the boulder drift, Sections 1 to 6.

Fig. 24. The channeling machine works by steam upon a track laid along the edge of the rock channel. With a long heavy chisel, shaped at the end like a letter Z, it cuts a groove in the limestone nearly three inches wide, and as deep as needed, ordinarily 10 or 12 feet. This cut makes a smooth wall for the channel, and prevents injury to the sides from blasting.

Fig. 25. After the channeling machine has cut down the walls along the side of the channel, holes to the same depth are made across the channel by steam or compressed air drills. When the holes are of the required depth, they are charged with dynamite, and fired by electricity as shown. The vertical streaks on the walls of rock cuts on the canal are caused by iron stain from the many small streams of water that seep through between the upper strata of rock.

Fig. 26. This magnificent view of a blast, in which 500 pounds of dynamite were fired at once, was taken by photographer Grant of the Sanitary District at the extremely dangerous distance of 300 feet, though partly sheltered. A blast is a very interesting sight, but is best seen at a safe distance.

Small stones from a blast, too small to be seen, and therefore more dangerous, have proved fatal at a distance of 1,500 feet. In this view can be seen the shadows, on the rock wall, of the stones as they fly.

Fig. 27. This view shows the condition of the rock after explosion, and tells better than words of the power of this modern servant of man. Upon one section, in one month, nearly 75,000 cubic yards of solid rock were removed.

Fig. 28. Laying the "Retaining Wall" on Section 5, to complete the rock wall where insufficient. This is a sample of the work on Sections 1 to 6.

Fig. 29. This view shows a drop, in the layers of rock, due to a variation in the erosive force of the glacier which passed through the valley. In some parts of the channel (Sections 5 and 6), this condition is often due to the work of the Sag Glacier acting diagonally to the one in the upper valley.

In some places the displaced rock has been moved so slightly that its origin was easily found, while the empty space was filled with clay and gravel.

Fig. 30. Full depth and width of channel in rock cut. The top is 162 feet wide, six inches on each side being taken up by each offset in the wall made by the channeling machine. The three layers of the work in the 30 to 35 feet of depth are shown on the wall. On the left is the spoil bank, and, in the distance, a blast and a large cantilever.

Those who are interested in the geology of the Drainage Canal will be pleased to learn that Mr. Chas. H. Ford, Principal of the Calhoun School, Chicago, has preserved a large collection of photographic views illustrating the interesting geological features of the excavation, and especially the glacial phenomena exposed, and will be able to supply copies to those who desire them.

FACTS WORTH NOTING.

Sanitary District Organized			Jan. 18, 1890
First Ground Broken			Sept. 3, 1892
Length of Channel			28 miles
Width of Channel	Rock Cut		160 feet
	Earth Cut		(bottom) 202 feet
	Side Slopes		2 to 1
Depth of Channel			30 to 35 feet
Length of Diversion Channel (artificial)			13 miles
Width of Diversion Channel			(bottom) 200 feet
Cost of Diversion Channel			nearly $1,000,000
Length of Levee			19 miles
			Cubic Yards
Volume of Excavation	Main Channel	Rock	12,071,668
		Earth	26,077,765
	Diversion Channel	Rock	258,926
		Earth	1,564,403
Retaining Wall			384,958
Capacity of Channel per minute			600,000 cubic feet
Velocity of Current per hour			(maximum) 3 miles
Dip of Channel	Earth Cut		1⅜ in. per mile
	Rock Cut		2¾ in. per mile
Length of Spillway			397 feet
Height of Spillway above datum*			16¼ feet
Height of Spillway above Sea Level			579.61 feet
Number of Men Employed			about 6,000
Average Daily Amount of Material Removed			60,000 cubic yards
Present Monthly Amount of Material Removed			1,514,574 cubic yards
Probable Date of Completion			Early in 1897
Estimated Cost			$29,000,000

* Datum is low water mark of Lake Michigan in 1847.

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REASONS WHY

1st. Because i
logical features, som

2d. Because it
esting mechanical de

3d. Because i
boulder drift.

4th. Because it is the **only** line which enables visitors to see t
"retaining wall" on Sections 1 to 6.

5th. Because each visitor to the Canal via the **"Alton"** receives o
of these beautiful and instructive aids to the study of the Canal, as a souve
of the visit.

6th. Because it is the **only** line reaching the landing place of Fath
Marquette, 1675. See engraving, on front cover, of monument erected by t
Chicago & Alton Railroad, 1895, to commemorate this event.

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