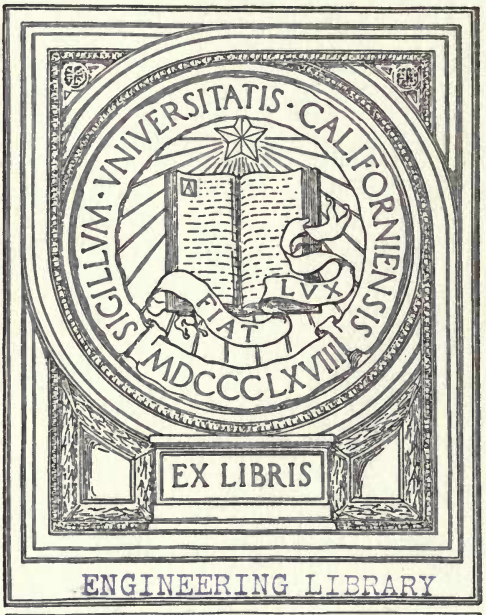


THE ELLSWORTH DAM

Ambursen hydraulic construction company.

THE ELLSWORTH DAM

ON THE

UNION RIVER

AT

ELLSWORTH, MAINE

PROPERTY OF THE

Bar Harbor and Union River Power Co.

ELLSWORTH ∴ **BANGOR**

Maine

Dams

Bar Harbor and Union River Power Co.

PRESIDENT

John R. Graham

CHIEF ENGINEER

James A. Leonard

CONSULTING ENGINEERS

Sellers & Rippey

DAM DESIGNED BY

Ambursen Hydraulic Construction Co.

CONSTRUCTORS OF ENTIRE DEVELOPMENT

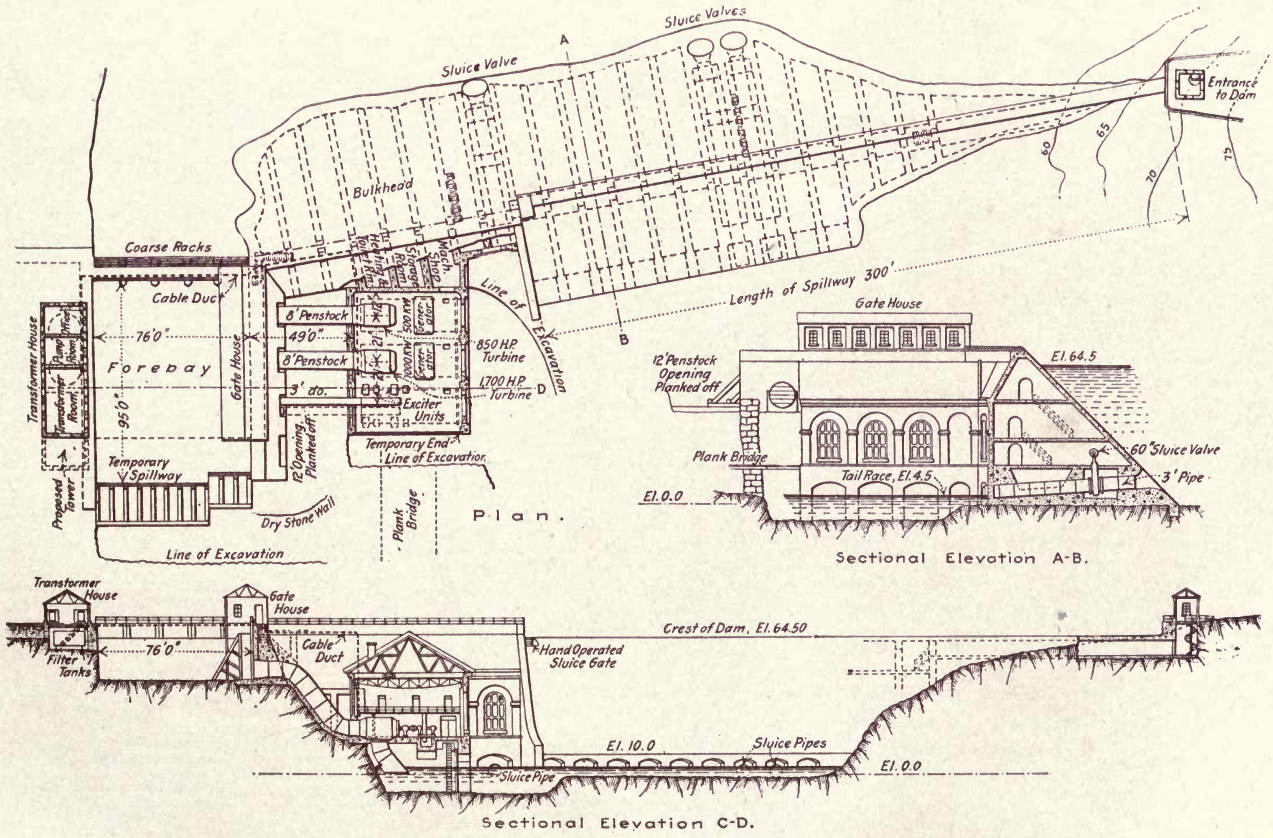
Ambursen Hydraulic Construction Co.

SUPERINTENDENT OF CONSTRUCTION

John A. Kellogg

Height of Rollway	65 feet
Height of Bulkhead	72 feet
Length of Rollway	275 feet
Length of Dam over all	500 feet

The cut on the opposite page is the original lay-out of the development

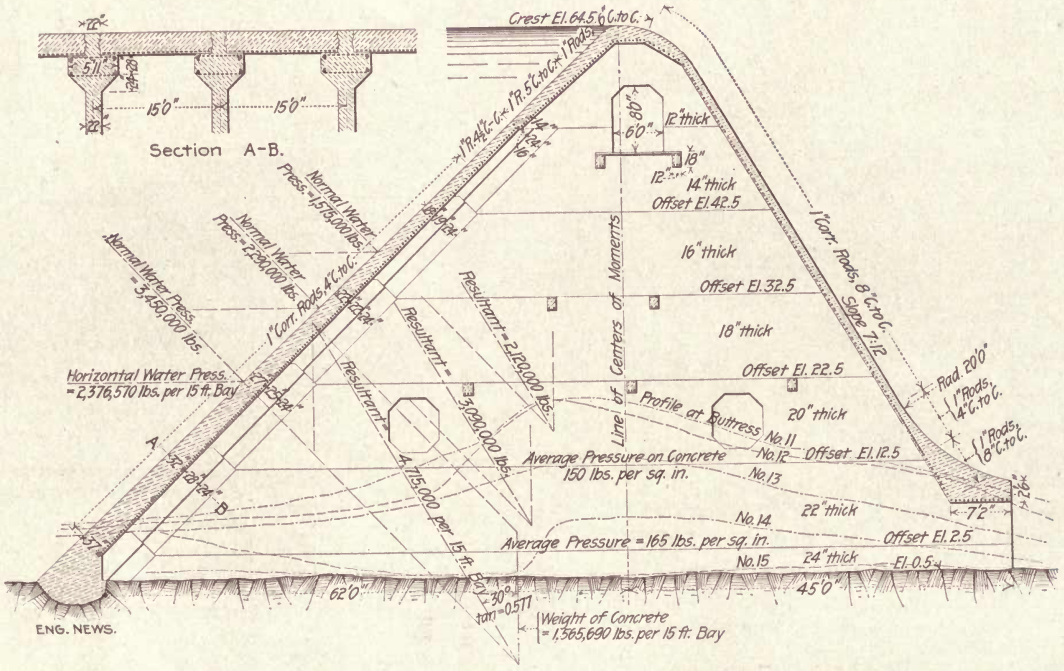


BAR HARBOR & UNION RIVER POWER CO.

ELLSWORTH, ME.

SELLERS & RIPPEY,
CONSULTING ENGINEERS,
PHILADELPHIA, PA.

J. A. LEONARD,
CHIEF ENGINEER.


Section A-B.
Crest El. 64.5
1" Rods, 6" C. to C.
1" Corr. Rods, 8" C. to C.
Slope 7:12
Normal Water Press. = 1,515,000 lbs.
Normal Water Press. = 1,290,000 lbs.
Normal Water Press. = 3,450,000 lbs.
Horizontal Water Press. = 2,376,510 lbs. per 15 ft. Bay
Resultant = 3,900,000 lbs.
Resultant = 2,820,000 lbs.
Resultant = 1,715,000 per 15 ft. Bay
Line of Centers of Moments
Profile at Buttress
12" thick
14" thick
Offset El. 42.5
16" thick
Offset El. 32.5
18" thick
Offset El. 22.5
20" thick
No. 11
No. 12
Offset El. 12.5
No. 13
22" thick
No. 14
Offset El. 2.5
No. 15
24" thick
El. 0.5
Average Pressure on Concrete 150 lbs. per sq. in.
Average Pressure = 165 lbs. per sq. in.
Rad. 20'0"
1" Rods, 14" C. to C.
1" Rods, 18" C. to C.
Weight of Concrete = 1,365,690 lbs. per 15 ft. Bay
tan = 0.577
ENG. NEWS.

January 1, 1908

THE beginning of the new year inaugurates the production of electric power at Ellsworth, Maine, by the Bar Harbor & Union River Power Co.

We beg to present in the briefest possible manner and more by the aid of pictures than by words, a review of the work upon this development during the year 1907, for it is very seldom that a company can plan a work of this magnitude, execute contracts and complete the entire development within the space of a single twelvemonth.

The perfected plans were not in existence January 1, 1907. It was about a year ago that orders were given to the Engineers to put plans and specifications into proper form and let contracts.

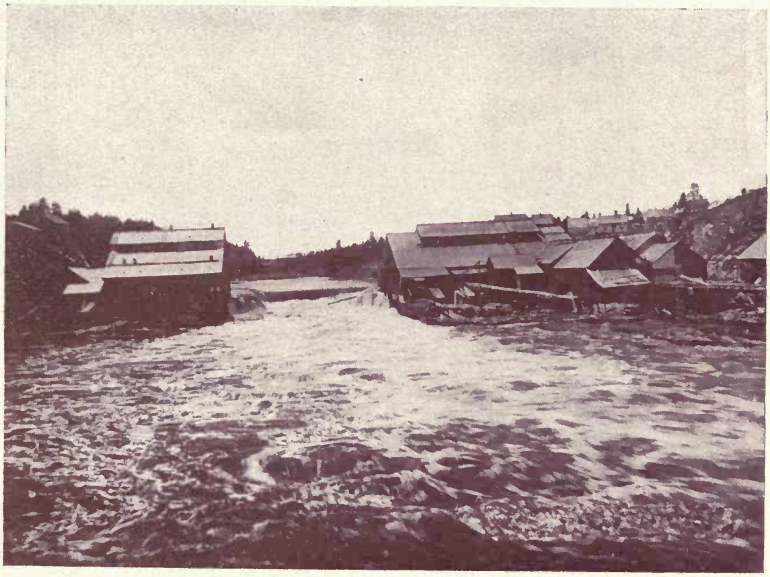
We signed on February 9th the contract for all of the construction work required on this development, based upon the plans as shown on page 3 together with our own designs for the rollway and bulkhead of the dam required. On the opposite page is a cross section of the rollway.

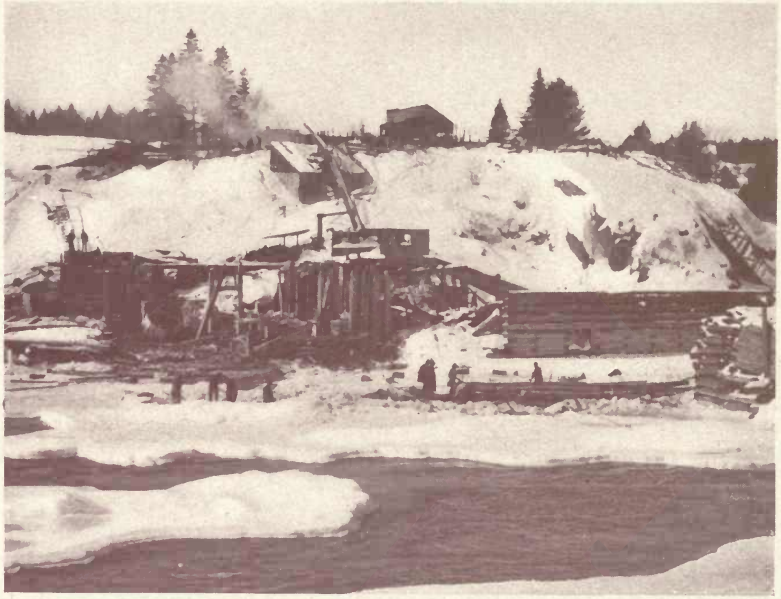
On the 10th day of February, 1907, our superintendent arrived at Ellsworth and the construction plant was ordered forward on the same day. Since that time the work has progressed in the manner indicated by the following pictorial record.

AMBURSEN HYDRAULIC CONSTRUCTION CO.

176 Federal Street
Boston, Mass.

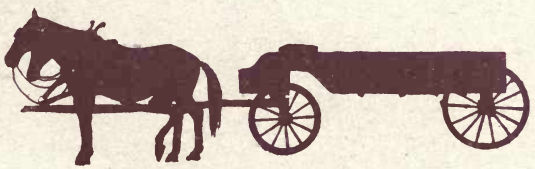
THIS photograph was made when the river at this site was being used to develop power for a saw mill. When the construction for the present development was started the building shown on the left was standing but the buildings on the right had been almost entirely removed.





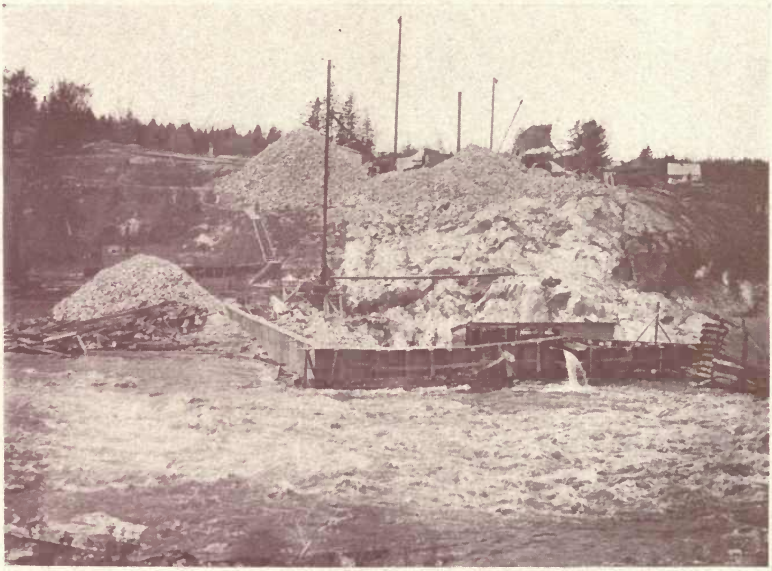
THE months of February and March were very cold and stormy. Snow was on the ground and at times to the depth of three feet. Consequently very little progress was made excepting in the building of cofferdams, which were easily handled through the ice, and in the erection of necessary buildings for storage and for the convenience of laborers. The construction plant was also received and set up and by the first of April the ice had gone out of the river and the site had been practically cleared.

These photographs show the building of the cofferdam and that portion of the site where the power house is to be erected at about the point covered by the building shown in the preceding picture.



May 15, 1907

FROM April 15th the work was concentrated on the foundations for the power house where it was necessary to excavate 3,000 yards of solid rock before any concrete could be laid. This work proceeded by day and night, the stone being broken and piled up for use in future concrete.

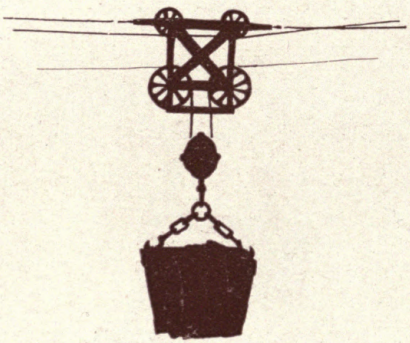


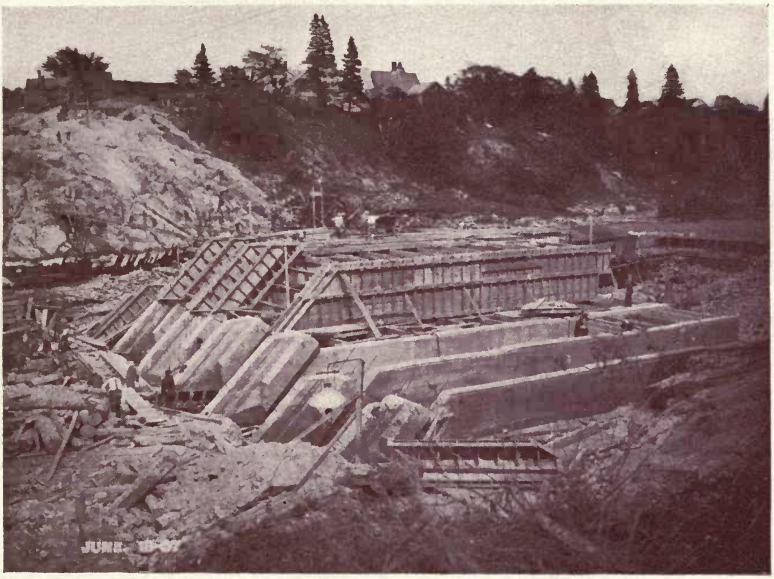
HERE is shown the condition of the work on June ninth. On this day the excavation for the power house being complete and the preparations of the foundations for the dam being in order, concreting was begun.

Notice upon the hill and on the downstream side of the cofferdam, the piles of broken rock which are stored ready for the crusher. A reference to the ground plan of this work on page 3 will show how narrow and constricted was the site, there being little opportunity for convenient storage elsewhere. These stone piles are directly upon that portion of the site where later the forebay must be excavated.

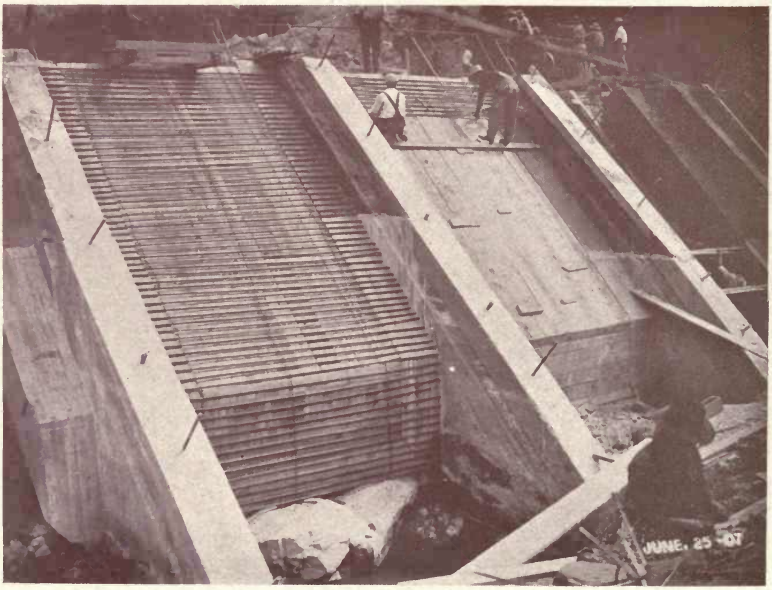
June 18, 1907

NINE days ago the first concrete was laid. Today we show the work completed to this stage, both views being taken inside the cofferdam; No. 1 looking downstream and No. 2 looking upstream. Both of these pictures show the movable sectional forms in place and No. 1 shows the enlargement of the buttresses into haunches, supporting the deck plate, which is put on later.

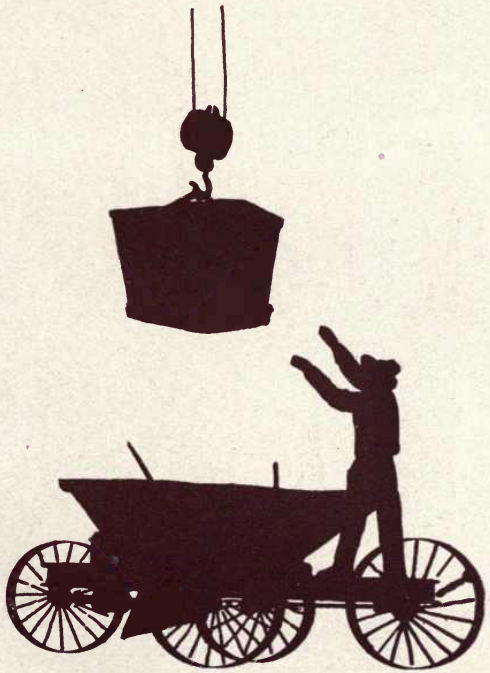



JUNE. 18-07


JUNE. 18-07


JUNE. 25 '07

SHOWING haunches on the up stream side of the buttresses. Notice in No. 2 the steel reinforcement being put in place and preparations being made for the placing of the deck slab, the varying thickness of which diminishing from the bottom to the top of the dam, is shown in the decreasing guage of the projecting rib.

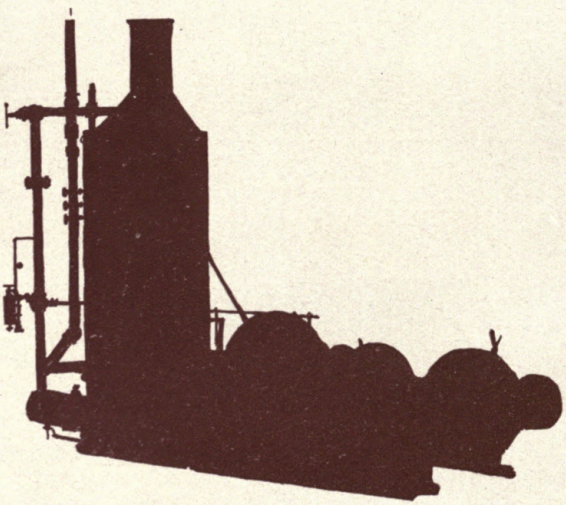


July 2, 1907

THIS section of the dam is now 32 feet in height and the deck slab has been put in place for 20 feet above the bottom. In the upper picture 10 feet of the bottom of the dam is hidden behind the cofferdam.

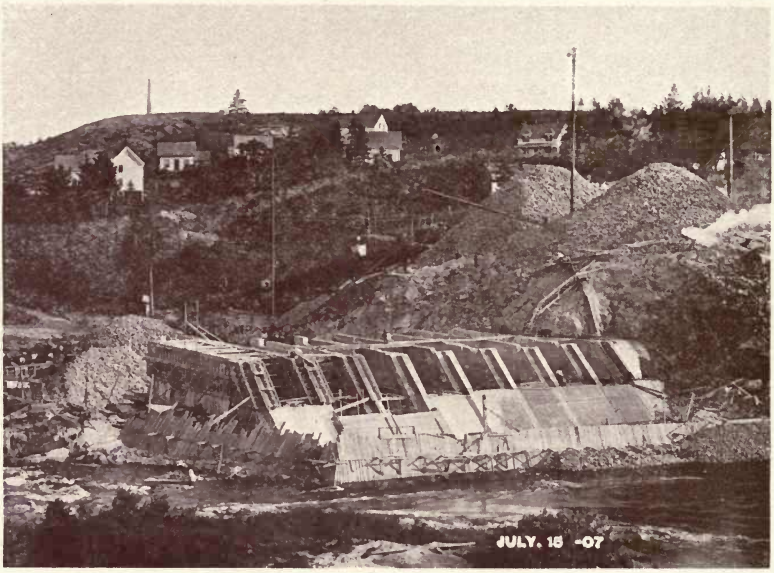
The lower picture is taken within the cofferdam, and shows one of the piers of the power house being put in place in front of the bulkhead section of the dam.

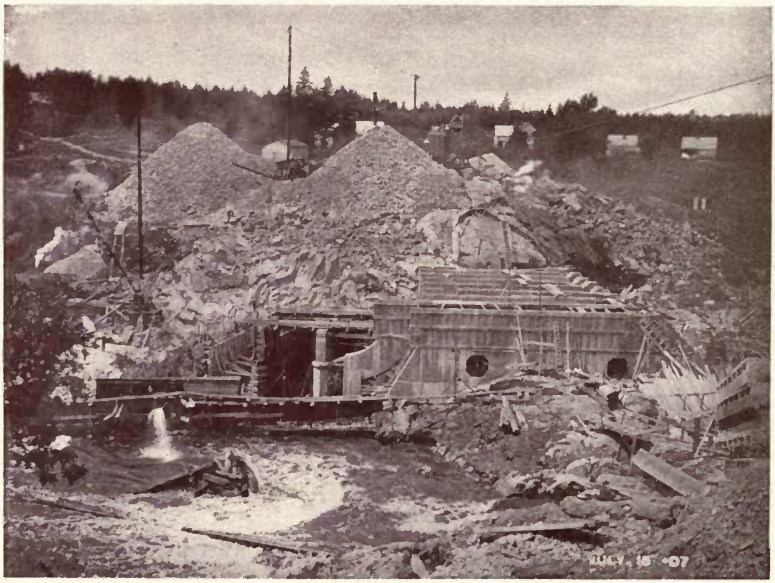
Twenty-four days have elapsed since the first concrete was laid.




JULY. 2 -07

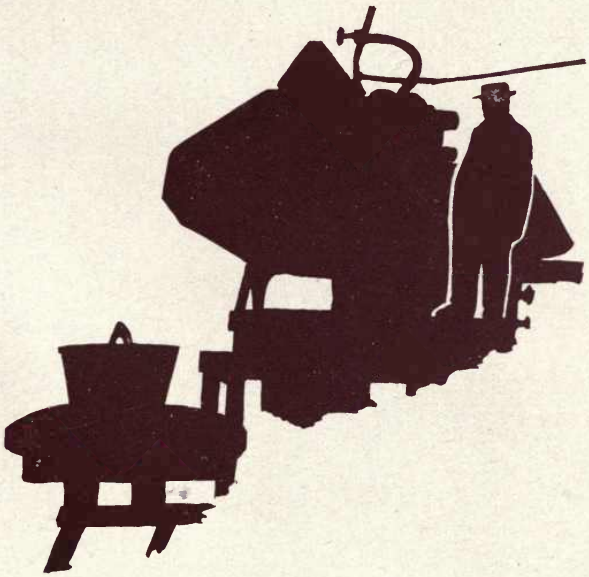

JULY. 2 -07


JULY. 18 -07


JULY. 18 -07

THE finished work is now to the 42.5 level but all of the concrete is not in the dam itself. The power house foundation piers are progressing and two of them are shown completed and on the third the forms are ready to be filled.

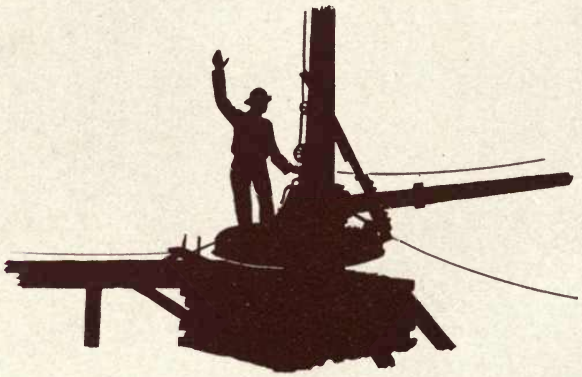
You will notice that the stone piles are diminishing and that the time necessary to reach this point has been thirty-six days.

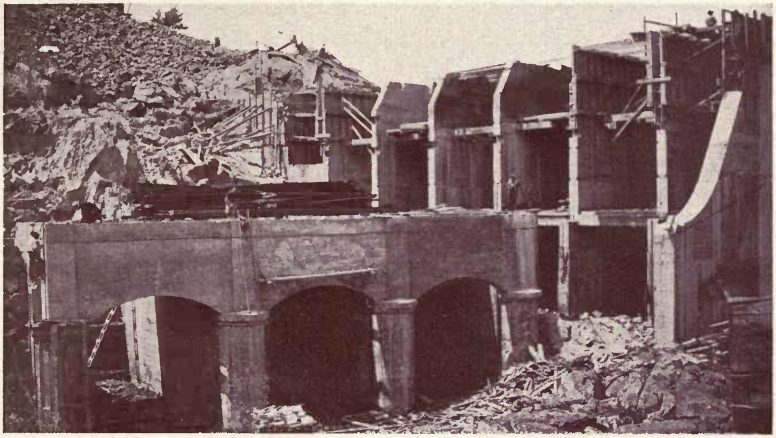


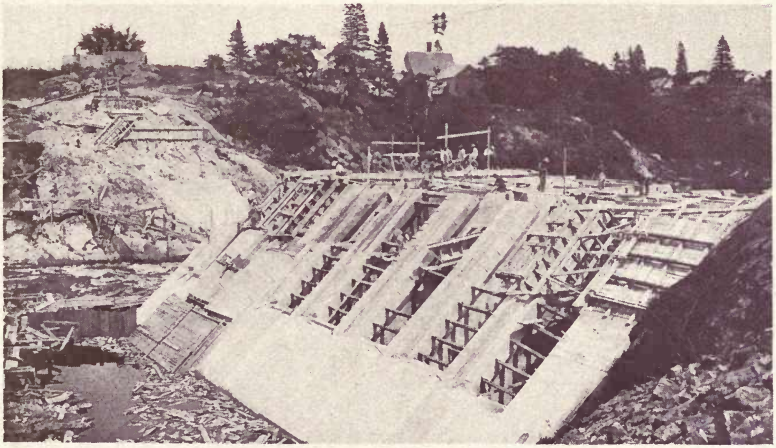
August 1, 1907

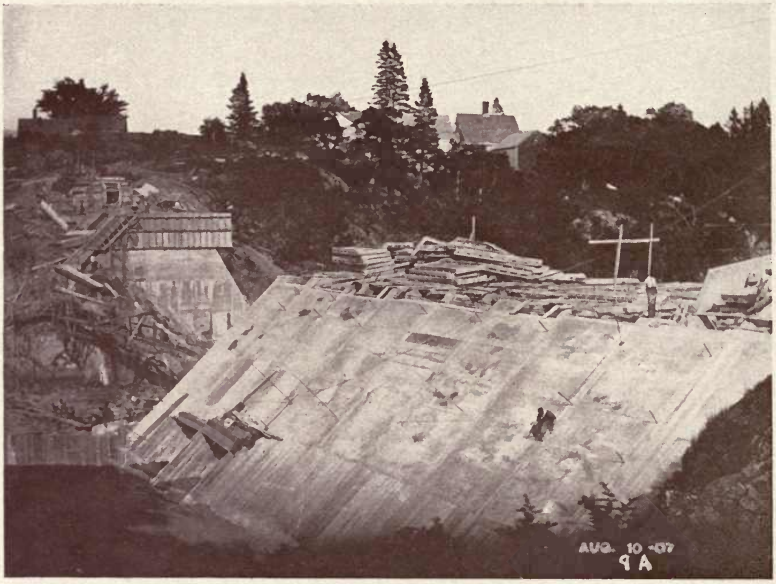
CONDITION of the work August first — fifty-three days. The work is now just beginning on the eastern bank of the stream.

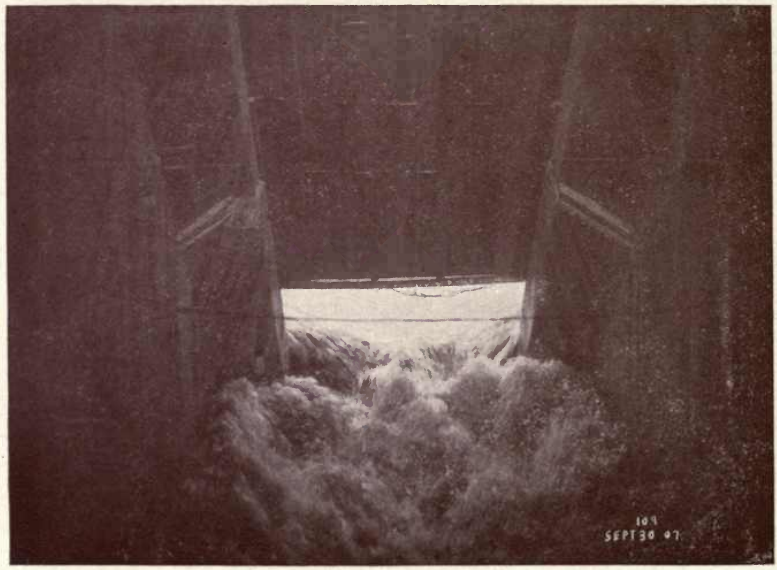
Note the openings in the dam which are here shown covered by timber through which the river must run when the cofferdam is removed and the river turned. On this date a little more than one-half of the yardage of concrete for the entire work is in place.








AUG. 10 -07
9 A


109
SEPT 30 07

August 10, 1907

ALTHOUGH the date shown on this picture is the tenth of August, the exposure was made on the seventh of August, six days later than that on the preceding page.

Here is shown the timber work removed from the openings and the river running through.

The cofferdam was removed and the water turned on Aug. 4th — fifty-seven days after laying the first concrete. Note progress of the buttresses on the eastern bank.

The second picture shows the inner side of the deck. After four months the edges of the concrete were as sharp as shown today notwithstanding the constant abrasion of the water.

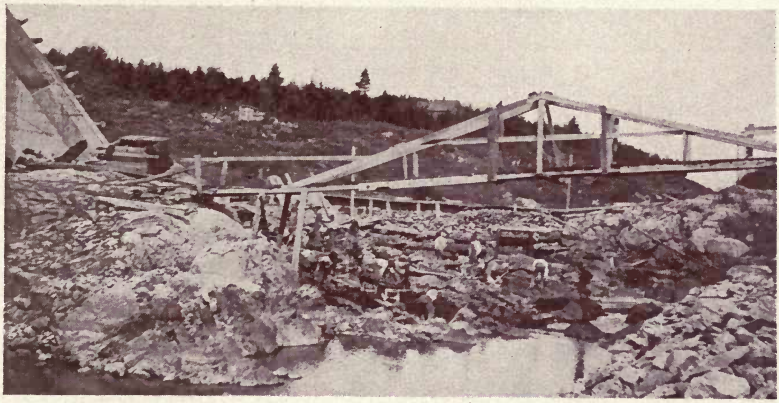
September 7, 1907

DURING the latter part of August the necessary excavation for foundations for the dam were prepared on the eastern section. Meantime the western section had been pushed up to level 52.5.

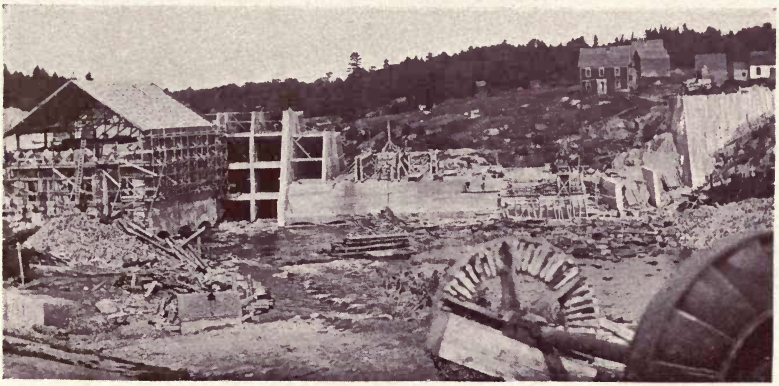
On September first the condition of the eastern section was shown in the first picture.

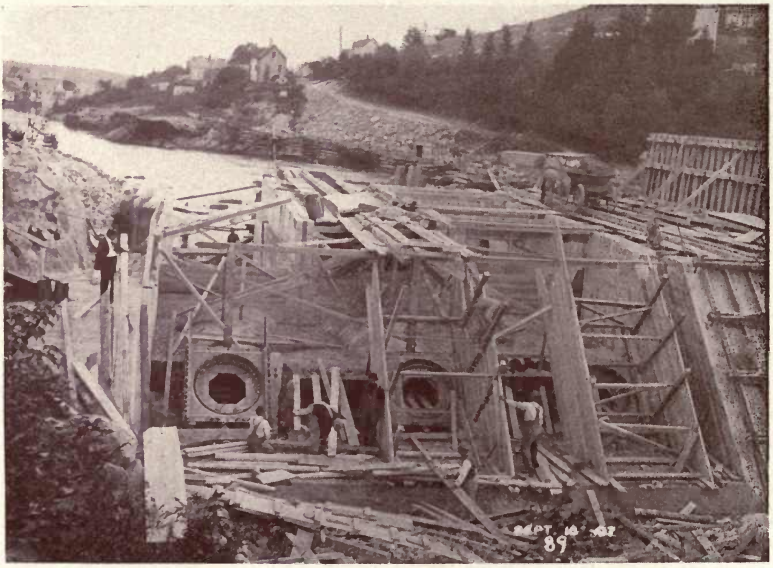
Seven days later the buttresses are up to their first level as shown in the second picture.

The entire dam is shown in the third picture looking upstream.




SEPT. 7 -07

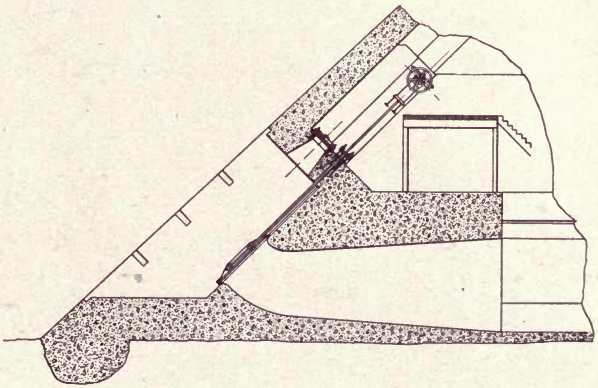




TWO views looking up stream showing the forms for waste way near the eastern bank. In No. 1 you will notice that there is a rabbet in the buttresses to receive a floor over the waste way, in order that when the gates are open the waste water can not interfere with the passage-way through the dam, which is seen above the floor level.

In the second view the forms are partially embedded in the concrete and the guides for the waste gates are in place.

These gates are operated from the interior of the dam as shown in the detailed sketch below.

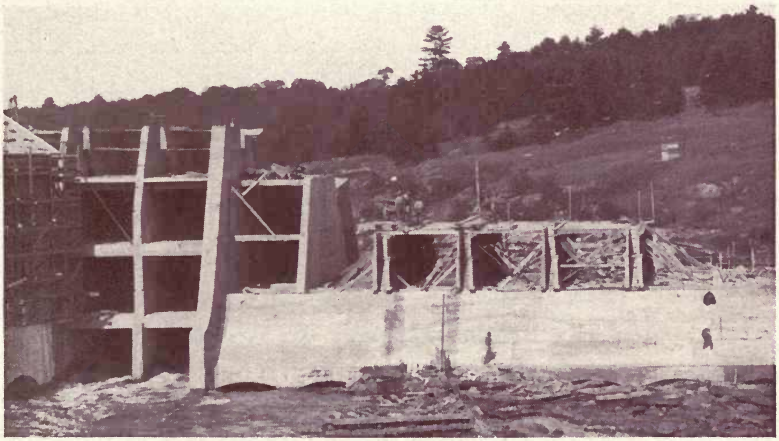


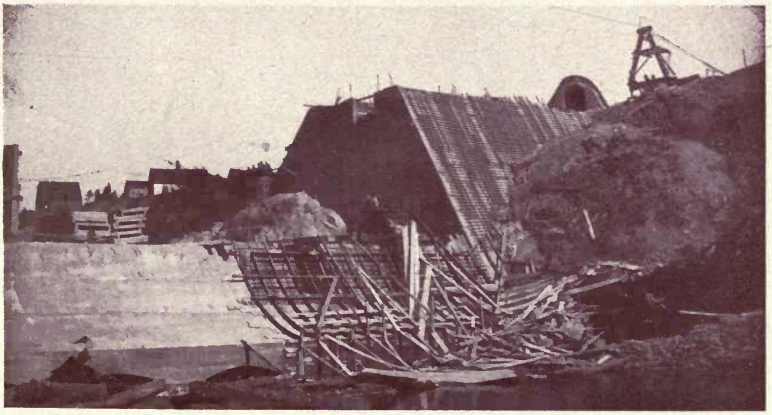
THESE three views taken together show the entire structure. In the first one note that the foundations for the canal wall are completed. 1500 yards of concrete were used here.

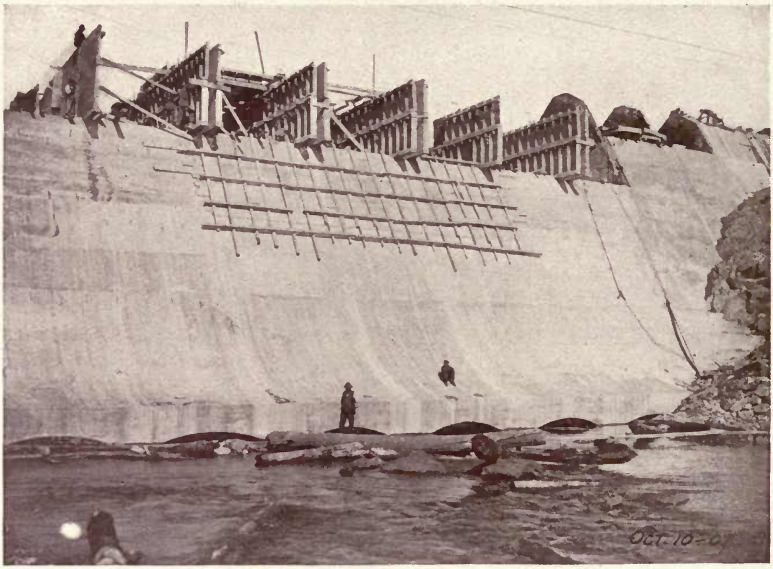
The power house, which is built of concrete blocks on a steel frame, is nearly completed and the concrete roof is being put on.

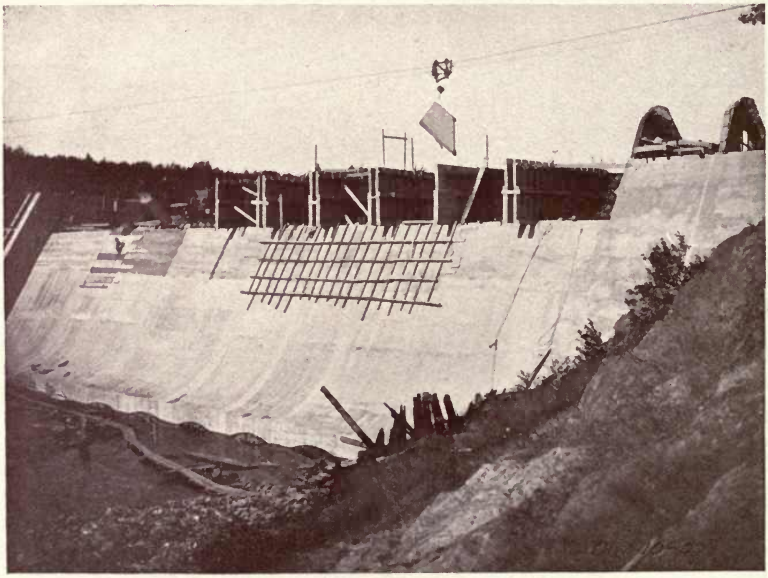
The bulkhead behind the power house is at 62.5 and the lower slope of the rollway section shows the curve of the bucket.

The extreme eastern section shows the reinforcing steel in place and a little of the crest shows at the extreme right.






Oct 10-07



October 10, 1907

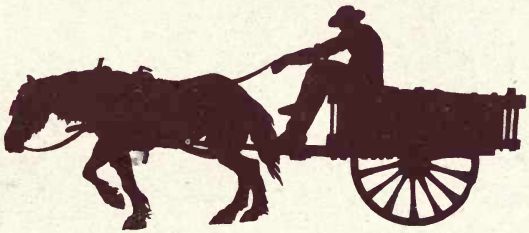
WORK has been concentrated upon the rollway of the dam and in the past twenty days the buttresses, the deck and the apron have progressed to this stage.

The first view is looking toward the east and the second is taken from the eastern bank looking toward the west.

Note that some of the buttresses are up to the level of the rollway — 62.5.

Note also the method of handling the sectional forms by cable way.

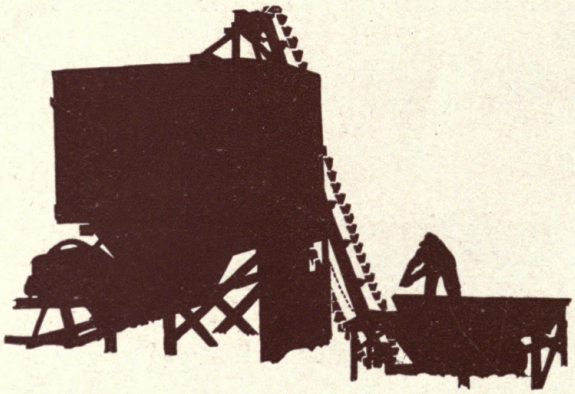
Both of these views are looking upstream.

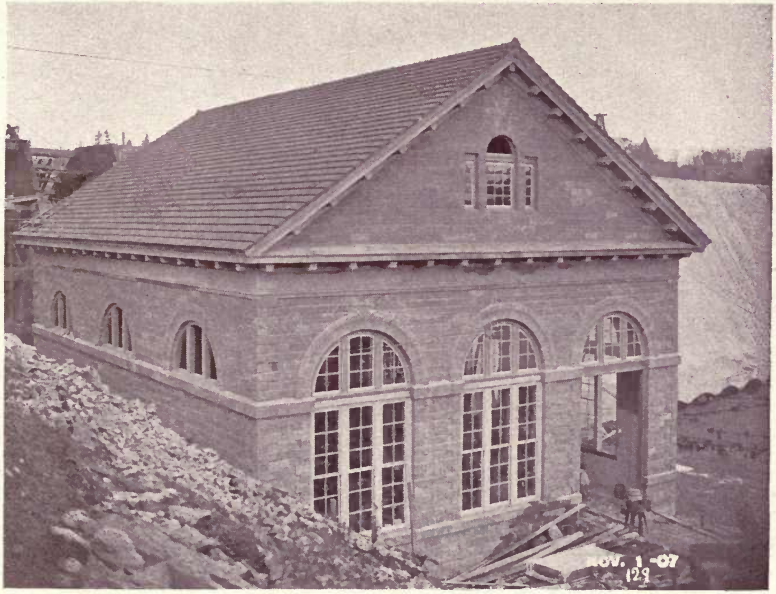


October 20, 1907

THE rollway of the dam completed; looking up stream from the western bank. The shadow of the power house is shown across the lower part of the rollway and the finished wall of the power house is on the extreme left.

A nearby view of the power house, a fine example of concrete block construction, the blocks being manufactured on the ground. The roof is of cinder concrete waterproofed with asphalt and covered with red Italian tiling.




NOV. 1-07
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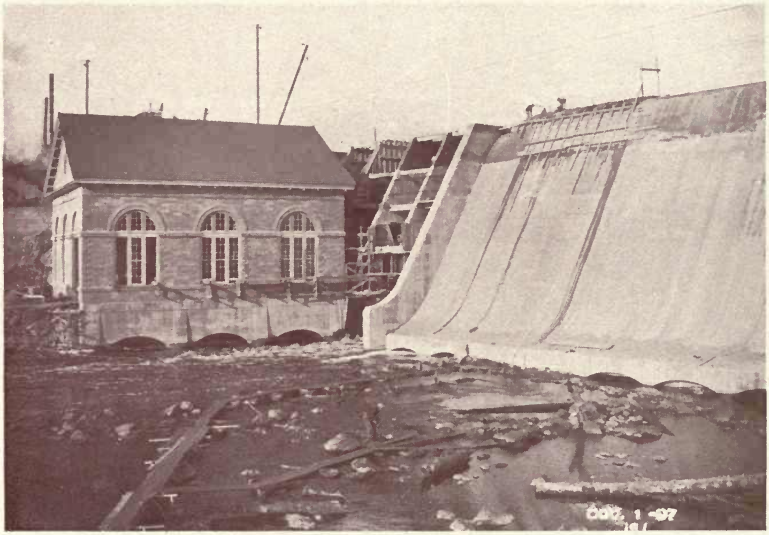
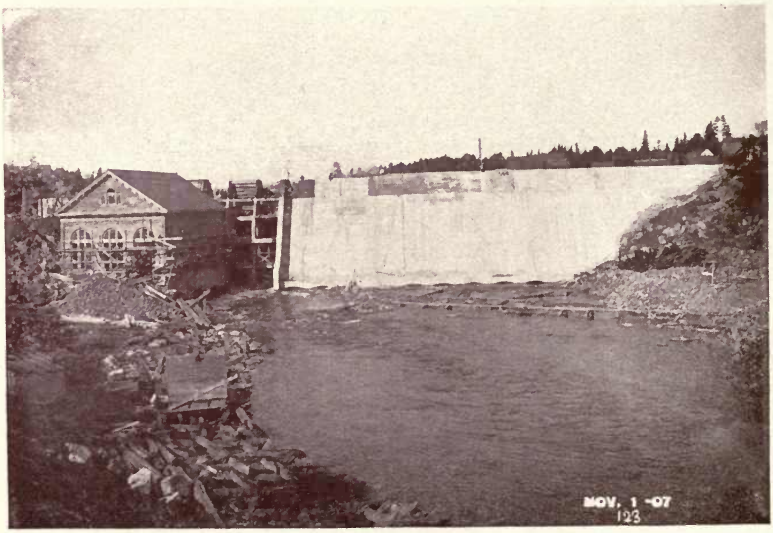

OCT. 1 -07


NOV. 1 -07
123

AN extended view showing power house and completed rollway looking upstream. The water is coming through the dam in the first two sections of the bulkhead and work is now proceeding on the bulkhead and on the canal.

Observe the sectional forms still in place near the crest; — these forms have been in continuous use since the beginning of the work and are still in good condition.

Note that two of the headgate piers at the entrance to the canal on the extreme left are completed.

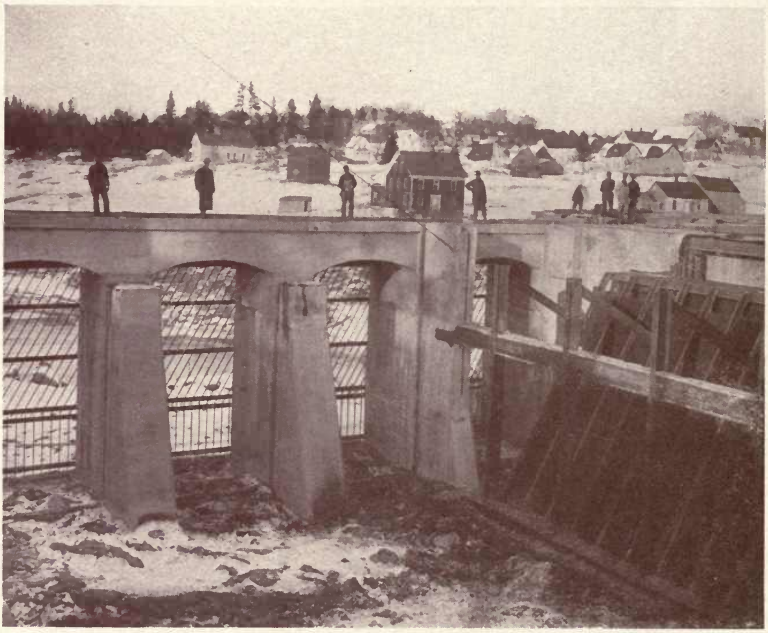
THIS view shows the front or downstream side of the bulkhead adjoining the power house, — see the gable end of the power house roof on the extreme right.

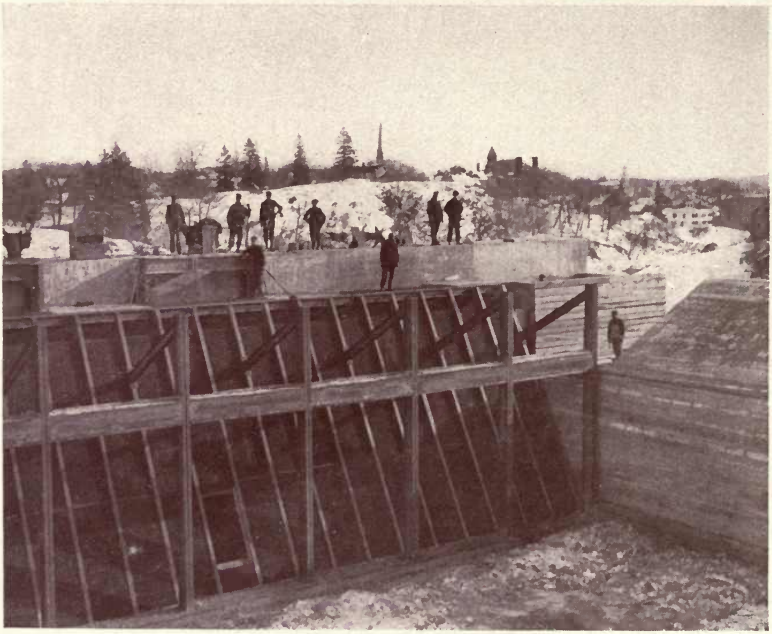
Through the opening is shown the edge of one of the floors which are built at various levels between the buttresses. The buttresses are pierced with doorways, making a series of rooms which are connected by iron stairways, lighted by electricity and are warm and dry.

These rooms are used for storage, for work-shops, and the sections here shown are utilized for transformer installation. The front of the entire bulkhead is covered with "Ferro-Inclave" as shown here.

Notice that the workmen are engaged in covering the ferro-inclave with cement plaster. The front of the entire bulkhead as well as the partitions are treated on both sides in like manner.

NOV. 15-07





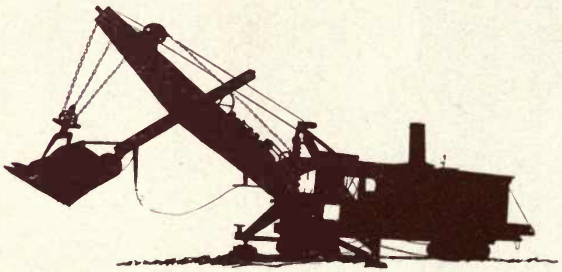
December 1, 1907

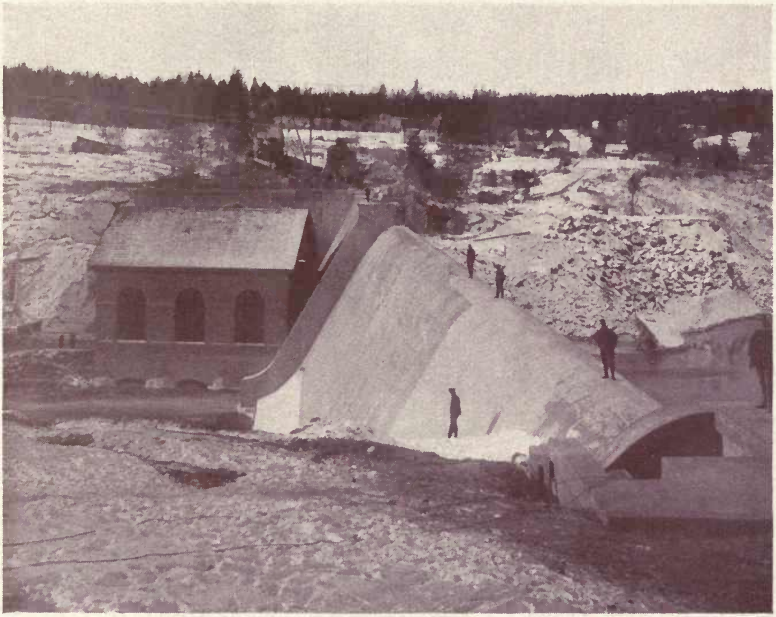
TWO views of the interior of the forebay above the power house with some detail of the racks and the temporary spillway. The first picture is looking up the river through the coarse racks. The fine racks and the penstock gates are on the right of the picture.

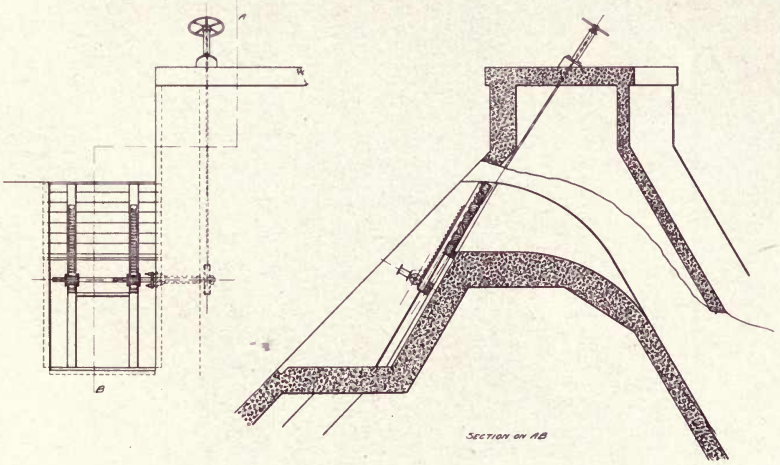
The second photograph shows more details of the fine racks and gates. The gate hoists are just being put in place. At the right of the picture is seen the temporary spillway at the end of the forebay. This is merely a wooden crib dam which will be removed at some future day when the forebay and power house are enlarged.

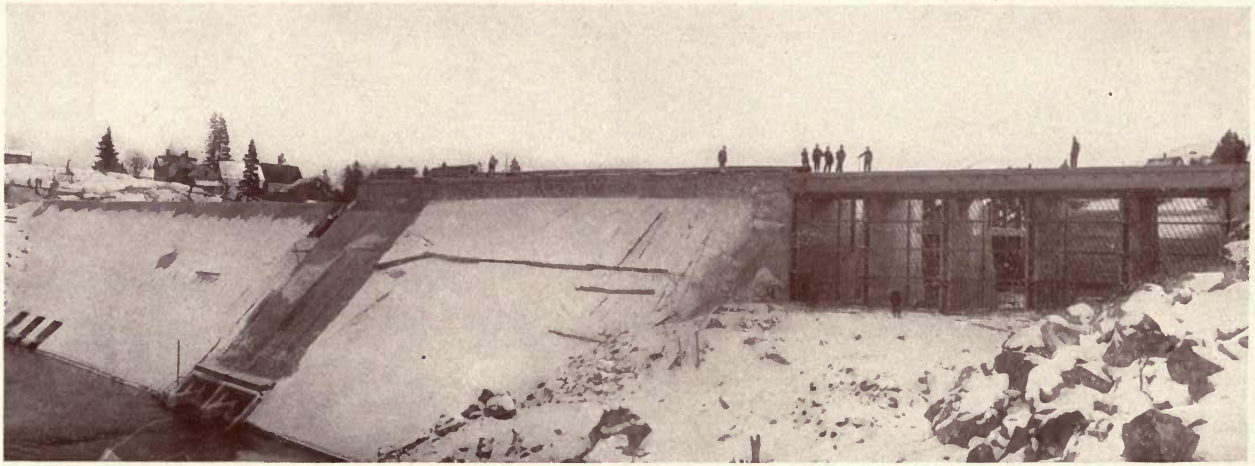
A FORE-SHORTENED view of the completed structure showing the curve of the apron and the entrance to the dam in the right foreground. The passageway through the dam to which this opening communicates, is just under the crest and is terminated by a stairway in the bulkhead which opens upon the bridge at the forebay. This passageway also communicates by stairways with a lower passageway at the level of the power house floor. These various passageways and stairways give access to every portion of the interior of the dam and bulkhead.

A log sluice or trash gate is provided near the bulkhead on the opposite shore, the gate being operated from the top of the bulkhead by a hand wheel as shown in this sketch.





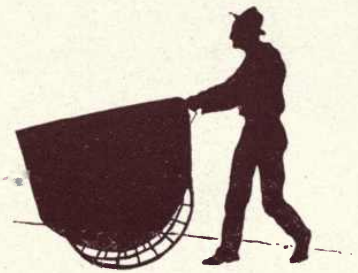

B
SECTION ON AB



AN extended view of the dam and entrance to the forebay from the up-stream side taken before the dam was closed; the river is now passing through the two openings just under the log sluice and the three openings for waste gates which are shown on the extreme left.

On the right are the coarse racks at the entrance of the forebay. The bridge above the racks and the top of the bulkhead will later be provided with a railing for the protection of visitors and workmen.

The eastern bulkhead just visible on the extreme left contains the stairways, etc., giving entrance to the dam as shown on the preceding page.

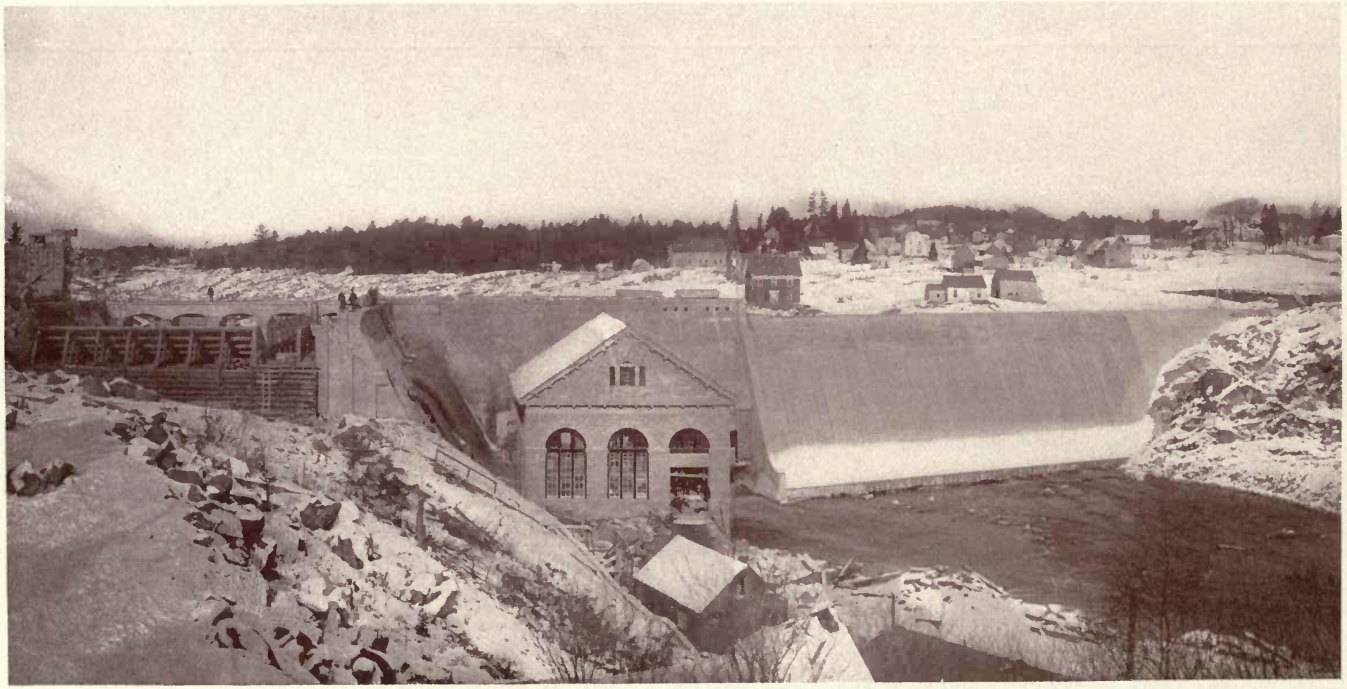


January 1, 1908

ANOTHER extended view of the entire development looking up stream. The temporary spillway is on the extreme left. Note the heavy forebay wall and the penstocks entering the power house.

The transformer rooms are in the bulkhead of the dam to the right of the power house, the high tension transmission wires coming out from the bulkhead through the six port holes shown near the top.

The log sluice gate is seen at the extreme left of the rollway next to the bulkhead.



IN considering these photographs due attention should be paid to the small number of men and to the small amount of construction plant necessary to produce this result.

The entire concrete capacity was contained in two concrete mixers each of 18 feet to the batch. This concrete was conveyed over a single cableway.

The crushing outfit was sufficient merely to supply the crushed stone to the concrete mixers as rapidly as they could use it, there being a storage capacity sufficient for three or four days' work.

One derrick was used to supply sand and cement to the mixers, the sand being brought to the work by teams from a pit two miles distant.

The other two derricks shown in the preceding views were principally used in rock excavation and in conveying the broken rock to the crusher, also in the placing of the steel work for the frame of the power house as well as the steel work in the racks.

These three derricks were so placed that they controlled the entire western end of the work and were not obliged to be shifted from their original position.

A separate concrete mixer of small capacity was used in connection with a concrete block machine in the building of the power house walls.

It is very evident that this development could have been completed in a shorter time had the construction plant been of larger capacity. The date of completion, however, was regulated by the power house structure and the installation of its machinery and greater speed was not desired, the contract time limit being set at January 1, 1908.

The power house was ready for the installation of machinery October 1st, and together with the rollway and bulkhead of dam was completed November 14th — **a period of five months and five days**. It is probable that this record for speed in construction has not been approached.

All the photographs were taken in the ordinary course of construction and show the men as they were engaged in their usual daily pursuits.

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