TABLE I.—*Showing the number of days in each year on which the Monongahela gauge at Pittsburgh stood at the subjoined readings.*

GAUGE READING IN FEET.

Above ..	−2	−1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Below ..	−1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1855					1	24	81	81	55	43	29	18	12	13	5		1	1			1													
1856			39	63	29	61	56	25	20	15	13	8	8	5	5	5	2	3	2	4	1	2												
1857					32	44	58	42	34	45	27	22	16	11	11	8	4	2	4	2	1		1	1										
1858				43	31	62	41	33	27	21	19	19	17	13	8	8	8	4	5	2		1	1		1		1							
1859			4	9	37	64	36	45	53	27	18	16	12	12	7	6	3	3	3	4	1	2	1		2									
1860					13	43	52	50	61	46	35	15	17	5	9	8	3	1	3	1	1				1					1		1		
1861				4	35	28	36	50	49	38	31	22	20	9	14	5	8	6	3	3	1	1					1						1	
1862			15	50	32	40	24	35	32	28	28	18	16	15	9	4	5	4	1		1	2			1		1		2			1	1	
1863				76	38	47	26	18	37	24	27	18	26	10	7	5	2	2	1		1													
1864				38	35	17	30	34	29	43	46	26	24	18	7	4	5	2	4	1	1	2												
1865				2	29	47	53	43	46	31	27	21	17	12	6	10	4	3	3	2	1	3	2				1					1		1
1866				17	51	59	51	36	43	28	20	19	14	11	9	2	3	1		1														
1867			22	110	34	41	14	12	18	19	32	14	11	6	11	5	5	2	3	2	1		2			1								
1868			2	65	32	38	32	47	42	32	23	9	10	9	7	2	3	3	4	3	1		1	1										
1869				16	49	32	41	51	45	32	28	19	15	13	4	6	4	5	3	1		1												
1870				20	21	79	57	51	34	25	25	18	11	3	3	3	3	4	2	5	1													
1871				77	102	39	31	27	17	24	16	10	5	8	3	1	2	1		1	1													
1872				42	58	93	59	45	26	18	7	6	6	2	1		1		1		1													
1873				18	35	34	42	39	44	35	25	25	20	9	11	5	4	2	8	4	1	2	1					1						
1874			24	59	30	29	41	34	34	30	14	19	10	10	9	10	2	2	5			1		1	1									
1875			5	22	39	66	37	46	36	25	19	16	18	9	5	9	2	1	1	5	1		2	1										
1876			14	15	51	58	42	36	38	30	19	21	18	5	5	6	3	1	1	2					1									
1877		2	40	42	35	45	55	41	26	16	18	12	5	7	7	3	4	2	2	1	1					1								
1878		10	28	27	38	34	48	48	37	22	20	20	11	6	4	3	3	1		1	1	1				2								
Total	...	12	193	815	887	1,124	1,043	969	883	697	566	411	339	221	167	118	84	56	59	45	19	18	11	4	7	4	4	1	2	1	....	3	2	1
Mean	..	0.5	8.0	34.0	37.0	46.8	43.5	40.4	36.8	29.0	23.6	17.1	14.1	9.2	7.0	4.9	3.5	2.3	2.5	1.9	0.8	0.7	0.5	0.2	0.3	0.2	0.2	0.04	0.08	0.04	....	0.1	0.08	0.04

TABLE II.—*Showing the number of days in each month of twenty-four years on which the Monongahela gauge at Pittsburgh stood at the subjoined readings, and also the average duration of each stage during each month.*

GAUGE READING IN FEET.

	Above	−1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	Below	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Total during twenty-four years.	January		1	3	68	97	62	91	102	79	62	52	28	30	16	11	12	9	4	7	3	1			1	1			2			1	1	
	February				27	65	98	98	77	66	61	47	32	27	23	23	9	5	6	8	1	2	3											
	March				2	23	42	68	87	98	92	75	85	48	39	21	19	10	15	7	4	2	2	1		1	1					1		1
	April				3	15	36	69	90	112	96	64	71	42	31	19	15	15	14	12	4	6			3		1			1		1		
	May				27	74	117	126	117	84	58	45	30	13	20	8	7	3	7			2	3	1	1		1							
	June			47	111	187	112	78	62	43	30	12	10	10	5	3	2	2	4	2														
	July			139	137	174	116	58	45	31	23	7	6	3	1	3	1																	
	August		29	169	159	113	107	64	52	21	12	9	3	1		2		1					2											
	September	2	72	261	89	77	73	36	32	21	18	12	4	11		3	2	2			1	1			1		1						1	
	October	10	78	146	146	120	85	54	36	15	12	15	13	4	3	4	1	1	1															
	November		13	39	85	91	108	127	82	52	36	24	21	12	8	5	4	4	2	2	3	1			1									
	December			11	33	88	87	100	101	75	66	49	36	20	21	16	12	4	6	7	3	3	1	2		2		1						
	Total	12	193	815	887	1,124	1,043	969	883	697	566	411	339	221	167	118	84	56	59	45	19	18	11	4	7	4	4	1	2	1	....	3	2	1
Average duration of each stage.	January		0.04	0.13	2.83	4.04	2.58	3.79	4.25	3.29	2.58	2.17	1.17	1.25	0.67	0.46	0.50	0.38	0.17	0.29	0.13	0.04			0.04	0.04			0.08			0.04	0.04	
	February				1.12	2.71	4.08	4.08	3.21	2.75	2.54	1 96	1.33	1.13	0.96	0.96	0.38	0.21	0.25	0.33	0.04	0.08	0.13											
	March				0.08	0.96	1.75	2.83	3.63	4.08	3.83	3.13	3.54	2.00	1.63	0.88	0.79	0.42	0.63	0.29	0.17	0.08	0.08	0.04		0.04	0.04					0.04		0.04
	April				0.13	0.62	1.50	2.88	3.75	4.67	4.00	2.67	2.96	1.75	1.29	0.79	0.62	0.62	0.58	0.50	0.17	0.25			0.13		0.04			0.04		0.04		
	May				1.12	3.08	4.88	5.25	4.88	3.50	2.42	1.88	1.25	0.54	0.83	0.33	0.29	0.13	0.29			0.08	0.13	0.04	0.04		0.04							
	June			1.96	4.63	7.79	4.67	3.25	2.58	1.79	1.25	0.50	0.42	0.42	0.21	0.12	0.08	0.08	0.17	0.08														
	July			5.79	5.71	7.25	4.83	2.42	1.88	1.29	0.96	0.29	0.25	0.13	0.04	0.12	0.04																	
	August		1.21	7.04	6.63	4.71	4.46	2.67	2.17	0.88	0.50	0.37	0.12	0.04		0.08		0.04					0.08											
	September	0.08	3.00	10.88	3.71	3.21	3.04	1.50	1.33	0.88	0.75	0.50	0.17	0.46		0.13	0.08	0.08			0.04	0.04			0.04		0.04						0.04	
	October	0.42	3.25	6.08	6.08	5.00	3.54	2.25	1.50	0.63	0.50	0.63	0.54	0.17	0.12	0.17	0.04	0.04	0.04															
	November		0.54	1.63	3.54	3.79	4.50	5.29	3.42	2.17	1.50	1.00	0.88	0.50	0.33	0.21	0.17	0.17	0.08	0.08	0.12	0.04			0.04									
	December			0.46	1.38	3.67	3.63	4.17	4.21	3.13	2.75	2.04	1.50	0.83	0.87	0.67	0.50	0.17	0.25	0.29	0.12	0.12	0.04	0.08		0.08		0.04						
	Total	0.50	8.04	33.97	36.96	46.83	43.46	40.38	36.81	29.06	23.58	17.14	14.13	9.21	6.95	4.92	3.49	2.34	2.46	1.86	0.79	0.73	0.46	0.16	0.29	0.16	0.16	0.04	0.08	0.04	....	0.12	0.08	0.04

TABLE III.—*Showing the average duration in days of various stages in the Ohio River at Pittsburgh, Pa.*

(Given to the nearest whole number.)

Month.	Under 3 feet.	Between 3 and 6 feet.	6 feet and over.	8 feet and over.
January	3	10	18	10
February	1	11	16	10
March	None.	6	25	18
April	None.	5	25	16
May	1	13	17	8
June	7	16	8	3
July	12	15	5	2
August	15	12	4	1
September	18	8	5	2
October	16	11	4	2
November	6	14	11	5
December	2	11	18	10
During the year	81	132	156	87

The titles to these tables explain their object and method of construction. A glance shows that while there is a general agreement to the law that there will be high-water in the spring and low-water in the summer and autumn, that there are yet great irregularities, and that the heights and durations of floods and the durations of very low-water cannot be predicted.

The higher stages at Pittsburgh may be divided into the three following classes:

1. From 6 to 20 feet on the gauge.
2. From 20 to 25 feet on the gauge.
3. More than 25 feet on the gauge.

The tables show that out of the 24 years that are included there were but 4 during which there was a height of water that exceeded 25 feet on the gauge, and that there were 18 in which the height exceeded 20 feet on the guage, leaving 6, or 25 per cent., during which the river surface did not once rise to the height of 20 feet. These dry years were 1855, 1863, 1866, 1870, 1871, 1872.

The highest stage in the table was reached in 1861 and 1865, during both of which years the water rose to between 31 and 32 feet on the gauge. In 1861 the highest rise took place in September, and in 1865 in March. The former occurred in one of the months during which the river is usually very low, and it was evidently due to a very heavy storm covering the sources of all the affluents of the river. The river rose in 24 hours from $4\frac{1}{2}$ feet to $30\frac{1}{2}$ feet, and in the next 24 hours to $31\frac{1}{2}$ feet. In 24 hours it fell to 19 feet and the next day to 8 feet. After this it went down gradually.

The rise of 1865 could be better expected, occurring as it did at the time of the spring thaws.

The stages of the river are divided into three classes by those engaged in its navigation:

1. The low-water navigation, or not less than 3 feet.
2. The coal-barge stage, or not less than 6 feet.
3. The coal-boat stage, or not less than 8 feet.

The first is the lowest profitable stage for steamboats.

From Table I, by adding up the number of days at which the river stands at 3 feet or over, we find that on an average boats drawing not over 3 feet of water can run during 285 days in each year. Similarly we find that boats drawing 6 feet can run during 155 days in each year, and boats drawing 8 feet during 89 days. But it must be stated that the records show that during dry years the average duration of the different depths is much diminished, while in wet years it is much increased.

During the 24 years ending December 31, 1878, we find the following maxima, minima, and averages:

THREE-FOOT NAVIGATION.

Average duration .... 285 days.
Maximum duration .... 364 days in 1855.
Minimum duration .... 186 days in 1871

SIX-FOOT NAVIGATION.

Average duration .... 155 days.
Maximum duration .... 212 days in 1861.
Minimum duration .... 69 days in 1872.

EIGHT-FOOT NAVIGATION.

Average duration .... 89 days.
Maximum duration .... 140 days in 1864.
Minimum duration .... 25 days in 1872.

It is curious to compare the different years and to notice their ups and downs, so to speak. Take, for example, 1855 and 1871. In the former we have the maximum duration of the stage of 3 feet or over, in the latter the minimum. The highest stage in each year was 18 feet. In 1871 the duration of the stage of 13 feet was twice as long as in 1855, but the 12-foot stage was only 1 day longer. Below this stage 1855 rapidly gains, until, at 5 feet, it had more than twice as many days as 1871. The years 1871 and 1872 were both exceedingly poor years for the coal interests. Both years had a maximum of 18 feet, each standing there 1 day; in the lower stages 1871 gradually takes the lead, and at 6 feet it has 89 days against 69 for 1872. At 5 feet they are about even, and at 3 feet 1872 is 80 days ahead.

It has been said, by some of those opposed to the radical improvement of the river, that coal has been shipped every month in the year. It is a fact that isolated shipments have been made at some time or other during each of the 12 months of some years, but the maximum number of days of coal navigation in any one year between 1855 and 1878, both inclusive, was 212, or 7 months, while the minimum was 69 days, or only $2\frac{1}{3}$ months.

Table II has been prepared in order to show how the depths of water vary by months. The upper half of the table shows the total number of days during the whole 24 years under examination during which any given stage occurred in any given month. The second half of the table is deduced from the first half, and it shows the average duration of each stage in each month of the year.

Table III is a condensation of Table II, showing the high and low water months. Taking 6 feet as our standard, and calling those months in which the river was at this stage during at least half the month "high-water" months, and those in which it stood at the same height less than half the month "low-water" months, we find that we have 6 high-water months and 6 low-water months. The former are:

1. March with 25 days of 6 feet or over.
2. April with 25 days of 6 feet or over.
3. December, with 18 days of 6 feet or over.
4. January, with 18 days of 6 feet or over.
5. May, with 17 days of 6 feet or over.
6. February, with 16 days of 6 feet or over.

The latter are:

1. November, with 11 days of 6 feet or over.
2. June, with 8 days of 6 feet or over.
3. July, with 5 days of 6 feet or over.
4. September, with 5 days of 6 feet or over.
5. August, with 4 days of 6 feet or over.
6. October, with 4 days of 6 feet or over.

At the 8-foot stage the order of the months is:

1. March, with 18 days.
2. April, with 16 days.
3. February, with 10 days.
4. December, with 10 days.
5. January, with 10 days.
6. May, with 8 days.
7. November, with 5 days.
8. June, with 3 days.
9. September, with 2 days.
10. October, with 2 days.
11. July, with 2 days.
12. August, with 1 day.

At stages of less than 3 feet the order of the months is:

1. September, with 18 days.
2. October, with 16 days.
3. August, with 15 days.
4. July, with 12 days.
5. June, with 7 days.
6. November, with 6 days.
7. January, with 3 days.
8. December, with 2 days.
9. February, with 1 day.
10. May, with 1 day.
11. March, with none.
12. April, with none.

These three lists show that in no month of the year can navigation be called absolutely continuous; it is more or less intermittent in every month.

The best boating season on the Ohio River in the vicinity of Pittsburgh is from the beginning of December to the end of May. This is likewise the best season (except when interrupted by ice) on the Ohio throughout its whole length, but it should be borne in mind that the duration of navigable stages increases as we descend the river, being very much greater in the vicinity of Cincinnati and Louisville, than it is near Pittsburgh.

A very important question suggests itself in looking over these tables. *Are the periods of navigation becoming shorter?* Glancing over Table I, it is at once seen that the upper half of the table indicates better water than the lower. Dividing the time covered by the table into two parts, the first covering the 12 years from 1867 to 1878, inclusive, we find in the first period as the average—

	Days.
Of the 8-foot stage and over	101
Of the 6-foot stage and over	174
Of the 3-foot stage and over	305
Of less than 3 feet	60

Whereas, in the second period we find—

	Days.
Of the 8-foot stage and over	77
Of the 6-foot stage and over	136
Of the 3-foot stage and over	266
Of less than 3 feet	99

Between 1855 and 1866 the river stood below the 1-foot stage during 58 days, and between 1867 and 1878 it stood there 147 days, 123 days of that time being in the last 5 years, 1874 to 1878. Since 1867, the river has reached the average number of days—

Of the 8-foot stage	3 times.
Of the 6-foot stage	1 time.
Of the 3-foot stage	3 times.

Before 1867 it reached the yearly average.

Of the 8-foot stage	9 times.
Of the 6-foot stage	10 times.
Of the 3-foot stage	9 times.

The national inference from these facts is that the periods of navigation are becoming shorter, but it would be well to investigate the question further. The reports that we have do not spread over a sufficient period of time, and we should not judge by the records kept at only one point. Those kept at other points should be examined and studied, and compared with each other; and then, perhaps, the question can be better answered. If it be answered in the affirmative, it is evidently time that something were under way in order to prolong the season of navigation.

The subject of the navigation of the river is of such importance that in order to arrive at a just appreciation of its extent, I have had a record kept as far as possible since January 1, 1879, of every boat passing the site of the Davis Island Dam. In the day-time this is comparatively easy, but at night it is impossible to tell anything, except whether the vessel be a towboat or a passenger-boat. In the day-time the name of each passing steamboat is registered, her class, direction, number of vessels in tow, and cargo as far as it can be seen from the work. Steamboats are divided into three classes, passenger-boats, towboats, and harbor-boats.

The result of these observations is given in the table below:

TABLE IV.—*Showing the number of steamboats that passed the site of Davis Island Dam.*

Month.	Towboats with tows.	Tow boats without tows.	Harbor-boats.	Passenger-boats.
1879.				
January	5	4	15	4
February	64	15	42	46
March	97	14	72	37
April	167	42	83	44
May	61	80	80	43
June	15	2	48	25
Total	409	85	340	199

This table includes tows of all kinds, whether of coal or other articles. During the night a tow boat can be distinguished from a passenger-boat without difficulty, and ordinarily a tow boat with a tow from one without. It is of course impossible to tell at night how many vessels are in a tow, and what they carry. Besides these numbers I have ascertained something of the *size* of *coal tows* passing this point during the same periods. I find that during *daylight* there passed during the first six months of 1879—

	Boats or barges.
29 steamboats, each towing	1
53 steamboats, each towing	2
42 steamboats, each towing	3
29 steamboats, each towing	4
26 steamboats, each towing	5
23 steamboats, each towing	6
9 steamboats, each towing	7
7 steamboats, each towing	8
5 steamboats, each towing	9
6 steamboats, each towing	10
1 steamboats, each towing	11
3 steamboats, each towing	12
1 steamboat, towing	13
1 steamboat, towing	14
1 steamboat, towing	15

This gives a total of 958 vessels and 236 tows. The average size of coal tows going out by *daylight* during the first six months of this year is therefore 4 barges. This is quite different from the generally received idea that the average sized coal fleet in this portion of the river is 1 of 10 barges. As a matter of fact only 13 tows passed the site of this work with as many as 10 barges. The difference between the number of the tows just given and that in the preceding table is this: those just given are *coal tows passing by day;* those in the table are *tows of any and all kinds by day or night.*

The statement has been made by some persons interested in the coal trade that there would be a very great loss of time in breaking up ascending tows of empty barges at the locks. During the 6 months ending June 30, there passed the work going up the river by *daylight.*

	Boats or barges
12 tows each of	10
3 tows each of	11
7 tows each of	12
2 tows each of	13
2 tows each of	14
1 tow of	16
1 tow of	17
2 tows each of	19
1 tow of	21

As the lock is large enough to allow a towboat with 10 barges and 2 flats to go through at one lockage, we see that 22 of these tows would have gone through without breaking up.

Those of 13 and 14 barges might have had difficulty, but that would depend upon the size of the towboat. The tows of 16, 17, and 19 barges would have had to be broken up to go through. That of 21 barges might as well have gone through in 2 parts because it had 2 towboats, each of which might have been taken through a part.

From this we see that the lock as proposed is quite equal to all calls that can be made on it now, except in a few isolated cases.

Very respectfully, your obedient servant,

F. A. MAHAN,
First Lieutenant Engineers.

Maj. W. E. MERRILL,
Corps of Engineers.

EXTRACT FROM LETTER OF M. MALÉZIEUX, INSPECTOR-GENERAL OF PONTS-ET-CHAUSSÉES.

* * * * * * *

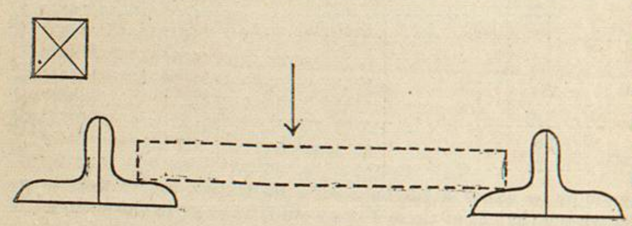
I think, in the interest of the introduction of movable dams in America, that it is very necessary to be careful to distinguish the systems which have been sanctioned by experience from those which are yet in the state of projects, studies, experiments, inchoate ideas, more or less venturesome.

Leaving out of consideration the ancient systems (prior to 1830), there only remain among modern dams three classic systems, which one may recommend without rashness; the Poirée, Chanoine, and Desfontaines systems.

The *Chanoine* system of *swinging wickets* was greatly improved, almost at the outset, by the substitution of a *foot-bridge on trestles* for a *maneuvering boat.*

Among the improvements in details which have since been made, there is none more important than the suppression of the *tripping-bar.* Mr. Pasqueau has proposed to replace it by what he calls a *double-stepped hurter.* Last week he showed the working of a model of this system in the presence of the general council of *Ponts-et-Chaussées,* who reported in favor of testing it in actual construction. This will soon be done at the navigable pass of the La Mulatière Dam, which is now in course of construction at Lyons on the Saône at its junction with the Rhone.

If a comparison were to be made of the practical value of the ideas on which modern dams are founded, I would unhesitatingly place in the first rank the trestle or *movable pier* of M. Poirée. As the length of needles or vertical scantlings becomes an obstacle in handling when the height is very great, I remarked in 1867 that if the upstream leg of the trestle, instead of being made of rectangular iron, were constructed of two angle-irons the trestles would answer to support, not simply a top bar against which



rest the heads of needles whose feet are sustained by a sill, but *horizontal* scantlings, or *horizontal* beams, which would be superposed and would rest at their two ends against the upstream legs of two consecutive trestles. I made use of this idea at the Joinville Dam, in the construction of a coffer-dam on the upper plate-band of the weir, which serves every other year to drain off the drums, so that they can be inspected and have their metallic parts repainted.* If several beams are *rigidly* united so that they can be maneuvered as one, we have the *Boulé gates.* If we unite these same beams, or rather needles or horizontal scantlings, by *articulations,* we have the ingenious curtain of Mr. Camère. It is thus that ideas interchain, and are developed one from the other.

* * * * * * *

PARIS, *April* 4, 1879.

* Annales des Ponts-et-Chaussées, 1875, 1st sem., p. 242.

Statistics of the principal movable dams constructed in France for the improvement of navigation (October 31, 1878).

Name of dam, beginning at the upper end of the river.	Nature of the movable parts. Navigable pass.	Nature of the movable parts. Weir.	Year of completion.	Remarks.
SEINE.				
Conflans	Chanoine wickets		1858	
Beaulieu	do		1865	
Le Vesoult	Poirée needle-dam		1856	Little Seine.
La Grande Bosse	do		1854	
Courbeton	do		1849	
Varennes and five others	Chanoine wickets	Chanoine wickets	1871	
Melun	do	Poirée	1854 1871	Upper Seine.
Vives-Eaux and five others	do	Chanoine	1871	
La Monnaie (Paris)		Poirée cylinders	1853	
Suresnes	Poirée		1867	
Besons	do		1867	
Marly	do		1868	
Andresy	do		1862	
Meulan	do		1855	Lower Seine.
La Garenne	do		1850	
Poses	do		1852	
Martot	do	Chanoine	1866	
St. Aubin	do		1866	Total, 28.
YONNE.				
La Chaînette	Poirée		1860	
L'Ile Brulée	Chanoine	Girard	1874	
Les Dumonts and five others	do	Poirée	1874	
Epineau	Poirée		1842	
Le Péchoir and fourteen others	Chanoine	Chanoine	1871	
Port Renard	Poirée		1860	Total, 25.
MARNE.				
Châlons	Chanoine	Desfontaines	1865	
Cumières	do	Poirée	1855	
Damery	do	Desfontaines	1857	
Vandières	do	Poirée	1859	
Courcelles	do	Desfontaines	1862	
Mont-Saint-Père and seven others	do	do	1865	
Vaires	do		1865	
Joinville	Poirée	Desfontaines	1867	Total, 15.
OISE.				
Verberie and five others		Poirée	1853	Total, 6.
LOIRE.				
Roanne	Poirée		1846	
Decize	Chanoine	Poirée	1868	Total, 2.
ALLIER.				
Vichy		Poirée	1868	Total, 1.
SAÔNE.				
St. Albin	Poirée		1878	
St. Jean de Losne and two others	do		1843	
Charnay		Poirée	1844	
Verdun		do	1841	
Gigny	Chanoine	do	1877	
Thoissey and two others	do	do	1878	
Ile Barbe	do	do	1870	Total, 11.

MOSELLE.

Nine Poirée needle-dams constructed between 1869 and 1875.

MEUSE.

Twenty-seven Poirée needle-dams constructed between 1875 and 1878.

Summary.

River.	No. of movable dams.	Navigable pass.		Weir.				
		Chanoine.	Poirée.	Chanoine.	Poirée.	Desfontaines.	Girard.	Poirée cylinders.
Seine	28	15	12	13	1	......	......	1
Yonne	25	22	3	15	6	......	1	......
Marne	15	14	1	......	2	12	......	......
Oise	6	......	......	......	6	......	......	......
Loire	2	1	1	......	1	......	......	......
Allier	1	......	......	......	1	......	......	......
Saône	11	5	4	......	7	......	......	......
Moselle	9	......	9	......	9	......	......	......
Meuse	27	......	27	......	27	......	......	......
Totals	124	57	57	28	60	12	1	1

It will be observed from the above table, which is from official sources, that the great utility of movable dams has been thoroughly demonstrated by constructions dating as far back as 1841, and that new dams are continually undertaken. It will also be noted that there are but two systems thus far in actual use to close navigable passes, while the same two systems and three others are in use on weirs.

DESCRIPTION OF THE MOVABLE DAMS CONSTRUCTED OR IN THE COURSE OF CONSTRUCTION IN THE MEUSE BETWEEN THE VILLAGE OF RIVIÈRE AND THE FRENCH FRONTIER.

By MARTIAL HANS, *Engineer of Ponts-et-Chaussées, of Belgium.*

GENERAL DESCRIPTION OF THE DAMS.

The construction of the lock and dam at Hun, which may be taken as the type of the dams built or in process of construction on the Meuse above Rivière, took place during 1874 and 1875. These works embrace—

1st. *A lock* located in a side-cut on the left bank of the river; this lock, like all those on the Meuse above Namur, has a total length of 410 feet, an available length of 328 feet, and a width in the clear of 39 feet 4 inches.

The two miter-sills are placed at the same level, and the depth on the lower miter-sill is 6 feet 11 inches.

2d. *A movable dam* placed in the bed of the river 790 feet above the lock, and connected with the latter by a dike of earth and gravel paved all over and extending 330 feet above the dam.

The movable dam is composed of a navigable pass and a weir separated by a pier.

The navigable pass consists of a floor supporting movable trestles, and an abutment connecting it with the dike. This navigable pass is 150 feet long, and its sill is placed at 2 feet below the low-water line of the river.

The weir is composed of a permanent floor supporting movable wickets, and a trestle foot-bridge. It is 179 feet long between the face of the pier and that of the abutment, and its floor is placed at the level of low-water in the river.

The combination of these works produces a pool, whose surface is at the height of 10 feet 2 inches above the sill of the navigable pass, or 8 feet 2 inches above low-water.

NAVIGABLE PASS.

The apparatus for closing this pass is composed of movable trestles and needles, in accordance with the system of M. Poiré, formerly inspector-general of the French corps of *Ponts-et-Chaussées.*

Floor of navigable pass.—This floor, wholly of masonry, is laid in a coffer work of piles and sheet piles, cut off and capped at 2 feet below low-water for the upper line, and at 3 feet 3 inches below for the lower line.

The two lines of piling at right angles to the course of the river are spaced 31 feet 9 inches between centers; the thickness of the floor above the sill is 8 feet 10 inches, but below the sill it is only 7½ feet.

The floor is in the first place composed of a mass of concrete 16 inches thick, which is prolonged under the pier and under the abutment; this bed of concrete is overlaid by a mass of rubble masonry on which the floor proper is placed; the latter is composed of two chains of cut stone at right angles to the current, and of a paving of rough-pointed squared stone, whose joints are also at right angles to the current. The two chains of cut stone receive, the one the wooden sill of the trestles, and the other the down-stream journal-boxes.

Blocks for temporary coffer-dams.—Blocks of oak, 12 by 12 cross-section, are imbedded in the floor on lines at right angles to the current, forming four distinct ranks, two above and two below the trestles; the centers of these blocks are pierced by vertical holes 2 inches in diameter, intended to receive the iron uprights of a coffer-dam which will be set up in case it should become necessary to repair the floor or the apparatus which is fastened to it.

Horizontal ties.—The corresponding stones of the two chains of the floor are connected together and to the two lines of the piles and sheet piles by means of horizontal iron ties, each consisting of three sections, placed in grooves cut in the vertical joints of the stones.

By means of two keys the middle section of each of these ties binds together the corresponding stones of the two chains, and makes them one mass to resist the considerable horizontal pressure which the trestles cause on their down-stream journals when the dam is up and the water is at its normal level. Each of the two end sections of these ties is connected with the middle section by means of an eye and a fork: two nuts, one at each end of a tie, fasten together the upper and lower lines of piles and sheet piles, so that all parts of the floor are thus made a solid mass.

Vertical ties.—The up-stream-journals of the trestles tend, when the dam backs up the water of the river, to lift the wooden sill in which the up-stream journal-boxes are set; in order to resist this tendency, this sill is connected to the foundation masonry by means of vertical anchoring-rods in two sections, which are placed in grooves cut in the joints of each of the stones of the upper chain; the lower part of the rod is attached to a cast-iron disk placed under the concrete; this part comes just to the top of the rubble. The connection at this point of the lower