THE JAMES LEFFEL & CO.

Manufacturers of
HYDRAULIC TURBINES

1978 Commerce Circle — Springfield, OH USA 45504-2012

Phone (937) 322-0116
Telefax (937) 322-0467

February 17, 2004

Mr. Roy Knutsen
P.O.Box 5
Stillwater, NJ 07875

Dear Mr. Knutsen:

Thank you for contacting *The James Leffel & Co.* with regard to your request for information about the products we provide.

Mr. Dynge, our General Manager, has instructed me to forward you our Bulletin 38, a reprinted publication entitled LEFFEL - Improved Vertical Samson Turbines for your review and use. This bulletin has a cutaway of the Samson inside the front cover that identifies the various components involved in the composition of the LEFFEL turbine.

If after your review there are further questions you need answered, or you wish to discuss the rehabilitation work on the unit(s) you have in-house, please don't hesitate to contact our office.

Sincerely,

Doris A. Fulton
Administrative Assistant

df/enclosures

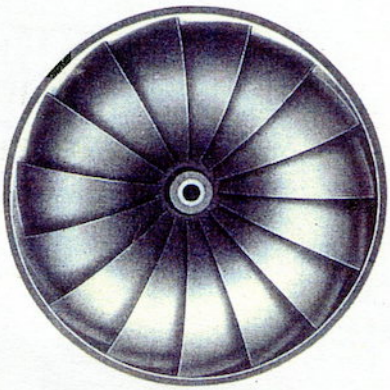
Stillwater NJ

2/17/2004

LEFFEL

IMPROVED VERTICAL SAMSON TURBINES

BULLETIN 38



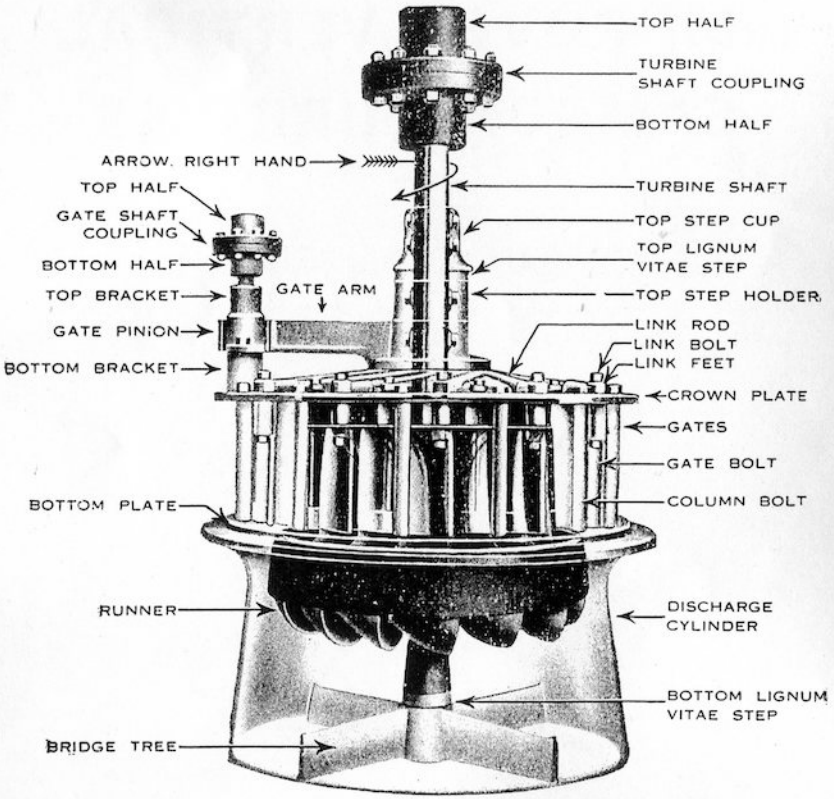
THE JAMES LEFFEL & CO.

SPRINGFIELD, OHIO, U. S. A.

ESTABLISHED 1862

Improved Vertical Samson Turbines

These turbines are built strong and substantial, and equipped with our exclusive design double steel bucket runners fitted on steel shafts. Large top and bottom lignumvitae step bearings for carrying the revolving parts of these turbines, including the weight of extra upright shafting and gearing. Also, balanced swing-type gates with separate adjustable steel connections. Each gate removable independently. All bearings of large dimensions and special material. Bolted couplings.



The above illustration shows the design and construction of our Improved Vertical SAMSON Turbines and gives the names of each of the various parts.

The arrow on Turbine Shaft shows Right Hand Rotation.

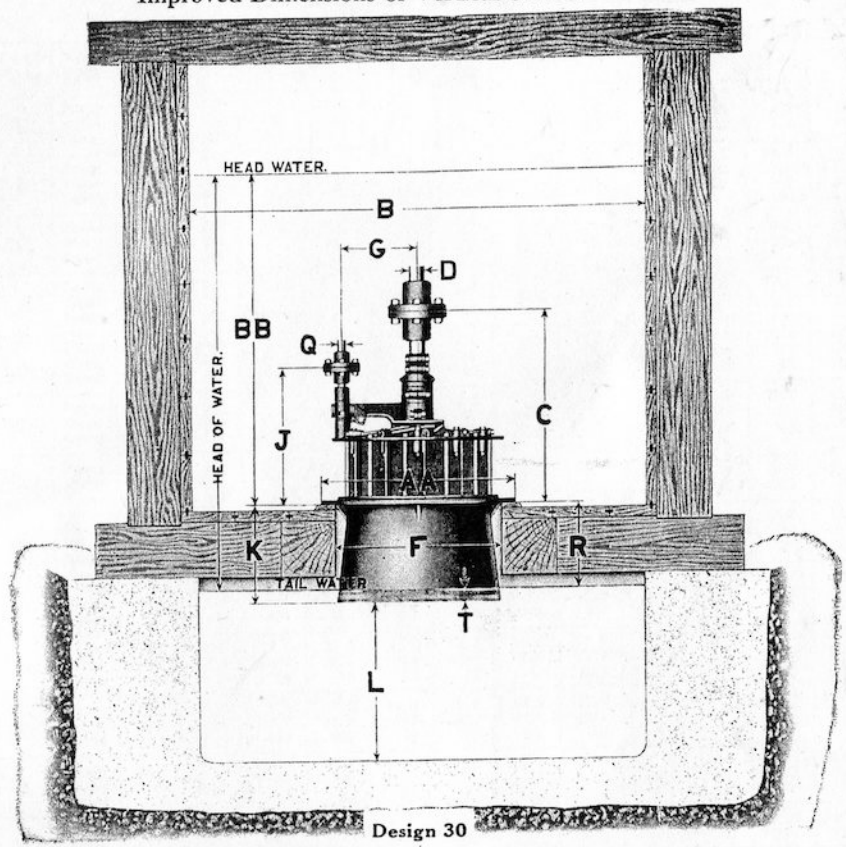
We bore and keyseat the top halves of Couplings to suit your requirements.

For dimensions of SAMSON Turbines in Open Flume Setting, see Page 3.

For dimensions of Steel Flumes for SAMSON Turbines, see Page 4.

For Power and Speed of Improved Vertical SAMSON Turbines, see Pages 5 and 6.

Improved Dimensions of Vertical Samson Turbines

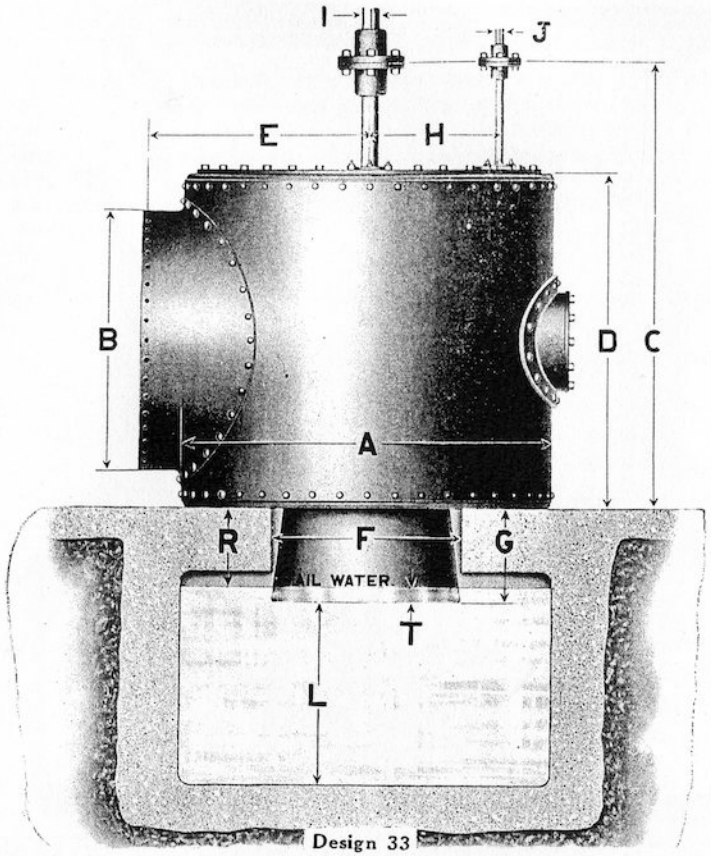


Design 30

SIZE OF SAMSON TURBINES		17E	17D	17C	17B	17A	20	23	26	30	35	40	45	50	56	62	68	74
AA	Cylinder Flange Diameter...	33	33	33	33	33	36	40	44	49	56	63	70	76	86	94	102	110
B	Penstock Width not less than	48	48	48	48	48	60	72	84	96	108	120	132	144	156	168	180	192
BB	Water Depth not less than ..	42	42	42	42	42	48	54	60	66	72	78	84	90	96	102	108	114
C	Turbine Shaft Height.....	32	32	32	32	32	35	40	45	50	55	60	65	70	75	80	85	90
D	Turbine Coupling Bore	2 1/8	2 3/8	2 3/8	2 5/8	2 5/8	2 7/8	3 1/8	3 3/8	3 7/8	4 3/8	4 7/8	5 3/8	5 7/8	6 3/8	6 7/8	7 3/8	7 7/8
F	Diameter Hole in Floor.....	28	28	28	28	28	31	35	39	44	51	57	64	70	78	86	94	102
G	Between Shaft Centers	12	12	12	12	12	14	16	18	20	22	25	28	31	34	38	42	46
J	Gate Shaft Height	23	23	23	23	23	25	27	29	32	35	38	42	46	50	54	59	64
K	Discharge Cylinder Length..	15	15	15	15	15	17	19	21	24	27	30	33	36	40	44	48	52
L	Discharge Depth not less than	27	27	27	27	27	30	36	42	48	54	60	66	72	84	96	108	120
Q	Gate Coupling Bore.....	1 3/16	1 3/16	1 3/16	1 3/16	1 3/16	1 7/16	1 7/16	1 11/16	1 11/16	1 15/16	1 15/16	2 3/16	2 3/16	2 7/16	2 7/16	2 11/16	2 11/16
T	Submergence not less than ..	3	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	6

All dimensions in the above table are given in INCHES.
Power tables of these vertical SAMSON turbines on pages 5 and 6 inclusive.
We also build these SAMSON turbines various horizontal designs as required.
Dimensions of STEEL FLUMES for these vertical SAMSON turbines on page 4.

Dimensions of Steel Flumes For Improved Vertical Samson Turbines



Design 33

	SIZE OF SAMSON TURBINES	17E	17D	17C	17B	17A	20	23	26	30	35	40	45	50	56
A	Diameter of Steel Flume	54	54	54	54	54	60	66	72	84	96	108	120	132	144
B	Inside Diameter of Feeder Pipe	24	26	28	30	36	42	48	54	60	72	84	96	108	120
C	Height of Turbine and Gate Shafts	54	56	58	60	66	72	78	84	90	102	114	132	144	156
D	Height of Steel Flume	36	38	40	42	48	54	60	66	72	84	96	108	120	132
E	Center Turbine Shaft to Center of Rivet Holes	33	33	33	33	33	36	39	42	48	54	60	66	72	78
F	Size of Hole to Clear Discharge Cylinder	28	28	28	28	28	31	35	39	44	51	57	64	70	78
G	Length of Discharge Cylinder under Flume	12	12	12	12	12	13	15	17	19	22	25	28	31	34
H	Distance Between Centers of Shafts	12	12	12	12	12	14	16	18	20	22	25	28	31	34
I	Diameter of Bore in Turbine Shaft Coupling	2 1/8	2 3/8	2 3/8	2 5/8	2 5/8	2 7/8	3 1/8	3 3/8	3 7/8	4 3/8	4 7/8	5 3/8	5 7/8	6 3/8
J	Diameter of Bore in Gate Shaft Coupling	1 3/16	1 3/16	1 3/16	1 3/16	1 3/16	1 7/16	1 7/16	1 11/16	1 11/16	1 15/16	1 15/16	2 3/16	2 3/16	2 7/16
L	Depth under Disch. Cylinder not less than	27	27	27	27	27	30	36	42	48	54	60	66	72	84
T	Submergence of Disch. Cylinder not less than	3	3	3	3	3	4	4	4	4	5	5	5	5	6

All dimensions in the above table are given in INCHES.
These STEEL FLUMES larger than 10 feet diameter made in sections, riveted together when placing to position. Top and bottom heads cast iron.
We build all sizes vertical and horizontal steel flumes, pipes and draft tubes.

Power Table – Improved Vertical Samson Turbines

Size of Turbine	Head	3	4	5	6	7	8	9	10	11	12	13	14
17 E.	Power	1.1	1.7	2.5	3.2	4.1	5.0	6.0	7.0	8.1	9.2	10.4	11.7
	Water	252	291	325	356	384	411	436	460	182	503	524	544
	Speed	161	186	208	228	246	264	280	294	308	322	335	348
17 D.	Power	1.5	2.3	3.2	4.3	5.4	6.5	7.8	9.2	10.6	12.0	13.6	15.2
	Water	328	379	423	464	502	536	569	601	629	657	683	709
	Speed	161	186	208	228	246	264	280	294	308	322	335	348
17 C.	Power	2.0	3.0	4.3	5.6	7.1	8.6	10.3	12.1	14.0	15.8	17.9	19.0
	Water	433	499	558	611	650	706	749	791	828	864	900	934
	Speed	161	186	208	228	246	264	280	294	308	322	335	348
17 B.	Power	2.4	3.7	5.3	7.0	8.7	10.6	12.7	14.9	17.2	19.5	22.0	24.7
	Water	533	616	689	754	815	871	924	975	1021	1066	1110	1153
	Speed	161	186	208	228	246	264	280	294	308	322	335	348
17 A.	Power	3.2	4.9	6.9	9.1	11.4	13.9	16.6	19.5	22.5	25.5	28.8	32.3
	Water	697	805	900	986	1065	1139	1208	1275	1335	1394	1451	1506
	Speed	161	186	208	228	246	264	280	294	308	322	335	348
20.	Power	4.2	6.4	9.0	11.9	15.0	18.3	21.8	25.5	29.5	33.6	37.8	42.3
	Water	914	1055	1180	1293	1396	1493	1583	1669	1750	1828	1903	1975
	Speed	140	162	182	199	215	230	244	257	270	282	293	304
23.	Power	5.5	8.5	11.9	15.7	19.8	24.2	28.8	33.8	39.0	44.4	50.0	55.9
	Water	1209	1391	1561	1710	1847	1974	2094	2207	2315	2418	2517	2612
	Speed	127	141	158	173	187	200	211	224	235	245	255	265
26.	Power	7.10	10.9	15.2	20.1	25.3	30.9	36.8	43.2	49.8	56.7	64.0	71.5
	Water	1545	1784	1995	2185	2360	2523	2676	2821	2959	3090	3216	3338
	Speed	108	125	140	153	166	177	188	198	207	217	226	234
30.	Power	9.44	14.5	20.3	26.7	33.6	41.1	49.1	57.5	66.3	75.5	85.2	95.2
	Water	2057	2375	2656	2909	3142	3359	3563	3756	3939	4114	4282	4444
	Speed	94	108	121	132	143	153	163	171	180	188	195	203
35.	Power	12.8	19.7	27.5	36.2	45.6	55.7	66.5	77.9	89.8	102.0	115.0	129.0
	Water	2789	3220	3600	3944	4260	4554	4830	5091	5339	5577	5805	6024
	Speed	81	93	104	114	123	132	140	147	154	161	168	174
40.	Power	16.8	25.8	36.1	47.5	59.8	73.1	87.2	102.0	118.0	134.0	151.0	169.0
	Water	3657	4223	4722	5172	5587	5972	6335	6677	7003	7315	7613	7900
	Speed	70	81	91	100	108	115	122	129	135	141	147	152
45.	Power	21.2	32.7	45.7	60.1	75.7	92.5	110.0	129.0	149.0	170.0	192.0	214.0
	Water	4629	5344	5975	6546	7070	7558	8017	8450	8861	9257	9635	9999
	Speed	63	72	81	88	96	102	109	114	120	125	130	135
50.	Power	26.2	40.5	56.4	74.2	93.5	114.0	136.0	160.0	184.0	210.0	235.0	264.0
	Water	5714	6598	7377	8081	8729	9331	9897	10433	10942	11429	11795	12341
	Speed	56	65	73	80	86	92	98	103	108	113	117	122
56.	Power	32.9	50.6	70.8	93.0	117.0	143.0	171.0	200.0	231.0	263.0	297.0	332.0
	Water	7168	8277	9254	10137	10950	11705	12415	13087	13726	14336	14922	15485
	Speed	50	58	65	71	77	82	87	92	96	101	105	109
62.	Power	40.3	62.1	86.8	114.0	144.0	176.0	210.0	245.0	283.0	323.0	364.0	407.0
	Water	8787	10146	11344	12426	13419	14349	15219	16042	16825	17574	18291	18982
	Speed	45	52	59	64	69	74	79	83	87	91	95	98
68.	Power	48.5	74.7	104.0	137.0	171.0	211.0	252.0	295.0	341.0	388.0	438.0	489.0
	Water	10570	12204	13645	14947	16145	17258	18306	19297	20238	21139	22002	22832
	Speed	41	48	53	59	63	68	72	76	79	83	86	89
74.	Power	57.5	88.5	124.0	162.0	205.0	250.0	299.0	350.0	403.0	460.0	518.0	579.0
	Water	12517	14453	16159	17701	19120	20439	21679	22852	23967	25034	26056	27039
	Speed	38	44	49	54	58	62	66	70	73	76	79	82

EXPLANATION OF ABOVE TABLES

HEAD = Effective head in feet. WATER = Cubic feet discharged per minute. POWER = Full gate horsepower. SPEED = Number of revolutions per minute.

We also build IMPROVED SAMSON turbines developing power and speed values HALF WAY between each of the different sizes of turbines given in above table.

These IMPROVED VERTICAL SAMSON turbines to develop above power, speed and efficiency values, must be installed and operated substantially as given on page 3.

Power Tables Continued on page 6.

Power Table – Improved Vertical Samson Turbines

Size of Turbine	Head	15	16	17	18	19	20	21	22	23	24	25	26
17 E.	Power	12.9	14.3	15.6	17.0	18.4	19.9	21.4	22.9	24.5	26.2	27.8	29.5
	Water	553	581	599	617	634	650	666	682	697	712	727	741
	Speed	360	373	384	394	405	416	426	436	446	454	464	474
17 D.	Power	16.9	18.6	20.4	22.1	24.0	25.9	27.9	29.9	32.0	34.1	36.2	38.5
	Water	734	758	782	804	827	848	869	889	909	929	948	967
	Speed	360	373	384	394	405	416	426	436	446	454	464	474
17 C.	Power	22.2	24.5	26.8	29.1	31.6	34.1	36.8	39.4	42.2	45.0	47.7	50.7
	Water	967	998	1029	1059	1088	1116	1144	1171	1197	1223	1248	1273
	Speed	360	373	384	394	405	416	426	436	446	454	464	474
17 B.	Power	27.4	30.2	33.1	36.0	39.0	42.1	45.4	48.6	52.0	55.5	58.9	62.6
	Water	1193	1232	1270	1307	1343	1377	1411	1444	1476	1509	1540	1571
	Speed	360	373	384	394	405	416	426	436	446	454	464	474
17 A.	Power	35.6	39.5	43.3	47.0	51.0	55.0	59.3	63.5	68.0	72.5	77.0	81.8
	Water	1559	1610	1660	1708	1755	1800	1845	1888	1930	1972	2013	2053
	Speed	360	373	384	394	406	416	426	436	446	454	464	474
20.	Power	46.9	51.5	56.6	61.7	66.9	72.2	77.7	83.3	89.0	94.9	101.0	107.0
	Water	2044	2111	2179	2239	2300	2360	2419	2476	2531	2586	2639	2691
	Speed	315	325	335	345	354	364	373	381	390	398	407	415
23.	Power	62.0	68.3	74.9	81.6	88.5	95.5	103.0	110.0	118.0	126.0	133.0	141.0
	Water	2703	2792	2878	2961	3043	3122	3199	3274	3348	3420	3489	3559
	Speed	274	283	292	300	308	316	324	332	339	346	354	361
26.	Power	79.3	87.3	95.7	104.0	113.0	121.0	131.0	141.0	151.0	160.0	171.0	180.0
	Water	3455	3569	3678	3785	3888	3919	4088	4181	4278	4370	4460	4549
	Speed	242	250	258	265	273	280	287	293	300	306	313	319
30.	Power	106.0	116.0	127.0	139.0	150.0	162.0	175.0	188.0	200.0	214.0	227.0	241.0
	Water	4600	4751	4897	5039	5177	5312	5443	5571	5696	5818	5938	6056
	Speed	210	217	224	230	236	242	248	254	260	265	271	276
35.	Power	143.0	158.0	173.0	188.0	204.0	220.0	237.0	254.0	272.0	290.0	308.0	327.0
	Water	6236	6440	6638	6831	7018	7200	7378	7552	7721	7887	8050	8210
	Speed	180	186	192	197	203	208	213	218	223	227	232	237
40.	Power	188.0	207.0	226.0	247.0	268.0	289.0	311.0	333.0	356.0	380.0	404.0	428.0
	Water	8178	8446	8706	8958	9204	9443	9676	9904	10126	10344	10558	10767
	Speed	157	163	168	172	177	182	186	191	195	199	203	207
45.	Power	238.0	262.0	287.0	312.0	336.0	366.0	393.0	422.0	451.0	481.0	511.0	542.0
	Water	10350	10689	11018	11337	11648	11951	12246	12534	12816	13091	13361	13626
	Speed	140	145	149	153	158	162	166	170	173	177	181	184
50.	Power	293.0	324.0	354.0	385.0	418.0	451.0	486.0	521.0	557.0	593.0	631.0	669.0
	Water	12777	13196	13603	13997	14380	14754	15118	15474	15822	16162	16496	16822
	Speed	126	130	134	138	142	145	149	153	156	159	162	166
56.	Power	368.0	405.0	444.0	484.0	524.0	566.0	609.0	653.0	699.0	744.0	791.0	839.0
	Water	16028	16554	17063	17558	18039	18508	18965	19411	19847	20274	20692	21102
	Speed	112	116	120	123	127	130	133	136	139	142	145	148
62.	Power	451.0	497.0	544.0	593.0	643.0	694.0	747.0	801.0	856.0	913.0	970.0	1030.0
	Water	19648	20292	20917	21523	22113	22688	23248	23795	24329	24853	25365	25868
	Speed	102	105	108	111	114	117	120	123	126	128	131	134
68.	Power	542.0	597.0	654.0	713.0	773.0	835.0	898.0	963.0	1030.0	1098.0	1167.0	1238.0
	Water	23634	24409	25160	25890	26599	27290	27964	28622	29265	29895	30511	31115
	Speed	93	96	99	101	104	107	109	112	115	117	120	122
74.	Power	642.0	708.0	775.0	844.0	916.0	992.0	1064.0	1141.0	1220.0	1296.0	1382.0	1466.0
	Water	27988	28906	29796	30659	31500	32318	33116	33895	34657	35403	36132	36848
	Speed	85	88	91	94	96	99	101	103	106	108	110	112

EXPLANATION OF ABOVE TABLES

HEAD = Effective head in feet. WATER = Cubic feet discharged per minute. POWER = Full gate horsepower. SPEED = Number of revolutions per minute. We also build IMPROVED SAMSON turbines developing power and speed values HALF WAY between each of the different sizes of turbines given in above table.

These IMPROVED VERTICAL SAMSON turbines to develop above power, speed and efficiency values, must be installed and operated substantially as given on page 3.

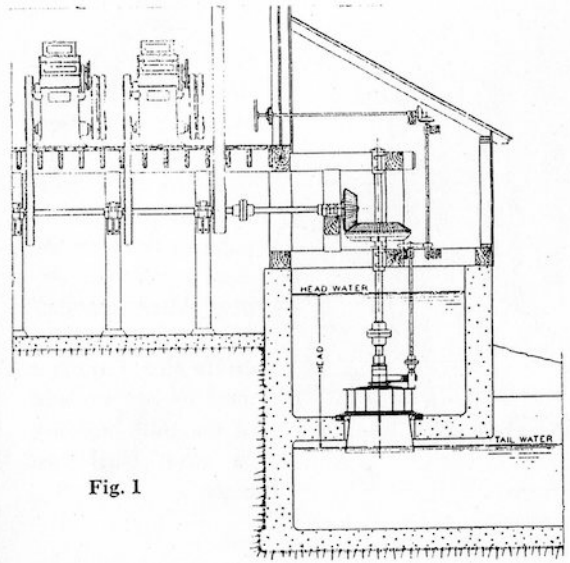


Fig. 1

Fig. 1 shows a Vertical SAMSON Turbine in an open flume, driving the main line shaft of a Flour Mill through Bevel Mortise Gears. This is an arrangement commonly used under low heads of water.

Improved SAMSON Turbine Driving Flour Mill

Fig. 2 shows a typical arrangement for driving a Feed Mill with a Vertical SAMSON Turbine under a low head of water. Many variations of this drive may be used in connection with Mill and other machinery.

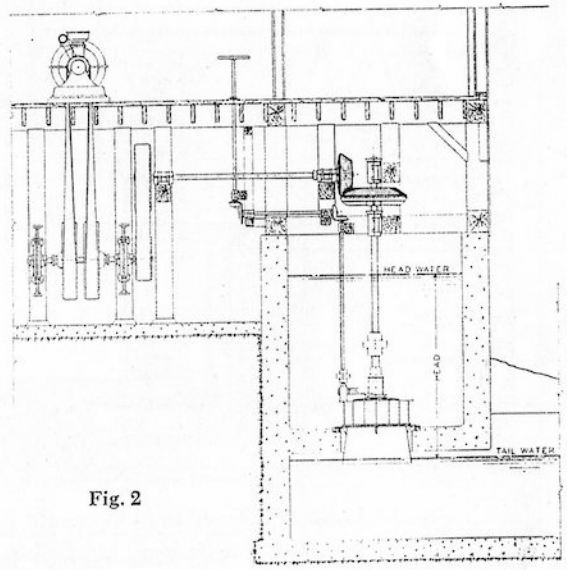


Fig. 2

Improved SAMSON Turbine Driving Feed Mill

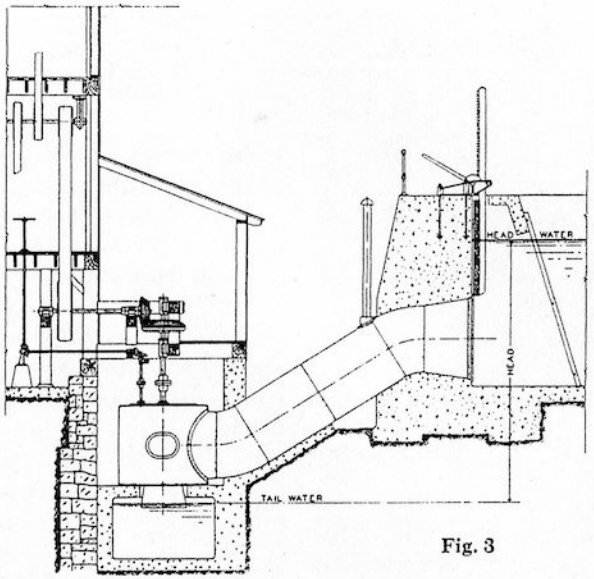


Fig. 3

Fig. 3. When higher heads of water are available, a Vertical SAMSON Turbine installed in a Steel Pressure Flume (see page 4) is often the most economical setting. When remodeling old water power mills the Turbine may be set outside of the mill building to save building costs.

Improved SAMSON Turbine in Steel Pressure Flume

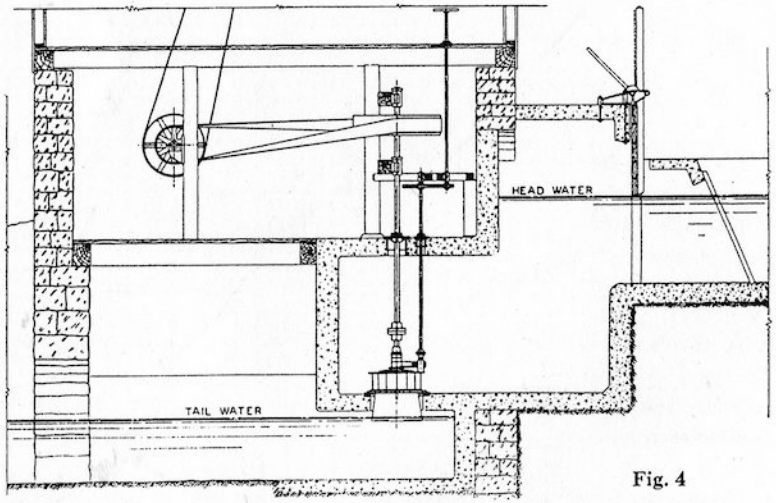


Fig. 4

Improved SAMSON Turbine in Concrete Pressure Flume

Fig. 4 illustrates a Vertical SAMSON Turbine in Concrete Pressure Flume driving line shaft through a Quarter Turn Belt. In some cases concrete construction is more convenient to use, especially where the reinforcement of old foundations and walls is desired.

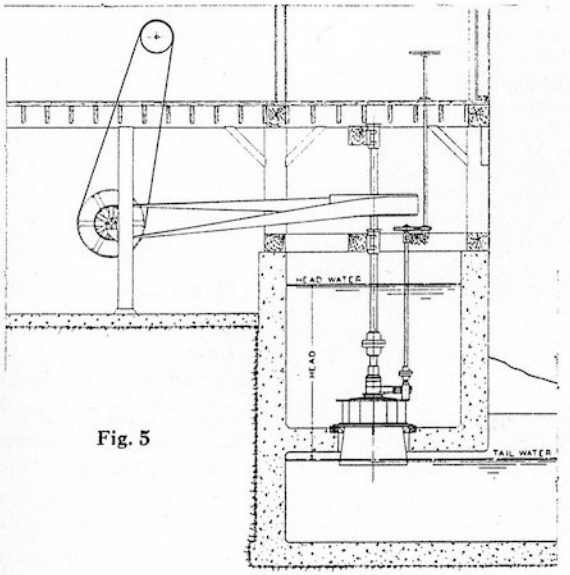


Fig. 5

Fig. 5. The relatively high speed of the Improved SAMSON Turbine under low heads of water frequently permits the use of a Quarter Turn Belt Drive, as a minimum diameter of driving pulley is required. This type of drive is quiet and efficient.

Improved SAMSON Turbine with Quarter Turn Belt Drive to Mill Line Shaft

Fig. 6 shows a Vertical SAMSON Turbine in Open Flume driving a high speed, horizontal Electric Generator through Quarter Turn Belt. A SAMSON Turbine may be used with or without a Governor.

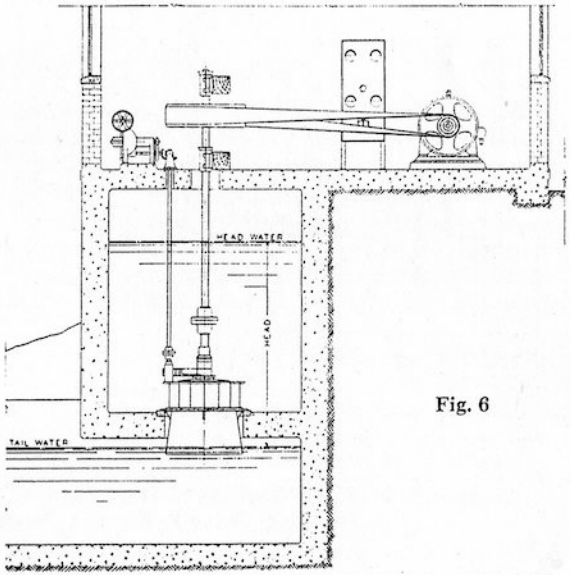


Fig. 6

Improved SAMSON Turbine with Quarter Turn Belt Drive to Electric Generator

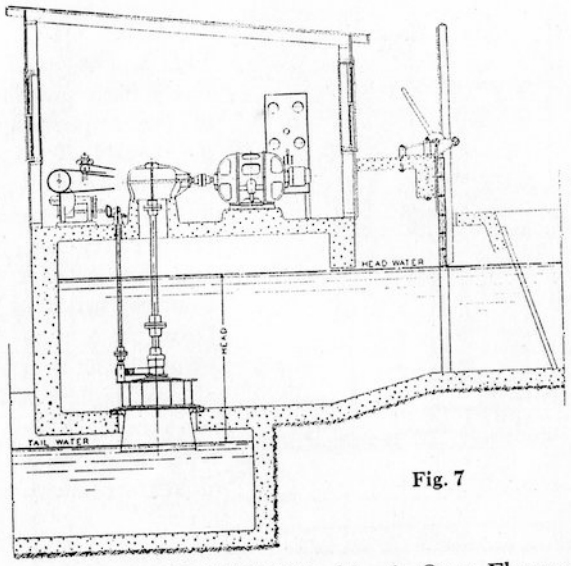


Fig. 7

Figures 7 and 8 shown on this page illustrate a very efficient and modern method of driving a horizontal, high speed Electric Generator using a Vertical SAMSON Turbine which may be installed in either an Open Flume (Fig. 7) or a Steel Pressure Flume (Fig. 8).

Improved SAMSON Turbine in Open Flume with Speed Increaser Drive to Electric Generator

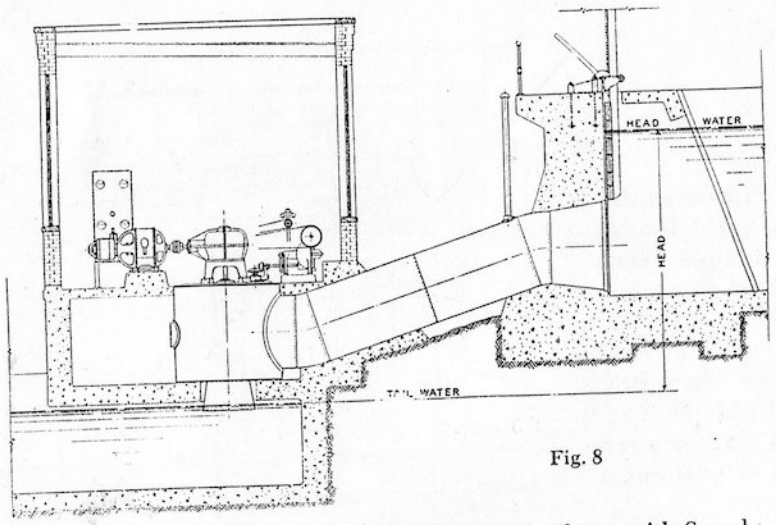


Fig. 8

Improved SAMSON Turbine in Steel Pressure Flume with Speed Increaser Drive to Electric Generator

The Speed Increaser Drive consists of accurately machined steel gears encased in a metal housing filled with oil. These gears are of the correct proportion to step up the Turbine speed to the high speed of the Generator. This makes a very quiet, compact and efficient arrangement. Further particulars will be furnished on request.

Our SAMSON TURBINE, described in this Bulletin (Pages 1 to 10, inclusive), is a product of over ninety-two years of continuous experience in the design and manufacture of high grade, hydraulic equipment. Many improvements have been made in this Turbine without changing overall dimensions or operating speed, and it is today the most POWERFUL and EFFICIENT TURBINE especially adapted for driving factory and mill equipment.

In addition to the foregoing examples of SAMSON TURBINE installation many other arrangements may be used, utilizing horizontal as well as vertical settings. Our Engineering Department will gladly assist and advise you regarding any details relating to the installation of LEFFEL Turbines. In order that you may realize the most from this service please give us **all possible information** with your first inquiry, using the following as a guide:

HEAD OF WATER: This is the vertical distance from Head Water surface down to Tail Water surface. The term "HEAD" is graphically illustrated on Figures 1 to 8, inclusive.

QUANTITY OF WATER AVAILABLE: If possible give minimum and average stream flow in cubic feet per minute. See pages 14 and 15 for instructions for measuring the flow of streams.

MACHINERY TO BE DRIVEN: State kinds of machinery to be driven, pulley sizes and line shaft speeds.

PRESENT TURBINES: State make and size of present turbines; this is always helpful in the selection of new equipment. Send drawings, sketches or photos of present conditions.

PIPE LINE: If present Pipe Line or Feeder Pipe is to be used state length and diameter. If it is to be new, state length required.

IMPORTANT – Please Note!

We ALSO design and manufacture a complete line of Vertical and Horizontal Turbines of various capacities and speeds for driving Electric Generators, Pumps, Paper Mills, Textile Mills and many other kinds of heavy duty machinery. A few of these Designs are illustrated on Pages 12 and 13.

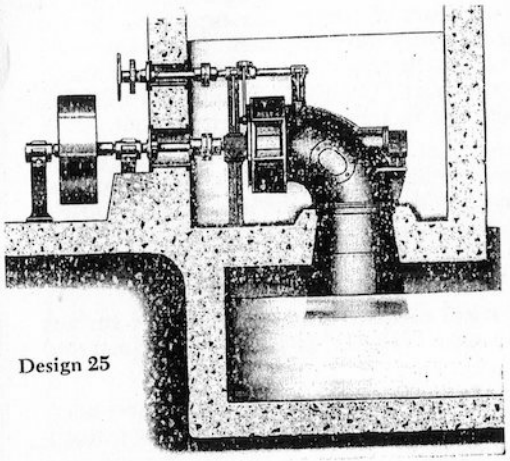
Our staff of designers, with a background of Company experience extending over more than three-quarters of a Century, have produced Hydraulic Turbines, tested by disinterested Engineers, that Established World's Record EFFICIENCIES in the Holyoke Testing Flume, in our Testing Laboratory, and in the field.

SEND FOR OUR LATEST BULLETINS AND INFORMATION CONCERNING HUNDREDS OF DESIGNS, TYPES AND CAPACITIES OF TURBINES MANUFACTURED BY US TO MEET YOUR SPECIFIC CONDITIONS AND REQUIREMENTS.

We also manufacture and are prepared to quote on:

Pipe Lines,
Penstocks,
Draft Tubes,
Manholes,
Head Gate Hoists,
Head Gates,
Trash Racks,
Drain Valves.

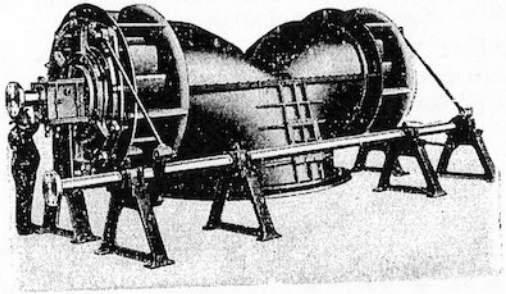
ALL OUR TURBINES ARE FULLY GUARANTEED



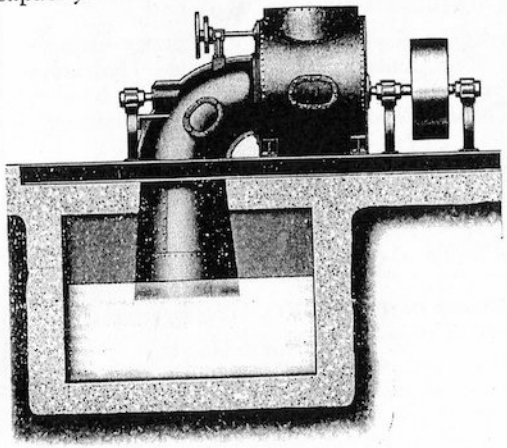
Design 25

Design 25 shows a Single Runner Horizontal Turbine in an Open Flume, arranged for belt drive. LEFFEL turbines of this Design can be furnished with coupling for direct connection, or a V Belt Drive may be used if desired. Numerous LEFFEL Designs, other than shown herein, are available to meet special requirements of head and capacity.

Design 22 indicates a Double Runner, Center Discharge, Horizontal Turbine designed for heavy duty. Turbines similar to this may be installed in Open Flumes or in Horizontal Steel Plate Pressure Cases. This Twin Runner design permits high speed with great capacity. Frequently pairs of Turbines of this type are connected in tandem for still greater capacity.

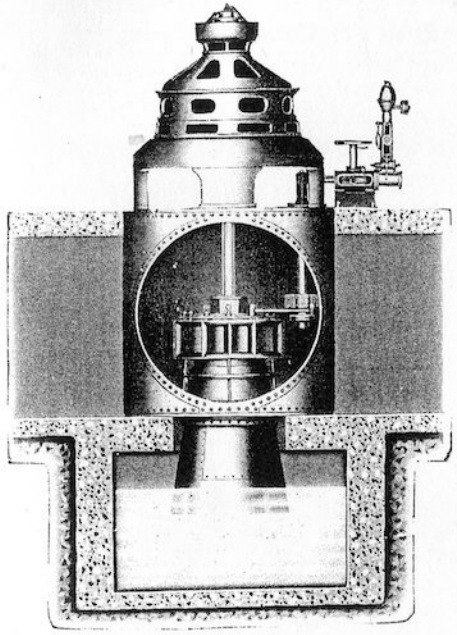


Design 22



Design 24

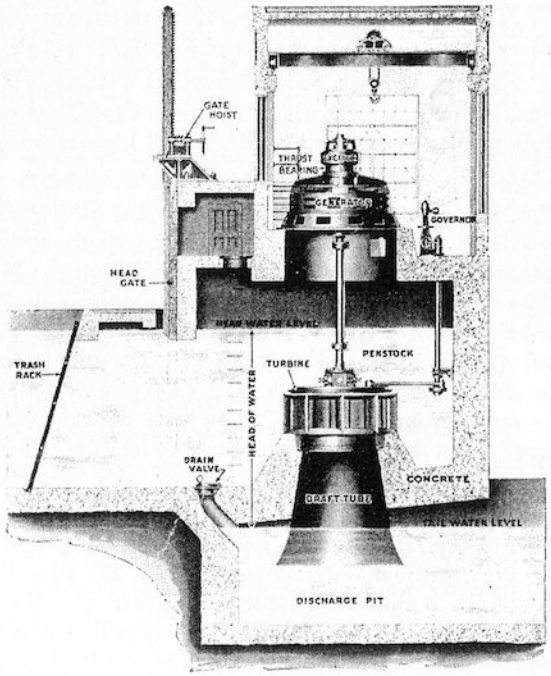
Design 24 illustrates a Single Discharge Horizontal Turbine similar to Design 25 except that it is installed in a Steel Plate Pressure Case suitable for higher heads of water. Many other forms of this same design are available. We also specialize in the design and manufacture of Horizontal and Vertical Scroll Case Turbines of various capacities and speeds. YOUR SPECIFICATIONS WILL RECEIVE OUR PROMPT ATTENTION.



Design 156

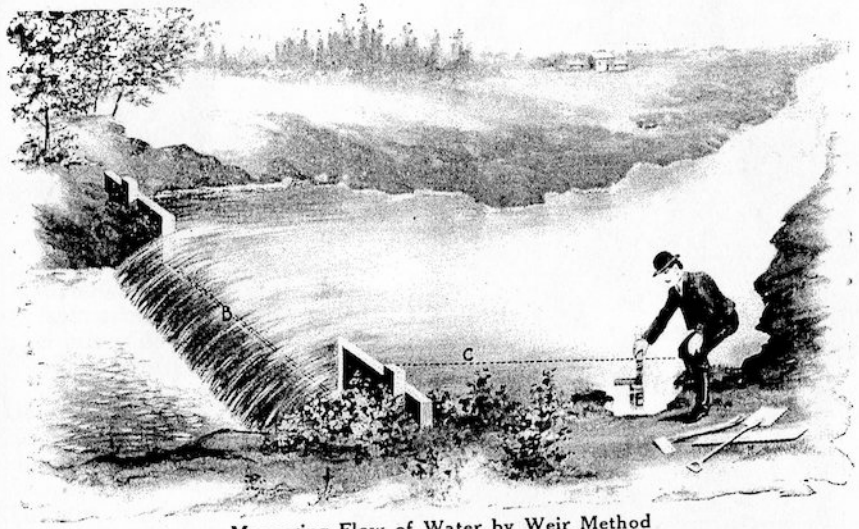
Design 156 shows a Vertical LEFFEL Turbine in a Steel Pressure Flume and direct connected to a Vertical Electric Generator which is mounted on top of the Flume. This makes a complete self contained unit, very economical as to field construction and erection costs. It may be used under low heads of water where present conditions do not permit of an economical open Flume installation and it is also admirably suited to the higher head developments involving Pipe Lines. LEFFEL Turbines of all types may be used in this Design.

Design A159, shown at the right, illustrates a complete typical Open Flume setting for a LEFFEL Vertical Turbine direct connect to Vertical Electric Generator. This type of setting is particularly adapted to the lower Heads of Water and, when ample water passages are provided, highest Efficiency is possible. WE ALSO FURNISH MANY other designs of Vertical Turbines suitable for high or low heads of water and for installation in cast iron, steel or concrete Scroll Cases. WRITE FOR FURTHER PARTICULARS.



Design A 159

Different Methods With Instructions For Measuring Water



Measuring Flow of Water by Weir Method

After deciding upon suitable location for the new power plant, the following preliminary measurements must be obtained:

FIRST, obtain in feet the head of water This is the vertical distance from the surface of water above dam down to the tail water surface below dam at the place where turbines will be located.

SECOND, obtain minute cubic feet of water. Several methods may be used, the easiest and most commonly used methods are as follows:

If the stream is large, select place where water flows slowly for some distance between parallel banks and where the bottom of stream is fairly even. Then carefully space and measure the cross sectional area of water in square feet. Then place a float that sinks well down into the water in the center of stream and accurately measure the distance in feet the float travels in one minute. Then multiply this distance by the cross sectional square feet area, and eighty-three per cent of this result will be approximately the minute cubic feet of water flowing in the stream. Or,

If the stream is small the water can be measured by weir. (See the above illustration.) Select first a suitable location in stream where water flows slowly, then place a board with notch in same, forming a weir dam; the down stream edge of weir notch beveled almost to a sharp edge; the width B must be about six times the greatest depth of water flowing over weir. The bottom edge of weir not less than one foot above

Table Giving Minute Cubic Feet of Water 1 Inch Wide Flowing Over Weir

Inches Depth C Over Stake		⅛ Inch	¼ Inch	⅜ Inch	½ Inch	⅝ Inch	¾ Inch	⅞ Inch
1 Inch	.40	.47	.55	.65	.74	.83	.93	1.03
2 "	1.14	1.24	1.36	1.47	1.59	1.71	1.83	1.96
3 "	2.09	2.23	2.36	2.50	2.63	2.78	2.92	3.07
4 "	3.22	3.37	3.52	3.68	3.83	3.99	4.16	4.32
5 "	4.50	4.67	4.84	5.01	5.18	5.36	5.54	5.72
6 "	5.90	6.09	6.28	6.47	6.65	6.85	7.05	7.25
7 "	7.44	7.64	7.84	8.05	8.25	8.45	8.66	8.86
8 "	9.10	9.31	9.52	9.74	9.96	10.18	10.40	10.62
9 "	10.86	11.08	11.31	11.54	11.77	12.00	12.23	12.47
10 "	12.71	12.95	13.19	13.43	13.67	13.93	14.16	14.42
11 "	14.67	14.92	15.18	15.43	15.67	15.96	16.20	16.46
12 "	16.73	16.99	17.26	17.52	17.78	18.05	18.32	18.58
13 "	18.87	19.14	19.42	19.69	19.97	20.24	20.52	20.80
14 "	21.09	21.37	21.65	21.94	22.22	22.51	22.79	23.08
15 "	23.38	23.67	23.97	24.26	24.56	24.86	25.16	25.46
16 "	25.76	26.06	26.36	26.66	26.97	27.27	27.58	27.89
17 "	28.20	28.51	28.82	29.14	29.45	29.76	30.08	30.39
18 "	30.70	31.02	31.34	31.66	31.98	32.31	32.63	32.96
19 "	33.29	33.61	33.94	34.27	34.60	34.94	35.27	35.60
20 "	35.94	36.27	36.60	36.94	37.28	37.62	37.96	38.31
21 "	38.65	39.00	39.34	39.69	40.04	40.39	40.73	41.09
22 "	41.43	41.78	42.13	42.49	42.84	43.20	43.56	43.92
23 "	44.28	44.64	45.00	45.38	45.71	46.08	46.43	46.81
24 "	47.18	47.55	47.91	48.28	48.65	49.02	49.39	49.76

the surface of water below the down-stream side of weir. Then drive a stake up stream several feet above weir. The top of stake must be exactly level with bottom edge of weir. When all water is flowing over weir, measure the depth C over top of stake, then read above weir table which gives the minute cubic feet of water 1 inch wide flowing over weir. Example: Assume width B of weir as 70 inches, depth C as 12½ inches. Look down the first column in weir table to 12 inches, then horizontally to column under ½ inch. The minute cubic feet flowing over weir 1 inch wide, 12½ inches deep will be 17.78 multiplied by 70 inches, the result is 1244.60 minute cubic feet flowing over weir.

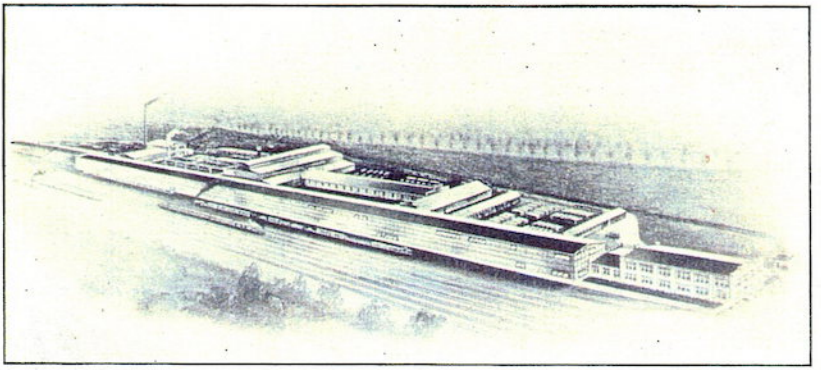
The horsepower of the minute cubic feet of water thus obtained for any head up to 50 feet given in power tables, pages 10 to 13, inclusive.

If water is measured by miner's inch method, give us the number of miner's inches of water per minute, together with the head of water. We then will advise the horsepower that can be developed by our turbines.

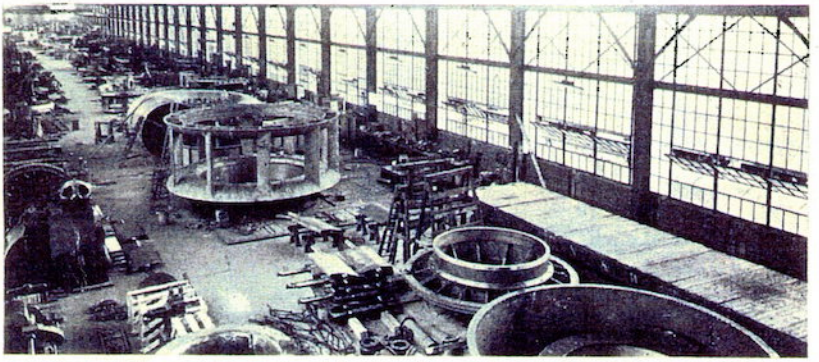
Send us full measurements and particulars regarding proposed new turbine installment. We will reply promptly with full information.

THE JAMES LEFFEL & CO.

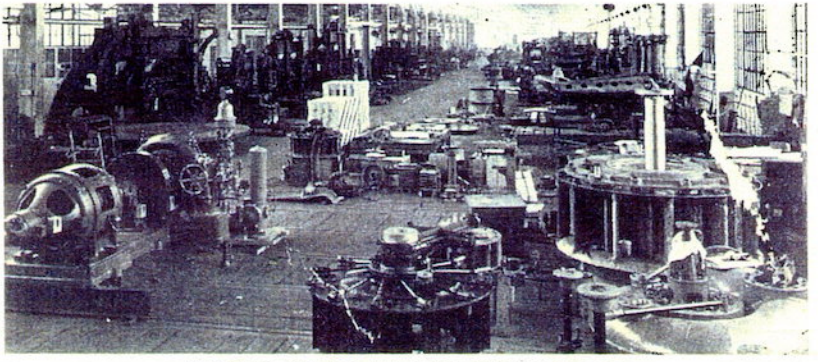
ESTABLISHED 1862



MAIN OFFICE AND FACTORY



MACHINE AND ERECTING DEPARTMENT



SHOWING LEFFEL TURBINES IN PRODUCTION

Our factory is located on several principal railroads and is of latest industrial design thruout, equipped with special motor driven machinery for produciton of Leffel turbine water wheels and accessories. We give all orders our most prompt and careful attention.