

For the Journal of the Franklin Institute.

*Strength of Cast Iron and Timber Pillars: A series of Tables showing the Breaking Weight of Cast Iron, Dantzic Oak, and Red Deal Pillars.* By WM. BRYSON, Civ. Eng.

Continued from vol. xlviii, page 349.

SOLID UNIFORM SQUARE PILLARS OF DANTZIC OAK, BOTH ENDS BEING FLAT AND FIRMLY FIXED.

Length or height of Pillar in feet.	Side of the square in inches.	Value of $w$ in tons from formula $w = 10 \cdot 95 \frac{D^4}{L^3}$	Value of $c$ .	Calculated breaking weight in tons from formula $Y = \frac{w \cdot c}{w + \frac{1}{3}c}$
6	11	4453.80	417.57	390.13
7	"	3271.81	"	383.87
8	"	2504.98	"	371.16
9	"	1979.24	"	360.52
10	"	1603.18	"	349.33
11	"	1324.95	"	337.74
12	"	1113.32	"	325.89
13	"	948.63	"	313.93
14	"	817.95	"	301.95
15	"	712.52	"	290.07
16	"	626.24	"	278.36
17	"	554.73	"	266.89
18	"	494.81	"	255.72
19	"	444.09	"	244.88
20	"	400.79	"	234.40
21	"	363.53	"	224.47
22	"	331.23	"	214.63
23	"	303.06	"	205.35
24	"	278.33	"	196.48
25	"	256.51	"	188.01
26	"	237.15	"	179.94
27	"	219.91	"	172.25
28	"	204.48	"	164.94
29	"	190.62	"	157.99
30	"	178.13	"	151.39

SOLID UNIFORM SQUARE PILLARS OF DANTZIC OAK, BOTH ENDS BEING FLAT AND FIRMLY FIXED.

1	12	227059.2	496.94	496.12
2	"	56764.8	"	493.69
3	"	25228.8	"	489.70
4	"	14191.2	"	484.22
5	"	9082.36	"	477.35
6	"	6307.2	"	469.21
7	"	4633.87	"	459.94
8	"	3547.8	"	449.69
9	"	2803.2	"	438.62
10	"	2270.59	"	426.87
11	"	1876.52	"	414.59
12	"	1576.8	"	401.93
13	"	1343.54	"	389.02
14	"	1158.46	"	375.97
15	"	1009.15	"	362.90
16	"	886.95	"	349.90

(TABLE CONTINUED.)

Length or height of Pillar in feet.	Side of the square in inches.	Value of $w$ in tons from formula $w = 10 \cdot 95 \frac{D^4}{L^3}$	Value of $e$ .	Calculated break- ing weight in tons from for- mula $Y = \frac{w}{w + \frac{1}{3}c}$
17	12	785·67	496·94	337·05
18	"	700·8	"	324·41
19	"	628·97	"	312·03
20	"	567·64	"	299·97
21	"	514·87	"	288·26
22	"	469·13	"	276·93
23	"	429·22	"	265·98
24	"	394·2	"	255·43
25	"	363·29	"	245·29
26	"	335·88	"	235·55
27	"	311·46	"	226·22
28	"	289·61	"	217·29
29	"	269·98	"	208·75
30	"	252·28	"	200·59
6	13	8687·30	583·21	555·25
7	"	6382·51	"	545·80
8	"	4886·60	"	535·29
9	"	3861·02	"	523·86
10	"	3127·42	"	511·65
11	"	2584·65	"	498·79
12	"	2171·82	"	485·44
13	"	1850·55	"	471·71
14	"	1595·62	"	457·73
15	"	1389·96	"	443·61
16	"	1221·65	"	429·44
17	"	1082·15	"	415·33
18	"	965·25	"	401·34
19	"	866·32	"	387·54
20	"	781·85	"	373·98
21	"	709·16	"	360·72
22	"	646·16	"	347·78
23	"	591·19	"	335·20
24	"	543·00	"	323·01
25	"	500·38	"	311·18
26	"	462·63	"	299·77
27	"	429·00	"	288·77
28	"	398·90	"	278·18
29	"	371·87	"	267·99
30	"	347·49	"	258·20

SOLID UNIFORM SQUARE PILLARS OF RED DEAL, BOTH ENDS BEING FLAT  
AND FIRMLY FIXED.

		$w = 7 \cdot 81 \frac{D^4}{L^3}$		
1	12	161948·16	423·36	422·53
2	"	40487·04	"	420·06
3	"	17994·24	"	416·01
4	"	10121·76	"	410·48
5	"	6477·92	"	403·57
6	"	4498·56	"	395·44
7	"	3305·06	"	386·25
8	"	2530·44	"	376·15

(TABLE CONTINUED.)

Length or height of Pillar in feet.	Side of the square in inches.	Value of $w$ in tons from formula $w = 7.81 \frac{D^4}{L^3}$	Value of $c$ .	Calculated breaking weight in tons from formula $Y = \frac{wc}{w + \frac{3}{4}c}$
9	12	1925.28	423.36	363.42
10	"	1619.48	"	353.96
11	"	1338.41	"	342.18
12	"	1124.64	"	330.14
13	"	958.27	"	317.99
14	"	826.26	"	305.83
15	"	719.76	"	293.76
16	"	632.61	"	281.87
17	"	560.37	"	270.12
18	"	499.84	"	258.89
19	"	448.60	"	247.89
20	"	404.87	"	237.27
21	"	367.22	"	227.04
22	"	334.60	"	217.22
23	"	306.14	"	207.81
24	"	281.16	"	198.82
25	"	259.11	"	190.23
26	"	239.56	"	182.05
27	"	222.15	"	174.27
28	"	206.56	"	166.86
29	"	192.56	"	159.82
30	"	179.94	"	153.13

HOLLOW UNIFORM CYLINDRICAL PILLARS OF CAST IRON, BOTH ENDS BEING FLAT AND FIRMLY FIXED.

Length or height of Pillar in feet.	External diameter in inches.	Internal diameter in inches.	No. of diameters contained in the length or height.	Calculated breaking weight in tons from formula $w = 46.65 \frac{D^{3.55} - d^{3.55}}{L^{1.7}}$	Value of $w$ .	Value of $c$ .	Calculated breaking weight in tons from formula $Y = \frac{wc}{w + \frac{3}{4}c}$
8	3	2	32		51.26	192.42	50.43
9			36	41.96			
10			40	35.08			
11			44	29.83			
12			48	25.73			
13			52	22.46			
14			56	19.80			
15			60	17.61			
16			64	15.78			
17			68	14.23			
18			72	12.91			
19			76	11.78			
20			80	10.79			
21			84	9.93			
22			88	9.18			
23			92	8.51			

(TABLE CONTINUED.)

Length or height of Pillar in feet.	External diameter in inches.	Internal diameter in inches.	No. of diameters contained in the length or height.	Calculated breaking weight in tons from formula $W = 46.65 \frac{D^3.55 - d^3.55}{L^{1.7}}$	Value of w.	Value of c.	Calculated breaking weight in tons from formula $Y = \frac{w c}{w + \frac{1}{4} c}$
24	4	3	96	7.92	119.40	269.39	100.06
25			100	7.38			
8			24				
9			27				
10			30				
11			33				
12			36	59.93			
13			39	52.30			
14			42	46.11			
15			45	41.01			
16			48	36.75			
17			51	33.15			
18			54	30.08			
19			57	27.43			
20			60	25.14			
21			63	23.14			
22			66	21.38			
23			69	19.83			
24			72	18.44			
25			75	17.21			
8	5	4	19.2		225.43	346.36	160.92
9			21.6				
10			24				
11			26.4				
12			28.8				
13			31.2				
14			33.6				
15			36	77.43			
16			38.4	69.38			
17			40.8	62.59			
18			43.2	56.79			
19			45.6	51.80			
20			48	47.48			
21			50.4	43.70			
22			52.8	40.37			
23			55.2	37.44			
24			57.6	34.82			
25			60	32.49			
8	6	5	16		375.06	423.33	229.26
9			18				
10			20				
11			22				
12			24				
13			26				
14			28				
15			30				
16			32				
17			34	104.13			
18			36	94.49			
19			38	86.19			
20			40	78.99			

(TABLE CONTINUED.)

Length or height of Pillar in feet.	External diameter in inches.	Internal diameter in inches.	No. of diameters contained in the length or height.	Calculated breaking weight in tons from formula $w = \frac{D^2 \cdot 55 - L^2 \cdot 55}{L \cdot 17}$ $w = 46 \cdot 65$	Value of w.	Value of c.	Calculated breaking weight in tons from formula $y = \frac{w \cdot c}{w + \frac{3}{4}c}$
21	7	5.5	42	72.70	782.50	721.58	426.56
22			44	67.18			
23			46	62.29			
24			48	57.94			
25			50	54.06			
8			13.714				
9			15.428				
10			17.142				
11			18.857				
12			20.571				
13			22.285				
14			24				
15			25.714				
16			27.428				
17			29.142				
18			30.857				
19			32.571	179.82			
20			34.285	164.81			
21	8	6.5	36	151.69	1139.76	837.03	539.73
22			37.714	140.15			
23			39.428	129.95			
24			41.142	120.89			
25			42.857	112.78			
8			12				
9			13.5				
10			15				
11			16.5				
12			18				
13			19.5				
14			21				
15			22.5				
16			24				
17			25.5				
18			27				
19			28.5				
20			30				
21			31.5				
22	9	7.5	33	204.14	1582.15	952.49	656.16
23			34.5	189.28			
24			36	176.08			
25			37.5	164.27			
8			10.666				
9			12				
10			13.333				
11			14.666				
12			16				
13			17.333				
14			18.666				
15			20				
16			21.333				
17			22.666				

(TABLE CONTINUED.)

Length or height of Pillar in feet.	External diameter in inches.	Internal diameter in inches.	No. of diameters con- tained in the length or height.	Calculated breaking weight in tons from formula $W = 46 \cdot 65 \frac{D^{3.55} - d^{3.55}}{L^{1.7}}$	Value of w.	Value of c.	Calculated breaking weight in tons from formula $Y = \frac{w c}{w + \frac{3}{2} c}$
18	10	8.5	24	228.04	398.61	1067.94	341.13
19			25.333		363.59		321.27
20			26.666		333.23		302.97
21			28		306.71		286.10
22			29.333		283.88		270.52
23			30.666		262.76		256.13
24			32		244.42		242.81
25			33.333				
8			9.6		2115.61		774.65
9			10.8		1731.70		730.20
10			12		1447.74		687.55
11			13.2		1231.19		647.01
12			14.4		1061.91		608.76
13			15.6		926.81		572.86
14			16.8		817.10		539.29
15			18		726.67		508.00
16			19.2		651.16		478.88
17			20.4		587.38		451.82
18			21.6		533.01		426.71
19			22.8		486.19		403.38
20			24		445.58		381.73
21			25.2		410.12		361.64
22			26.4		378.93		342.97
23			27.6		351.36		325.63
24			28.8		326.84		309.53
25			30		304.93		294.46
8	11	9	8.727		3449.00	1539.38	1153.31
9			9.818		2823.16		1092.57
10			10.909		2360.19		1033.71
11			12		2007.16		977.25
12			13.090		1731.18		923.49
13			14.181		1510.94		872.60
14			15.272		1332.08		824.64
15			16.363		1184.66		779.60
16			17.454		1061.56		737.39
17			18.545		957.58		697.91
18			19.636		868.95		661.06
19			20.727		792.61		626.62
20			21.818		726.42		594.50
21			22.909		668.60		564.53
22			24		617.76		536.57
23			25.090		572.80		510.47
24			26.181		532.83		486.10
25			27.272		497.12		463.32
8	12	10	8		4392.96	1693.32	1313.57
9			9		3595.83		1251.35
10			10		3006.15		1190.41
11			11		2556.51		1131.31
12			12		2205.00		1074.46
13			13		1924.47		1020.12
14			14		1696.66		968.42

(TABLE CONTINUED.)

Length or height of Pillar in feet.	External diameter in inches.	Internal diameter in inches.	No. of diameters contained in the length or height.	Value of w in tons from formula $w = \frac{d^3 \cdot 55}{L \cdot 17}$	Value of c.	Calculated breaking weight in tons from formula $y = \frac{w \cdot c}{w + \frac{3}{4} c}$
15	13	11	15	1508.90	1693.32	919.45
16			16	1352.10		873.17
17			17	1219.66		829.54
18			18	1106.77		788.51
19			19	1009.55		749.92
20			20	925.23		713.69
21			21	851.60		679.69
22			22	786.84		647.77
23			23	729.57		617.83
24			24	678.67		589.74
25			25	633.18		563.36
8			7.384	5479.02		1474.43
9			8.307	4484.82		1411.28
10			9.230	3749.36		1348.84
11			10.153	3188.55		1287.73
12			11.076	2750.13		1228.41
13			12	2400.26		1171.22
14			12.923	2116.12		1116.36
15			13.846	1881.94		1063.98
16			14.769	1686.88		1014.11
17			15.692	1521.20		966.76
18			16.615	1380.40		921.94
19			17.538	1259.14		879.51
20			18.461	1153.98		839.44
21			19.384	1062.14		801.62
22			20.307	981.37		765.94
23			21.230	909.95		732.30
24			22.153	846.46		700.58
25			23.076	789.72		670.67
8	14	12	6.857	6715.87	2001.19	1635.64
9			7.714	5497.24		1571.99
10			8.571	4595.74		1508.52
11			9.428	3908.34		1445.92
12			10.285	3370.96		1384.67
13			11.142	2942.10		1325.16
14			12	2593.82		1267.66
15			12.857	2306.78		1212.37
16			13.714	2067.07		1159.37
17			14.571	1864.60		1108.72
18			15.428	1692.01		1060.48
19			16.285	1543.38		1014.56
20			17.142	1414.48		971.37
21			18	1301.91		929.55
22			18.857	1202.91		890.32
23			19.714	1115.36		853.14
24			20.571	1037.54		817.95
25			21.428	967.99		784.61
8	15	12.5	6.4	9700.51	2645.81	2196.47
9			7.2	7940.29		2116.78
10			8	6638.17		2036.89
11			8.8	5645.27		1957.65

(TABLE CONTINUED.)

Length or height of Pillar in feet.	External diameter in inches.	Internal diameter in inches.	No. of diameters con- tained in the length or height.	Value of $w$ in tons from formula $w = 46.65 \frac{D^{3.55} - d^{3.55}}{L^{1.7}}$	Value of $c$ .	Calculated breaking weight in tons from formula $Y = \frac{w c}{w + \frac{3}{4} c}$
12	15	12.5	9.6	4869.06	2838.23	1879.71
13			10.4	4249.61		1803.59
14			11.2	3746.56		1729.66
15			12	3331.94		1658.21
16			12.8	2985.71		1589.41
17			13.6	2693.26		1523.37
18			14.4	2443.97		1460.18
19			15.2	2229.28		1399.77
20			16	2043.10		1342.17
21			16.8	1880.50		1287.33
22			17.6	1737.51		1235.14
23			18.4	1611.05		1185.52
24			19.2	1498.64		1138.39
25			20	1398.18		1093.62
8	16	13.5	6	11594.01	2838.23	2397.96
9			6.75	9490.21		2318.24
10			7.5	7933.91		2237.82
11			8.25	6747.20		2157.54
12			9	5819.49		2078.09
13			9.75	5079.12		2000.01
14			10.5	4477.87		1923.73
15			11.25	3982.33		1849.57
16			12	3568.51		1777.76
17			12.75	3218.97		1708.45
18			13.5	2921.03		1641.79
19			14.25	2664.43		1577.73
20			15	2441.90		1516.36
21			15.75	2247.56		1457.66
22			16.5	2076.66		1401.56
23			17.25	1925.52		1348.00
24			18	1791.12		1296.90
25			18.75	1671.10		1248.22
8	17	14.5	5.647	13697.25	3030.66	2599.31
9			6.354	11211.80		2519.81
10			7.058	9373.18		2439.16
11			7.764	7971.20		2358.21
12			8.470	6875.16		2277.64
13			9.176	6000.52		2198.04
14			9.882	5290.19		2119.84
15			10.588	4704.75		2043.42
16			11.294	4215.87		1969.04
17			12	3802.92		1896.89
18			12.705	3450.92		1827.17
19			13.411	3147.78		1759.87
20			14.117	2884.88		1695.09
21			14.823	2655.29		1632.87
22			15.529	2453.38		1573.16
23			16.235	2274.82		1515.93
24			16.941	2116.10		1461.16
25			17.647	1974.25		1408.74
8	18	15.5	5.333	16017.99	3223.08	2800.45



(TABLE CONTINUED.)

Length or height of Pillar in feet.	External diameter in inches.	Internal diameter in inches.	No. of diameters contained in the length or height.	Value of w in tons from formula $w = \frac{D^{3.55} - L^{3.55}}{L^{1.7}}$ $w = 46.85$	Value of c.	Calculated breaking weight in tons from formula $y = \frac{w c}{w + \frac{1}{3} c}$
9			6	13111.43		2721.35
10			6.666	10961.29		2640.71
11			7.333	9321.76		2559.38
12			8	8040.05		2478.03
13			8.666	7017.19		2397.26
14			9.333	6186.51		2317.53
15			10	5501.88		2239.24
16			10.666	4930.17		2162.69
17			11.333	4447.25		2088.09
18			12	4035.62		2015.69
19			12.666	3681.11		1945.50
20			13.333	3373.67		1877.68
21			14	3105.18		1812.27
22			14.666	2869.06		1749.25
23			15.333	2660.25		1688.64
24			16	2474.63		1630.42
25			16.666	2308.75		1574.52

(To be continued.)

*On Chemistry Applied to the Arts.* By Dr. F. CRACE CALVERT,  
F.R.S., F.C.S.

From the London Chemical News, No. 243.

(Continued from page 114.)

## LECTURE IV.

ANIMAL FATTY MATTERS, the various processes for liberating them from the tissues in which they are contained. Their composition and conversion into soap. Composite candles. The refining of lard. *Cod liver, Sperm,* and other oils. *Spermaceti and wax.*

It will be quite out of the question for me to enter upon a general description of the properties and composition of fatty matters, as to do so would be to undertake far too wide a field of research. All that I can attempt in this lecture is to give an idea of their composition, and to describe some of their most recent applications to arts and manufactures.

The question of the source of the fatty matters in herbivorous animals has been the subject of a great number of scientific researches, but those of Baron Liebig, Dumas, Boussingault, Payen, and Milne Edwards have left no doubt that when the food of an animal contains a sufficient amount of fatty matter, this is simply extracted from the