61ST CONGRESS : : 3D SESSION

DECEMBER 5, 1910-MARCH 4, 1911

HOUSE DOCUMENTS

VOL. 24

WASHINGTON : : GOVERNMENT PRINTING OFFICE : : 1911

61ST CONGRESS, 3d Session } HOUSE OF REPRESENTATIVES { DOCUMENT No. 1089

REPORT

OF THE

TESTS OF METALS

AND

OTHER MATERIALS

MADE WITH THE

UNITED STATES TESTING MACHINE AT WATERTOWN ARSENAL, MASSACHUSETTS, DURING THE FISCAL YEAR ENDED JUNE 30

1910

WASHINGTON
1911

WAR DEPARTMENT,
Washington, December 6, 1910.

SIR: I have the honor to transmit herewith a letter from the Chief of Ordnance, United States Army, dated November 23, 1910, submitting, for transmission to Congress as required by law, the report of the commanding officer of Watertown Arsenal, of "Tests of Iron and Steel and Other Material for Industrial Purposes," made at that arsenal during the fiscal year ended June 30, 1910.

Very respectfully,

J. M. DICKINSON,
Secretary of War.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ORDNANCE,
Washington, November 23, 1910.

SIR: I have the honor to submit, for transmission to Congress, as required by law, the report of the commanding officer of Watertown Arsenal of "Tests of Iron and Steel and other Material for Industrial Purposes," made at that arsenal during the fiscal year ended June 30, 1910 (O.O. file 18563).

Very respectfully,

WILLIAM CROZIER,
Brig. Gen., Chief of Ordnance.

The honorable the SECRETARY OF WAR.

WATERTOWN ARSENAL,
Watertown, Mass., November 19, 1910.

SIR: I have the honor to submit herewith the annual report of tests of iron, steel, and other materials made at this arsenal during the fiscal year ended June 30, 1910:

The total number of specimens tested during the year was 3,225, classified as follows:

Gun specimens	78
For Ordnance Department	2,370
Fo other Government departments	20
Tests for private parties	757
Total	3,225

The receipts and expenditures were as follows:

Amount appropriated for testing machine and testing work	$15,000.00
Received from private parties	2,452.32
Total received	17,452.32
Amount expended for services and labor	12,521.82
Amount expended for light, power, tools, implements, and material for test	4,029.94
Deposited to credit of Treasurer of United States	900.56
Total expended	17,452.32

Mr. James E. Howard, who has been engineer of tests at this arsenal for many years, severed his connection with it in March, 1910, by resignation. This position was filled by the appointment of Mr. H. L. Whittemore, who assumed his duties on June 20, 1910.

The tests made for the Ordnance Department consisted principally of those of the products of the arsenal foundry and smith shop and of materials purchased for the purposes of the department. Tests for private parties have been made in accordance with the provision of the law whereby any citizen of the United States may have tests made at this arsenal upon defraying the cost of the same. The names of parties who availed themselves of these facilities are appended to the report. The results of such tests are considered confidential and are not, therefore, published.

Respectfully,

C. B. WHEELER,
Lieut. Col., Ordnance Department,
United States Army, Commanding.

The CHIEF OF ORDNANCE UNITED STATES ARMY,
Washington, D. C.

TABLE OF CONTENTS.

REPORT

OF THE

TESTS OF METALS

AND

OTHER MATERIALS

MADE WITH THE

UNITED STATES TESTING MACHINE AT WATERTOWN
ARSENAL, MASSACHUSETTS, DURING THE
FISCAL YEAR ENDED JUNE 30, 1910

3-INCH FIELD GUN, 1905.

SPECIMENS FROM TUBE, JACKET, LOCK HOOP, BREECHBLOCK.

3-INCH FIELD GUN, 1905.

TUBE.

No. 9049.

Marks, B 5119, BT, 3 M.
Diameter, 0.504 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads per sq. in.	In gaged length.		Per inch.		Remarks.
	Elongation.	Set.	Elongation.	Successive elongation.	
Lb.	*In.*	*In.*	*In.*	*In.*	
1 000	0.	0.	0.	0.	
5 000	.0002	0.	.00010	.00010	
10 000	.0006	.....	.00030	.00020	
20 000	.0019	.....	.00095	.00065	
30 000	.0019	.....	.00095	0.	
40 000	.0025	0.	.00125	.00030	10 000 to 40 000 lb. per sq. in.
45 000	.0028	.....	.00140	.00015	Modulus of elasticity = 31 500 000 lb. per sq. in.
50 000	.0031	.....	.00155	.00015	
55 000	.0035	.....	.00175	.00020	
60 000	.0038	.....	.00190	.00015	
65 000	.0044	.....	.00220	.00030	
67 000	.0049	.....	.00245	.00025	Elastic limit.
68 000	.0055	.....	.00275	.00030	
69 000	.0078	.....	.00390	.00115	
70 000	.0163	.....	.00815	.00425	
105 000	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.41 in. in 2 in. = 20.5 per cent.
Elongation of inch sections, .26*, .15.
Diameter at fracture, 0.39 in. Area, 0.1194 sq. in.
Contraction of area, 40.3 per cent.
Position of fracture, at middle of stem.
Appearance of fracture, silky.

No. 9050.

Marks, B 5128, MT, 3 M.
Diameter, 0.504 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads per sq. in.	In gaged length.		Per inch.		Remarks.
	Elongation.	Set.	Elongation.	Successive elongation.	
Lb.	*In.*	*In.*	*In.*	*In.*	
1 000	0.	0.	0.	0.	
5 000	.0002	0.	.00010	.00010	
10 000	.0006	.....	.00030	.00020	
20 000	.0012	.....	.00060	.00030	
30 000	.0022	.....	.00110	.00050	
40 000	.0029	0.	.00145	.00035	10 000 to 40 000 lb. per sq. in.
45 000	.0033	.....	.00165	.00020	Modulus of elasticity = 26 000 000 lb. per sq. in.
50 000	.0036	.....	.00180	.00015	
55 000	.0039	.....	.00195	.00015	
60 000	.0044	.....	.00220	.00025	
65 000	.0048	.....	.00240	.00020	
69 000	.0052	.....	.00260	.00020	Elastic limit.
70 000	.0055	.....	.00275	.00015	
71 000	.0060	.....	.00300	.00025	
72 000	.0068	.....	.00340	.00040	
73 000	.0093	.....	.00465	.00125	
103 000	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.41 in. in 2 in. = 20.5 per cent.
Elongation of inch sections, .21*, .20*.
Diameter at fracture, 0.37 in. Area, 0.1075 sq. in.
Contraction of area, 46.2 per cent.
Position of fracture, at middle of stem.
Appearance of fracture, silky.

No. 9051.

Marks, B 5132, MT, 3 M.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads per sq. in.	In gaged length.		Per inch.		Remarks.
	Elongation.	Set.	Elongation.	Successive elongation.	
Lb.	*In.*	*In.*	*In.*	*In.*	
1 000	0.	0.	0.	0.	
5 000	.0002	0.	.00010	.00010	
10 000	.0007	.....	.00035	.00025	
20 000	.0015	.....	.00075	.00040	
30 000	.0022	.....	.00110	.00035	
40 000	.0028	0.	.00140	.00030	10 000 to 40 000 lb. per sq. in.
45 000	.0032	.....	.00160	.00020	Modulus of elasticity = 27 200 000 lb. per sq. in.
50 000	.0035	.....	.00175	.00015	
55 000	.0038	.....	.00190	.00015	
60 000	.0043	.....	.00215	.00025	
65 000	.0047	.....	.00235	.00020	
69 000	.0051	.....	.00255	.00020	Elastic limit.
70 000	.0054	.....	.00270	.00015	
71 000	.0061	.....	.00305	.00035	
72 000	.0067	.....	.00335	.00030	
73 000	.0096	.....	.00480	.00145	
74 000	.0141	.....	.00705	.00225	
103 500	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.40 in. in 2 in. = 20 per cent.
Elongation of inch sections, .13, .27*.
Diameter at fracture, 0.37 in. Area, 0.1075 sq. in.
Contraction of area, 46.2 per cent.
Position of fracture, 0.9 in. from the neck.
Appearance of fracture, silky.

No. 9052.

Marks, B 5123, BT, 3 M.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads per sq. in.	In gaged length.		Per inch.		Remarks.
	Elongation.	Set.	Elongation.	Successive elongation.	
Lb.	*In.*	*In.*	*In.*	*In.*	
1 000	0.	0.	0.	0.	
5 000	.0002	0.	.00010	.00010	
10 000	.0004	.....	.00020	.00010	
20 000	.0011	.....	.00055	.00035	
30 000	.0018	.....	.00090	.00035	
40 000	.0025	0.	.00125	.00035	10 000 to 40 000 lb. per sq. in.
45 000	.0029	.....	.00145	.00020	Modulus of elasticity = 28 500 000 lb. per sq. in.
50 000	.0032	.....	.00160	.00015	
55 000	.0035	.....	.00175	.00015	
60 000	.0040	.....	.00200	.00025	
65 000	.0044	.....	.00220	.00020	
70 000	.0050	.....	.00250	.00030	
73 000	.0062	.....	.00310	.00060	Elastic limit.
74 000	.0080	.....	.00400	.00090	
75 000	.0109	.....	.00545	.00145	
76 000	.0131	.....	.00655	.00110	
108 000	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.36 in. in 2 in. = 18 per cent.
Elongation of inch sections, .26*, .10.
Diameter at fracture, 0.38 in. Area, 0.1134 sq. in.
Contraction of area, 43.3 per cent.
Position of fracture, 0.60 in. from the neck.
Appearance of fracture, silky.

No. 9053.

Marks, B 5131, MT, 3 M.
Diameter, 0.504 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads per sq. in.	In gaged length.		Per inch.		Remarks.
	Elongation.	Set.	Elongation.	Successive elongation.	
Lb.	*In.*	*In.*	*In.*	*In.*	
1 000	0.	0.	0.	0.	
5 000	.0002	0.	.00010	.00010	
10 000	.0004	.....	.00020	.00010	
20 000	.0012	.....	.00060	.00040	
30 000	.0019	.....	.00095	.00035	
40 000	.0026	0.	.00130	.00035	10 000 to 40 000 lb. per sq. in.
45 000	.0029	.....	.00145	.00015	Modulus of elasticity = 27 200 000 lb. per sq. in.
50 000	.0032	.....	.00160	.00015	
55 000	.0036	.....	.00180	.00020	
60 000	.0041	.....	.00205	.00025	
62 000	.0043	.....	.00215	.00010	Elastic limit
63 000	.0046	.....	.00230	.00015	
64 000	.0053	.....	.00265	.00035	
65 000	.0065	.....	.00325	.00060	
66 000	.0100	.....	.00500	.00175	
103 000	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.39 in. in 2 in. = 19.5 per cent.
Elongation of inch sections, .24*, .15.
Diameter at fracture, 0.38 in. Area, 0.1134 sq. in.
Contraction of area, 43.3 per cent.
Position of fracture, 1 in. from the neck.
Appearance of fracture, silky.

JACKET.

No. 9054.

Marks, B 3241, BT, 2 M.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads per sq. in.	In gaged length.		Per inch.		Remarks.
	Elongation.	Set.	Elongation.	Successive elongation.	
Lb.	*In.*	*In.*	*In.*	*In.*	
1 000	0.	0.	0.	0.	
5 000	.0003	0.	.00015	.00015	
10 000	.0006	.....	.00030	.00015	
20 000	.0014	.....	.00070	.00040	
30 000	.0022	.....	.00110	.00040	
40 000	.0030	0.	.00150	.00040	10 000 to 40 000 lb. per sq. in.
45 000	.0032	.....	.00160	.00010	Modulus of elasticity = 25 000 000 lb. per sq. in.
50,000	.0037	.....	.00185	.00025	
55 000	.0041	.....	.00205	.00020	
56 000	.0043	.....	.00215	.00010	Elastic limit.
57 000	.0115	.....	.00575	.00360	
58 000	.0200	.....	.01000	.00425	
59 000	.0227	.....	.01135	.00135	
92 500	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.46 in. in 2 in. = 23 per cent.
Elongation of inch sections, .12, .34*.
Diameter at fracture, 0.36 in. Area, 0.1018 sq. in.
Contraction of area, 49.1 per cent.
Position of fracture, 0.90 in. from the neck.
Appearance of fracture, silky.

No. 9055.

Marks, B 3262, BT, 2 M.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads per sq. in.	In gaged length.		Per inch.		Remarks.
	Elongation.	Set.	Elongation.	Successive elongation.	
Lb.	*In.*	*In.*	*In.*	*In.*	
1 000	0.	0.	0.	0.	
5 000	.0002	0.	.00010	.00010	
10 000	.0004	.....	.00020	.00010	
20 000	.0010	.....	.00050	.00030	
30 000	.0015	.....	.00075	.00025	
40 000	.0021	0.	.00105	.00030	10 000 to 40 000 lb. per sq. in.
45 000	.0025	.....	.00125	.00020	Modulus of elasticity = 35 300 000 lb. per sq. in.
50 000	.0028	.....	.00140	.00015	
55 000	.0030	.....	.00150	.00010	
60 000	.0035	.....	.00175	.00025	
64 000	.0040	.....	.00200	.00025	Elastic limit.
65 000	.0045	.....	.00225	.00025	
66 000	.0103	.....	.00515	.00290	
67 000	.0132	.....	.00660	.00145	
102 000	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.25 in. in 2 in. = 12.5 per cent.
Elongation of inch sections, .16*, .09.
Diameter at fracture, 0.43 in. Area, 0.1452 sq. in.
Contraction of area, 27.4 per cent.
Position of fracture, 0.90 in. from the neck.
Appearance of fracture, silky, serrated section.

No. 9056.

Marks, B 3239, MT, 2 M.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads per sq. in.	In gaged length.		Per inch.		Remarks.
	Elongation.	Set.	Elongation.	Successive elongation.	
Lb.	*In.*	*In.*	*In.*	*In.*	
1 000	0.	0.	0.	0.	
5 000	.0002	0.	.00010	.00010	
10 000	.0004	.....	.00020	.00010	
20 000	.0011	.....	.00055	.00035	
30 000	.0019	.....	.00095	.00040	
40 000	.0026	0.	.00130	.00035	10 000 to 40 000 lb. per sq. in.
45 000	.0028	.....	.00140	.00010	Modulus of elasticity = 27 200 000 lb. per sq. in.
50 000	.0031	.....	.00155	.00015	
55 000	.0035	.....	.00175	.00020	
60 000	.0040	.....	.00200	.00025	
62 000	.0043	.....	.00215	.00015	Elastic limit.
63 000	.0062	.....	.00310	.00095	
64 000	.0093	.....	.00465	.00155	
65 000	.0132	.....	.00660	.00195	
97 000	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.33 in. in 2 in. = 16.5 per cent.
Elongation of inch sections, .21*, .12.
Diameter at fracture, 0.42 in. Area, 0.1385 sq. in.
Contraction of area, 30.7 per cent.
Position of fracture, 1.08 in. from the neck.
Appearance of fracture, silky, striated.

No. 9057.

Marks, B 3227, BT, 2 M.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads per sq. in.	In gaged length.		Per inch.		Remarks.
	Elongation.	Set.	Elongation.	Successive elongation.	
Lb.	*In.*	*In.*	*In.*	*In.*	
1 000	0.	0.	0.	0.	
5 000	.0003	0.	.00015	.00015	
10 000	.0005	.....	.00025	.00010	
20 000	.0013	.....	.00065	.00040	
30 000	.0026	.....	.....	.....	
40 000	.0034	0.	.00170	.00105	10 000 to 40 000 lb. per sq. in.
45 000	.0038	.....	.00190	.00020	Modulus of elasticity=20 700 000 lb. per sq. in.
50 000	.0043	.....	.00215	.00025	
55 000	.0049	.....	.00245	.00030	
56 000	.0065	.....	.00325	.00080	Elastic limit.
57 000	.0132	.....	.00660	.00335	
58 000	.0165	.....	.00825	.00165	
103 000	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.40 in. in 2 in. = 20 per cent.
Elongation of inch sections, .14, .26*.
Diameter at fracture, 0.36 in. Area, 0.1018 sq. in.
Contraction of area, 49.1 per cent.
Position of fraction, 1.07 in. from the neck.
Appearance of fracture, silky.

No. 9058.

Marks, B 3260, BT, 2 M.
Diameter, 0.504 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads per sq. in.	In gaged length.		Per inch.		Remarks.
	Elongation.	Set.	Elongation.	Successive elongation.	
Lb.	*In.*	*In.*	*In.*	*In.*	
1 000	0.	0.	0.	0.	
5 000	.0002	0.	.00010	.00010	
10 000	.0005	.....	.00025	.00015	
20 000	.0011	.....	.00055	.00030	
30 000	.0019	.....	.00095	.00040	
40 000	.0026	0.	.00130	.00035	10 000 to 40 000 lb. per sq. in.
45 000	.0028	.....	.00140	.00010	Modulus of elasticity=28 500 000 lbs. per sq. in.
50 000	.0032	.....	.00160	.00020	
55 000	.0035	.....	.00175	.00015	
60 000	.0040	.....	.00200	.00025	
62 000	.0043	.....	.00215	.00015	Elastic limit.
63 000	.0175	.....	.00875	.00660	
64 000	.0216	.....	.01080	.00205	
65 000	.0241	.....	.01205	.00125	
100 500	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.43 in. in 2 in.=21.5 per cent.
Elongation of inch sections, .26*, .17.
Diameter at fracture, 0.37 in. Area 0.1075 sq. in.
Contraction of area, 46.2 per cent.
Position of fracture at middle of stem.
Appearance of fracture, silky.

Lock Hoop.

No. 9059.

Marks B 5364, MT, 2 M.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads per sq. in.	In gaged length.		Per inch.		Remarks.
	Elongation.	Set.	Elongation.	Successive elongation.	
Lb.	*In.*	*In.*	*In.*	*In.*	
1 000	0.	0.	0.	0.	
5 000	.0002	0.	.00010	.00010	
10 000	.0004	.....	.00020	.00010	
20 000	.0009	.....	.00045	.00025	
30 000	.0016	.....	.00080	.00035	
40 000	.0022	.....	.00110	.00030	10 000 to 40 000 lb. per sq. in.
50 000	.0030	.....	.00150	.00040	Modulus of elasticity = 33 300 000 lb. per sq. in.
58 000	.....	.....	.....	.....	Elastic limit, approximate.
60 000	.0100	.0060	.00300	.00150	
61 000	.0120	.....	.00600	.00300	
62 000	.0130	.....	.00650	.00050	
63 000	.0160	.....	.00800	.00150	
99 500	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.36 in. in 2 in. = 18 per cent.
Elongation of inch sections, .19*, .17*.
Diameter at fracture, 0.39 in. Area, 0.1194 sq. in.
Contraction of area, 40.3 per cent.
Position of fracture at middle of stem.
Appearance of fracture, silky.

BREECHBLOCK.

No. 9060.

Marks, B 3460, T, 2 M.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads per sq. in.	In gaged length.		Per inch.		Remarks.
	Elongation.	Set.	Elongation.	Successive elongation.	
Lb.	*In.*	*In.*	*In.*	*In.*	
1 000	0.	0.	0.	0.	
5 000	.0002	0.	.00010	.00010	
10 000	.0004	.....	.00020	.00010	
20 000	.0010	.....	.00050	.00030	
30 000	.0016	.....	.00080	.00030	
40 000	.0023	0.	.00115	.00035	10 000 to 40 000 lb. per sq. in.
45 000	.0026	.....	.00130	.00015	Modulus of elasticity = 28 500 000 lb. per sq. in.
50 000	.0029	.....	.00145	.00015	
55 000	.0033	.....	.00165	.00020	
60 000	.0036	.....	.00180	.00015	
65 000	.0040	.....	.00200	.00020	
70 000	.0044	.....	.00220	.00020	
75 000	.0048	.....	.00240	.00020	
80 000	.0052	.....	.00260	.00020	
85 000	.0056	.....	.00280	.00020	
90 000	.0062	.....	.00310	.00030	
94 000	.0074	.....	.00370	.00060	Elastic limit.
95 000	.0079	.....	.00395	.00025	
96 000	.0086	.....	.00430	.00035	
97 000	.0089	.....	.00445	.00015	
98 000	.0095	.....	.00475	.00030	
99 000	.0108	.....	.00540	.00065	
100 000	.0119	.....	.00595	.00055	
101 000	.0132	.....	.00660	.00065	
102 000	.0144	.....	.00720	.00060	
103 000	.0159	.....	.00795	.00075	
104 000	.0173	.....	.00865	.00070	
130 500	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.27 in. in 2 in. = 13.5 per cent.
Elongation of inch sections, .08, .19*.
Diameter at fracture, 0.40 in. Area, 0.1257 sq. in.
Contraction of area, 37.1 per cent.
Position of fracture, 0.90 in. from the neck.
Appearance of fracture, silky.

4.7-INCH SIEGE RIFLE, 1906.

SPECIMENS FROM TUBE, JACKET, AND GUN BODY.

4.7-INCH SIEGE RIFLE, 1906.

TUBE.

No. 9046.

Marks, B 5189, BT, 3 M.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads per sq. in.	In gaged length.		Per inch.		Remarks.
	Elongation.	Set.	Elongation.	Successive elongation.	
Lb.	*In.*	*In.*	*In.*	*In.*	
1 000	0.	0.	0.	0.	
5 000	.0002	0.	.00010	.00010	
10 000	.0005	.....	.00025	.00015	
20 000	.0012	.....	.00060	.00035	
30 000	.0019	.....	.00095	.00035	
40 000	.0027	0.	.00135	.00040	10 000 to 40 000 lb. per sq. in.
45 000	.0030	.....	.00150	.00015	Modulus of elasticity = 27 200 000 lb. per sq. in.
50 000	.0033	.....	.00165	.00015	
55 000	.0036	.....	.00180	.00015	
60 000	.0040	.....	.00200	.00020	
65 000	.0044	.....	.00220	.00020	
67 000	.0046	.....	.00230	.00010	Elastic limit.
68 000	.0052	.....	.00260	.00030	
69 000	.0090	.....	.00450	.00190	
70 000	.0127	.....	.00635	.00185	
103 000	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.40 in. in 2 in. = 20 per cent.
Elongation of inch sections, .25*, .15.
Diameter at fracture, 0.36 in. Area, 0.1018 sq. in.
Contraction of area, 49.1 per cent.
Position of fracture, 1.04 in. from the neck.
Appearance of fracture, silky.

JACKET.

No. 9047.

Marks, B 3231, MT, 3 M.
Diameter, 0.563 in.
Sectional area, 0.25 sq. in.
Gaged length, 3 in.

Applied loads per sq. in.	In gaged length.		Per inch.		Set.	Remarks.
	Elongation.	Set.	Elongation.	Successive elongation.		
Lb.	*In.*	*In.*	*In.*	*In.*	*In.*	
1 000	0.	0.	0.	0.	0.	
5 000	.0002	0.	.00007	.00007	.....	
10 000	.0006	0.	.00020	.00013	.....	
20 000	.0016	.....	.00053	.00033	.....	
30 000	.0027	0.	.00090	.00037	.....	
40 000	.0037	0.	.00123	.00033	.....	10 000 to 40 000 lb. per sq. in.
45 000	.0042	0.	.00140	.00017	.....	Modulus of elasticity= 29 100 000 lb. per sq. in.
50 000	.0048	.....	.00160	.00020	.....	
55 000	.0053	.....	.00177	.00017	.....	
56 000	.0055	.....	.00183	.00006	.....	
57 000	.0057	.....	.00190	.00007	.....	
58 000	.0058	.....	.00193	.00003	.....	
59 000	.0060	.....	.00200	.00007	.....	
60 000	.0062	.....	.00207	.00007	.....	
61 000	.0076	.....	.00253	.00046	.....	Elastic limit.
62 000	.0149	.....	.00497	.00244	.....	
63 000	.0188	.....	.00627	.00130	.....	
64 000	.0235	.....	.00783	.00156	.....	
65 000	.0268	.....	.00893	.00110	.....	
66 000	.0301	.....	.01003	.00110	.....	
100 000	.....	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.47 in. in 3 in. = 15.7 per cent.
Elongation of inch sections, .12, .25*, .10.
Diameter at fracture, 0.47 in. Area, 0.1735 sq. in.
Contraction of area, 30.6 per cent.
Position of fracture, 1.40 in. from the neck.
Appearance of fracture fine granular 40 per cent, lamellar 60 per cent.

Gun Body.

No. 9048.

Marks, B 3211, MT, 3 I.
Diameter, 0.564 in.
Sectional area, 0.25 sq. in.
Gaged length, 3 in.

Applied loads per sq. in.	In gaged length.		Per inch.		Set.	Remarks.
	Elongation.	Set.	Elongation.	Successive elongation.		
Lb.	*In.*	*In.*	*In.*	*In.*	*In.*	
1 000	0.	0.	0.	0.	.....	
5 000	.0003	0.	.00010	.00010	.....	
10 000	.0009	0.	.00030	.00020	.....	
20 000	.0019	.....	.00063	.00033	.....	
30 000	.0031	0.	.00103	.00040	.....	
40 000	.0042	0.	.00140	.00037	.....	10 000 to 40 000 lb. per sq. in.
45 000	.0047	0.	.00157	.00017	.....	Modulus of elasticity= 27 200 000 lb. per sq. in.
50 000	.0052	.....	.00173	.00016	.....	
55 000	.0057	.....	.00190	.00017	.....	
60 000	.0063	.....	.00210	.00020	.....	
61 000	.0065	.....	.00217	.00007	.....	
62 000	.0068	.....	.00227	.00010	.....	
63 000	.0071	.....	.00237	.00010	.....	
64 000	.0079	.....	.00263	.00026	.....	Elastic limit.
65 000	.0102	.....	.00340	.00077	.....	
66 000	.0134	.....	.00447	.00107	.....	
67 000	.0167	.....	.00557	.00110	.....	
68 000	.0214	.....	.00713	.00156	.....	
69 000	.0255	.....	.00850	.00137	.....	
70 000	.0296	.....	.00987	.00137	.....	
98 400	.....	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.49 in. in 3 in. = 16.3 per cent.
Elongation of inch sections, .16, .25*, .08.
Diameter at fracture, 0.42 in. Area, 0.1385 sq. in.
Contraction of area, 44.6 per cent.
Position of fracture, 1.35 in. from the neck.
Appearance of fracture, silky.

6-INCH GUN, 1908.

SPECIMENS FROM JACKET CASTING.

6-INCH GUN, 1908.

Jacket Casting for Watervliet Arsenal.

No. 9212.

Marks, T. C. B. 1.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
.....	1 000	0.	0.	
.....	5 000	.0003	0.	
.....	10 000	.0006	.....	
.....	20 000	.0011	.....	
.....	30 000	.0018	.....	
.....	40 000	.0025	0.	Elastic limit.
.....	42 000	.....	.....	
.....	43 000	.0070	.....	
.....	44 000	.0080	.....	
.....	45 000	.0088	.....	
.....	46 000	.0288	.....	
.....	47 000	.0360	.....	
.....	48 000	.0388	.....	
.....	49 000	.0425	.....	
.....	50 000	.0455	.....	
.....	70 500	.....	.....	Tensile strength.

Elongation after fracture, 0.28 in. in 2 in. = 14 per cent.
Elongation of inch sections, .19*, .09.
Diameter at fracture, 0.44 in. Area, 0.1521 sq. in.
Contraction of area, 24 per cent.
Position of fracture, 0.55 in. from the neck.
Appearance of fracture silky, with lamellar and fine granular streak across the center.

No. 9213.

Marks, T. C. B 2.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
.....	1 000	0.	0.	
.....	5 000	.0003	0.	
.....	10 000	.0008	.....	
.....	20 000	.0013	.....	
.....	30 000	.0020	.0003	
.....	40 000	.0026	.0003	
.....	41 000	.0027	.....	
.....	42 000	.0029	.....	Elastic limit.
.....	43 000	.0045 .0100	.....	
.....	44 000	.0145	.....	
.....	45 000	.0359	.....	
.....	46 000	.0385	.....	
.....	47 000	.0395	.....	
.....	48 000	.0410	.....	
.....	49 000	.0428	.....	
.....	50 000	.0460	.....	
.....	72 200	.....	.....	Tensile strength.

Elongation after fracture, 0.32 in. in 2 in. = 16 per cent.
Elongation of inch sections, .10, .22*.
Diameter at fracture, 0.42 in. Area, 0.1385 sq. in.
Contraction of area, 30.7 per cent.
Position of fracture, 0.65 in. from the neck.
Appearance of fracture silky, with streak of granular near circumference.

No. 9214.

Marks, T. C. M 1.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
.....	1 000	0.	0.	
.....	5 000	.0003	0.	
.....	10 000	.0005	.....	
.....	20 000	.0010	.....	
.....	30 000	.0018	0.	
.....	40 000	.0024	0.	
.....	42 000	.0025	.....	
.....	44 000	.0027	.....	
.....	45 000	.0028	.....	
.....	46 000	.0028	.....	
.....	47 000	.0029	.....	Elastic limit.
.....	48 000	.0055 .0115	.....	
.....	49 000	.0400	.....	
.....	50 000	.0410	.....	
.....	51 000	.0418	.....	
.....	52 000	.0455	.....	
.....	53 000	.0469	.....	
.....	54 000	.0500	.....	
.....	55 000	.0535	.....	
.....	75 500	.....	.....	Tensile strength.

Elongation after fracture, 0.26 in. in 2 in. = 13 per cent.
Elongation of inch sections, .11, .15*.
Diameter at fracture, 0.45 in. Area, 0.1590 sq. in.
Contraction of area, 20.5 per cent.
Position of fracture, 0.30 in. from the neck.
Appearance of fracture silky, with streak of fine granular near center.

No. 9215.

Marks, T. C. M. 2
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
.....	1 000	0.	0.	
.....	5 000	.0003	0.	
.....	10 000	.0005	.....	
.....	20 000	.0011	.....	
.....	30 000	.0018	0.	
.....	40 000	.0025	0.	
.....	41 000	.0025	.....	
.....	42 000	.0026	.....	
.....	43 000	.0027	.....	
.....	44 000	.0028	.....	
.....	45 000	.0028	.....	
.....	46 000	.0030	.....	
.....	47 000	.0030	.....	Elastic limit
.....	48 000	{ .0040 / .0155 }	.....	
.....	49 000	.0400	.....	
.....	50 000	.0405	.....	
.....	51 000	.0413	.....	
.....	52 000	.0435	.....	
.....	53 000	.0470	.....	
.....	54 000	.0520	.....	
.....	55 000	.0530	.....	
.....	76 000	.....	.....	Tensile strength.

Elongation after fracture, 0.31 in. in 2 in. = 15.5 per cent.
Elongation of inch sections, .13, .18*.
Diameter at fracture, 0.46 in. Area, 0.1662 sq. in.
Contraction of area, 16.9 per cent.
Position of fracture, 0.90 in. from the neck.
Appearance of fracture silky, with fine granular streak near circumference.

6-INCH SIEGE HOWITZER, 1908.

SPECIMENS FROM GUN BODY.

6-INCH SIEGE HOWITZER, 1908.

Gun Body.

No. 9045.

Marks, B 3254, BT, 3 M.
Diameter, 0.564 in.
Sectional area, 0.25 sq. in.
Gaged length, 3 in.

Applied loads per sq. in.	In gaged length.		Per inch.		Remarks.
	Elongation.	Set.	Elongation.	Successive elongation.	
Lb.	*In.*	*In.*	*In.*	*In.*	
1 000	0.	0.	0.	0.	
5 000	.0003	0.	.00010	.00010	
10 000	.0008	0.	.00027	.00017	
20 000	.0018	.....	.00060	.00033	
30 000	.0028	0.	.00093	.00033	
40 000	.0038	0.	.00127	.00034	10 000 to 40 000 lb. per sq. in.
45 000	.0043	0.	.00143	.00016	Modulus of elasticity = 30 000 000. lb. per sq. in.
50 000	.0048	.....	.00160	.00017	
55 000	.0053	.....	.00177	.00017	
60 000	.0058	.....	.00193	.00016	
65 000	.0064	.....	.00213	.00020	
70 000	.0071	.....	.00237	.00024	
71 000	.0073	.....	.00243	.00006	
72 000	.0076	.....	.00253	.00010	Elastic limit.
73 000	.0107	.....	.00357	.00104	
74 000	.0138	.....	.00460	.00103	
75 000	.0176	.....	.00587	.00127	
76 000	.0222	.....	.00740	.00153	
77 000	.0256	.....	.00853	.00113	
105 600	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.48 in. in 3 in. = 16 per cent.
Elongation of inch sections, .09, .29*, .10.
Diameter at fracture, 0.44 in. Area, 0.1521 sq. in.
Contraction of area, 39.2 per cent.
Position of fracture, 1.60 in. from the neck.
Appearance of fracture, silky.

6-INCH GUN No. 235.

TENSILE TESTS OF SPECIMENS FROM 6-INCH GUN NO. 235.

Marks.	Diameter.	Sectional area.	Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation in 2 in.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	In.	*Sq. in.*	*Lb.*	*Lb.*	*Per ct.*	*Per ct.*	*In.* *In.*	
L. O.	0.505	0.20	53 500	89 500	27.5	54.6	.31*, .24	Silky.
L. I.	.505	.20	52 500	89 500	27.0	54.6	.19, .35*	Do.
L. M.	.505	.20	50 000	89 500	26.5	49.1	.36*, .17	Do.
T. O.	.505	.20	50 500	88 000	24.5	46.2	.32, .17	Do.
T. I.	.505	.20	49 500	86 500	22.5	46.2	.13, .32*	Do.
[1] R.	.505	.20	49 500	90 500	22.0	34.0	.22*,	Serrated.
[1] R.	.505	.20	49 500	90 000	21.0	32.6	.21*,	Do.
[1] R.	.505	.20	49 000	90 500	22.0	30.7	.22*,	Do.

[1] The stem in these specimens was only 1 in. long, instead of 2 in. as in the others.

6-INCH HOWITZER CARRIAGE, MODEL 1908.

TESTS OF CRADLE HEADS.

TESTS OF CRADLE HEADS.

Cradle heads, Types 1, 2, 3, and 4, were tested with stresses up to 17 000 lb. with circumferences unsupported and supported, except in the case of Head no. 1, which was tested in an unsupported condition only.

Loads were applied with increments of 1 000 lb. each and deflections measured in a longitudinal direction at 12 places on each head and measuring diameters at three places on two diameters taken at right angles to each other.

The maximum load applied, 17 000 lb., was within the elastic limit of each head.

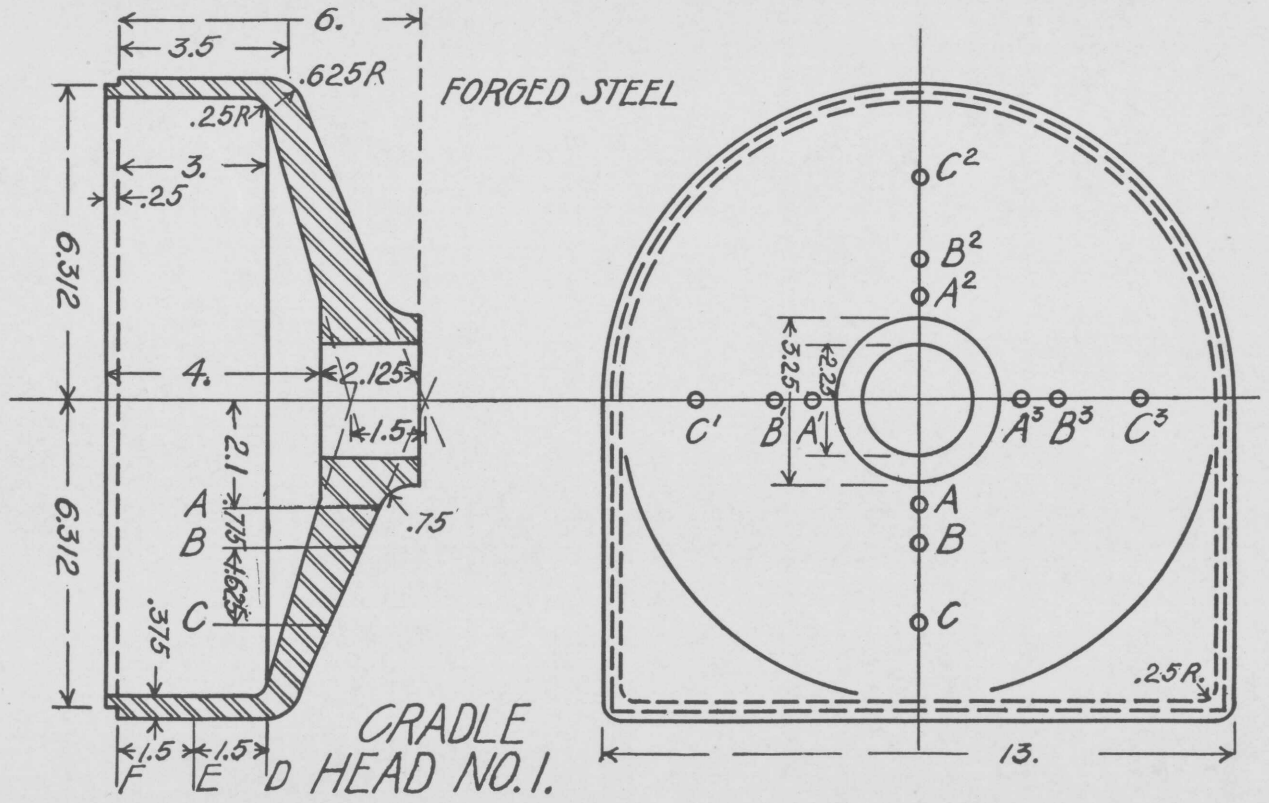
The accompanying tables show the deflections in lengths and diameters as the loads were successively applied.

Tests of Cradle Heads for 6-Inch Howitzer Carriage, Model 1908.

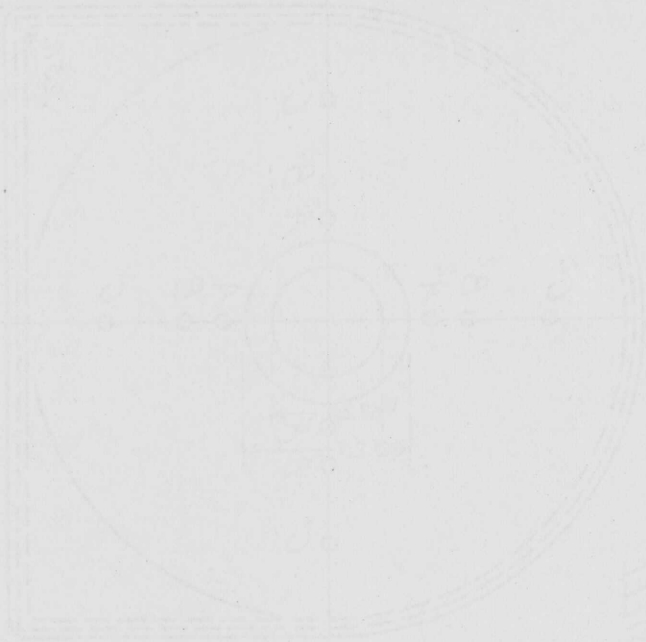
CRADLE HEAD NO. 1.

CIRCUMFERENCE UNSUPPORTED WITH RING.

Applied loads.	Deflections, in length, at points.											
	A.	B.	C.	A.[1]	B.[1]	C.[1]	A.[2]	B.[2]	C.[2]	A.[3]	B.[3]	C.[3]
Lb.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2 000	.0003	.0003	.0004	.0004	.0003	.0002	.0004	.0003	.0002	.0003	.0003	.0001
3 000	.0007	.0007	.0008	.0008	.0006	.0005	.0007	.0005	.0003	.0006	.0005	.0003
4 000	.0010	.0011	.0011	.0012	.0010	.0007	.0010	.0008	.0004	.0009	.0008	.0005
5 000	.0014	.0014	.0014	.0015	.0013	.0009	.0013	.0011	.0006	.0012	.0010	.0007
6 000	.0017	.0018	.0018	.0019	.0016	.0011	.0015	.0013	.0007	.0015	.0012	.0009
7 000	.0021	.0021	.0021	.0023	.0018	.0013	.0018	.0015	.0008	.0017	.0015	.0011
8 000	.0024	.0025	.0023	.0026	.0021	.0015	.0020	.0017	.0010	.0020	.0018	.0013
9 000	.0027	.0028	.0026	.0029	.0024	.0017	.0023	.0019	.0012	.0023	.0021	.0015
10 000	.0030	.0031	.0029	.0032	.0026	.0018	.0026	.0022	.0013	.0026	.0023	.0016
11 000	.0033	.0034	.0031	.0034	.0028	.0020	.0028	.0024	.0015	.0029	.0025	.0018
12 000	.0036	.0037	.0034	.0037	.0031	.0021	.0031	.0026	.0016	.0031	.0027	.0020
13 000	.0038	.0040	.0036	.0040	.0033	.0022	.0033	.0028	.0017	.0034	.0030	.0021
14 000	.0042	.0043	.0039	.0043	.0036	.0024	.0036	.0030	.0018	.0037	.0033	.0023
15 000	.0045	.0046	.0041	.0046	.0038	.0025	.0038	.0032	.0019	.0040	.0035	.0025
16 000	.0048	.0049	.0043	.0048	.0040	.0026	.0040	.0034	.0020	.0041	.0037	.0027
17 000	.0050	.0052	.0045	.0050	.0042	.0028	.0042	.0036	.0022	.0044	.0040	.0029
1 000	0.	.0001	.0001	.0002	.0001	.0001	0.	0.	0.	0.	0.	.0002
1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
17 000	.0052	.0052	.0044	.0049	.0041	.0028	.0040	0.0034	.0022	.0045	.0041	.0030
1 000	0.	0.	0.	0.	0.	.0001	0.	0.	0.	0.	0.	0.



CRADLE HEAD NO. 1.



CRADLE HEAD NO. 1—continued.

CIRCUMFERENCE UNSUPPORTED WITH RING.

Applied loads.	Deflections, in diameter, at points.					
	D.	E.	F.	D.[1]	E.[1]	F.[1]
Lb.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
1 000	0.	0.	0.	0.	0.	0.
2 000	0.	.0001	.0001	.0001	0.	0.
3 000	0.	.0002	.0002	.0002	0.	.0001
4 000	.0001	.0003	.0002	.0003	.0001	.0002
5 000	.0002	.0004	.0002	.0004	.0002	.0002
6 000	.0003	.0005	.0003	.0005	.0004	.0003
7 000	.0004	.0006	.0004	.0006	.0005	.0004
8 000	.0005	.0007	.0004	.0007	.0005	.0004
9 000	.0005	.0008	.0004	.0008	.0007	.0004
10 000	.0006	.0009	.0005	.0009	.0008	.0005
11 000	.0007	.0010	.0005	.0010	.0010	.0006
12 000	.0008	.0011	.0006	.0011	.0011	.0006
13 000	.0009	.0012	.0006	.0012	.0012	.0006
14 000	.0010	.0013	.0007	.0013	.0013	.0007
15 000	.0011	.0014	.0008	.0014	.0014	.0007
16 000	.0012	.0015	.0008	.0015	.0015	.0007
17 000	.0013	.0016	.0009	.0016	.0016	.0007
1 000	0.	0.	0.	0.	0.	0.
1 000	0.	0.	0.	0.	0.	0.
17 000	.0014	.0016	.0009	.0016	.0016	.0007
1 000	0.	0.	0.	0.	0.	0.

CRADLE HEAD SUPPORTED AT THE OUTER EDGE.

Applied loads.	Deflections at points.		Remarks.
	Length A.	Diameter D.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0017	.0003	
10 000	.0035	.0008	
15 000	.0052	.0011	
17 000	.0056	.0013	
1 000	0.	0.	
20 000	.0065	.0015	
1 000	.0002	0.	
25 000	.0080	.0020	
30 000	.0093	.0025	
1 000	.0002	0.	
35 000	.0107	.0029	
40 000	.0122	.0033	
1 000	.0004	0.	
45 000	.0135	.0038	
50 000	.0147	.0045	
1 000	.0006	0.	
55 000	.0158	.0048	
60 000	.0172	.0053	
1 000	.0006	.0001	
60 000	.0169	.0053	
65 000	.0183	.0057	
70 000	.0192	.0062	
1 000	.0007	0.	
70 000	.0194	.0062	
75 000	.0206	.0067	
80 000	.0215	.0071	
1 000	.0008	0.	
80 000	.0018	.0072	
85 000	.0222	.0076	
90 000	.0237	.0081	
1 000	.0006	0.	
90 000	.0242	.0081	
95 000	.0253	.0085	
100 000	.0264	.0090	
1 000	.0089	0.	Rested under initial load over night.
1 000	.0012	.0005	
100 000	.0264	.0093	

CRADLE HEAD NO. 1—continued.

CRADLE HEAD SUPPORTED AT THE OUTER EDGE—Continued.

Applied loads.	Deflections at points		Remarks.
	Length A.	Diameter D.	
Lb.	*In.*	*In.*	
105 000	.0278	.0097	
110 000	.0291	.0102	
1 000	.0012	.0001	
110 000	.0291	.0100	
112 000	.0295	.0103	
114 000	.0299	.0103	
116 000	.0302	.0105	
118 000	.0310	.0107	
120 000	.0314	.0108	
1 000	.0312	0.	
120 000	.0313	.0108	
122 000	.0317	.0110	
124 000	.0323	.0112	
126 000	.0327	.0113	
128 000	.0331	.0115	
130 000	.0336	.0118	
1 000	.0012	.0001	
130 000	.0337	.0117	
132 000	.0338	.0119	
134 000	.0346	.0122	
136 000	.0351	.0125	
138 000	.0354	.0126	
140 000	.0358	.0128	
1 000	.0012	0.	
140 000	.0358	.0128	
142 000	.0360	.0130	
144 000	.0372	.0132	
146 000	.0375	.0134	
148 000	.0379	.0135	
150 000	.0382	.0139	
1 000	.0015	0.	
150 000	.0383	.0138	
152 000	.0388	.0140	
154 000	.0394	.0142	
156 000	.0398	.0144	
158 000	.0402	.0146	
160 000	.0408	.0149	
1 000	.0018	.0002	
160 000	.0409	.0149	
162 000	.0416	.0150	
164 000	.0419	.0152	
166 000	.0424	.0155	
168 000	.0428	.0157	
170 000	.0434	.0159	
1 000	.0019	.0003	
170 000	.0434	.0159	
172 000	.0439	.0161	
174 000	.0445	.0163	
176 000	.0450	.0165	
178 000	.0455	.0168	
180 000	.0461	.0170	
1 000	.0024	.0003	Rested under initial load ½ hour.
1 000	.0024	.0019	
180 000	.0462	.0178	
182 000	.0467	.0180	
184 000	.0473	.0181	
186 000	.0479	.0183	
188 000	.0484	.0185	
190 000	.0489	.0186	
1 000	.0027	.0010	
190 000	.0489	.0185	
191 000	.0493	.0187	
192 000	.0497	.0187	
193 000	.0498	.0188	
194 000	.0500	.0188	
195 000	.0505	.0190	
196 000	.0507	.0190	
197 000	.0508	.0192	
198 000	.0512	.0193	
199 000	.0515	.0194	
200 000	.0517	.0195	
1 000	.0032	.0011	

CRADLE HEAD NO. 1—continued.

CRADLE HEAD SUPPORTED AT THE OUTER EDGE—Continued.

Applied loads.	Deflections at points.		Remarks.
	Length A.	Diameter D.	
Lb.	*In.*	*In.*	
200 000	.0520	.0195	
201 000	.0524	.0195	
202 000	.0527	.0197	
203 000	.0528	.0198	
204 000	.0532	.0199	
205 000	.0534	.0200	
206 000	.0537	.0201	
207 000	.0541	.0203	
208 000	.0543	.0204	
209 000	.0545	.0205	
210 000	.0547	.0206	
1 000	.0042	.0011	
210 000	.0549	.0206	
211 000	.0552	.0207	
212 000	.0555	.0208	
213 000	.0557	.0210	
214 000	.0560	.0211	
215 000	.0562	.0212	
216 000	.0566	.0213	
217 000	.0569	.0215	
218 000	.0575	.0215	
219 000	.0582	.0217	
220 000	.0584	.0218	
1 000	.0052	.0014	
220 000	.0582	.0220	
221 000	.0587	.0221	
222 000	.0591	.0223	
223 000	.0594	.0223	
224 000	.0597	.0225	
225 000	.0599	.0225	
226 000	.0602	.0227	
227 000	.0605	.0228	
228 000	.0609	.0230	
229 000	.0612	.0230	
230 000	.0616	.0232	
1 000	.0065	.0015	

After loading cradle head to 230 000 lb., with the regular fixtures, the cradle head was removed from the testing machine and a plug was fitted to the $2\frac{1}{4}$-in. hole in head. A steel pin 3.10 in. diameter was placed against the center of head and the test resumed. Micrometer readings on gaged length A were discontinued as this length was inaccessible.

CRADLE HEAD NO. 1—continued.

CRADLE HEAD SUPPORTED AT THE OTHER EDGE—Continued.

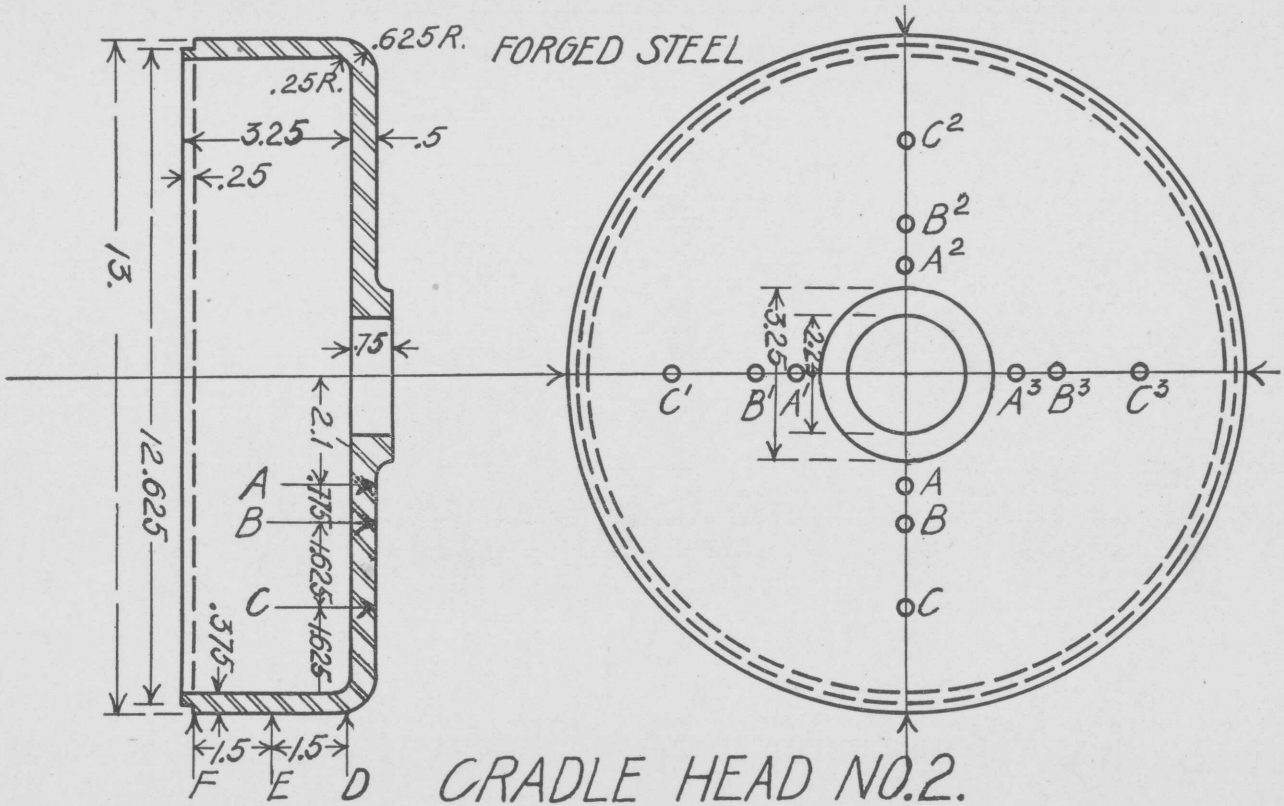
Applied loads.	Deflections at points.		Remarks.
	Length A.	Diameter D.	
Lb.	*In.*	*In.*	
1 000	.....	0.0015	
230 000	.....	.0215	
1 000	.....	.0015	
230,000	.....	.0215	
1 000	.....	.0015	
250 000	.....	.0233	
1 000	.....	.0015	
260 000	.....	.0247	
1 000	.....	.0020	
270 000	.....	.0265	
1 000	.....	.0030	
280 000	.....	.0287	
1 000	.....	.0041	
285 000	.....	.0301	
290 000	.....	.0315	
1 000	.....	.0055	
295 000	.....	.0334	
300 000	.....	.0350	
1 000	.....	.0077	
302 000	.....	.0358	
304 000	.....	.0370	
306 000	.....	.0377	
308 000	.....	.0384	
310 000	.....	.0397	
1 000	.....	.0113	
312 000	.....	.0406	
314 000	.....	.0420	
316 000	.....	.0435	
318 000	.....	.0438	
320 000	.....	.0444	
1 000	.....	.0148	
Micrometer readings on diameter D, while under high loads, were discontinued and sets only taken after each increment.			
330 000	.....	.....	
1 000	.....	0.0215	Rested under initial load over night.
1 000	.....	.0217	
330 000	.....	.....	
1 000	.....	.0238	
340 000	.....	.....	
1 000	.....	.0385	
350 000	.....	.....	
1 000	.....	.0737	
360 000	.....	.....	
1 000	.....	.1522	
361 200	.....	.....	Ultimate strength.

Cradle head expanded between diameters D and E to 13.42 in.

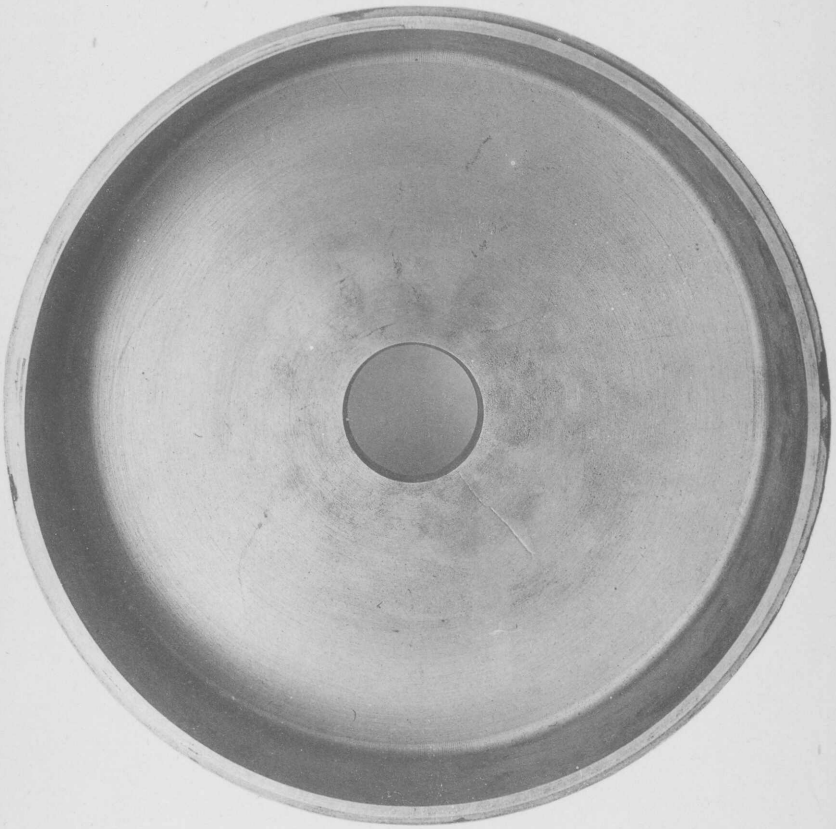
Changed the shape of cone of the head from a right line to a concaved one.

Steel pin at center of head embedded itself in head about 0.02 in.

No well-defined elastic limit. Sets remained without material change up to 190 000 lb., but no decided sets occurred until loads reached 200 000 to 210 000 lb.



CRADLE HEAD NO.2.



No. 2.

APPEARANCE OF CRADLE HEAD AFTER TESTING, SHOWING RADIAL CRACK DEVELOPED INSIDE OF HEAD.

CRADLE HEAD NO. 2.

CIRCUMFERENCE UNSUPPORTED WITH RING.

Applied loads.	Deflections, in length, at points.											
	A.	B.	C.	A¹.	B¹.	C¹.	A².	B².	C².	A³.	B³.	C³.
Lb.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2 000	.0019	.0016	.0008	.0020	.0015	.0005	.0020	.0019	.0007	.0020	.0016	.0007
3 000	.0039	.0030	.0015	.0039	.0031	.0011	.0042	.0038	.0016	.0040	.0031	.0014
4 000	.0059	.0048	.0022	.0060	.0047	.0019	.0062	.0053	.0022	.0060	.0046	.0020
5 000	.0080	.0063	.0029	.0078	.0063	.0025	.0083	.0067	.0030	.0080	.0062	.0024
6 000	.0099	.0079	.0036	.0098	.0077	.0034	.0103	.0080	.0036	.0100	.0078	.0032
7 000	.0119	.0094	.0042	.0118	.0094	.0039	.0122	.0098	.0042	.0120	.0093	.0040
8 000	.0140	.0109	.0049	.0138	.0110	.0045	.0142	.0114	.0049	.0140	.0108	.0046
9 000	.0160	.0125	.0056	.0158	.0126	.0055	.0161	.0130	.0056	.0160	.0124	.0051
10 000	.0180	.0141	.0062	.0178	.0141	.0060	.0182	.0145	.0062	.0179	.0140	.0057
11 000	.0200	.0155	.0070	.0198	.0158	.0069	.0201	.0160	.0069	.0199	.0156	.0062
12 000	.0219	.0171	.0076	.0219	.0174	.0074	.0222	.0175	.0076	.0219	.0171	.0072
13 000	.0239	.0186	.0084	.0240	.0191	.0081	.0241	.0190	.0083	.0239	.0188	.0078
14 000	.0258	.0201	.0090	.0260	.0205	.0087	.0260	.0206	.0090	.0256	.0202	.0084
15 000	.0278	.0217	.0096	.0278	.0218	.0093	.0280	.0220	.0096	.0276	.0217	.0091
16 000	.0296	.0231	.0102	.0296	.0232	.0100	.0299	.0234	.0103	.0294	.0233	.0099
17 000	.0313	.0245	.0109	.0313	.0246	.0107	.0317	.0250	.0110	.0312	.0247	.0105
1 000	0.	0.	.0001	0.	0.	0.	0.	0.	0.	0.	0.	0.

CIRCUMFERENCE UNSUPPORTED WITH RING.

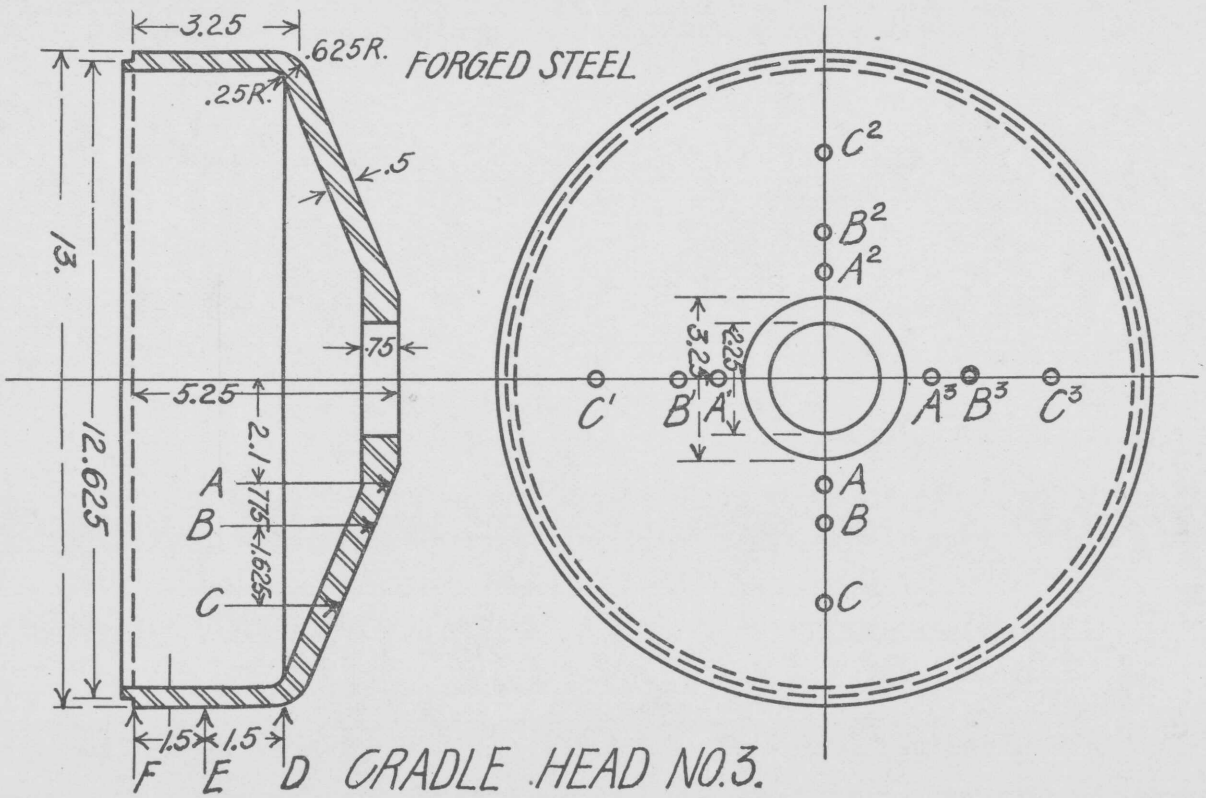
Applied loads.	Deflections, in diameter, at points.					
	D.	E.	F.	D¹.	E¹.	F¹.
Lb.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
1 000	0.	0.	0.	0.	0.	0.
2 000	.0002	.0001	.0001	0.	.0001	0.
3 000	.0002	.0002	.0002	.0001	.0002	0.
4 000	.0003	.0003	.0002	.0002	.0003	0.
5 000	.0004	.0004	.0002	.0002	.0004	0.
6 000	.0005	.0006	.0002	.0003	.0005	0.
7 000	.0005	.0008	.0002	.0004	.0006	0.
8 000	.0006	.0009	.0002	.0004	.0007	0.
9 000	.0007	.0011	.0002	.0005	.0008	0.
10 000	.0008	.0013	.0002	.0005	.0010	0.
11 000	.0008	.0014	.0002	.0006	.0011	0.
12 000	.0009	.0015	.0002	.0007	.0013	0.
13 000	.0009	.0016	.0002	.0008	.0014	0.
14 000	.0010	.0017	.0002	.0009	.0016	0.
15 000	.0010	.0018	.0002	.0010	.0018	0.
16 000	.0011	.0020	.0002	.0011	.0019	0.
17 000	.0012	.0022	.0002	.0012	.0020	0.
1 000	0.	0.	0.	0.	0.	0.

CIRCUMFERENCE SUPPORTED WITH RING.

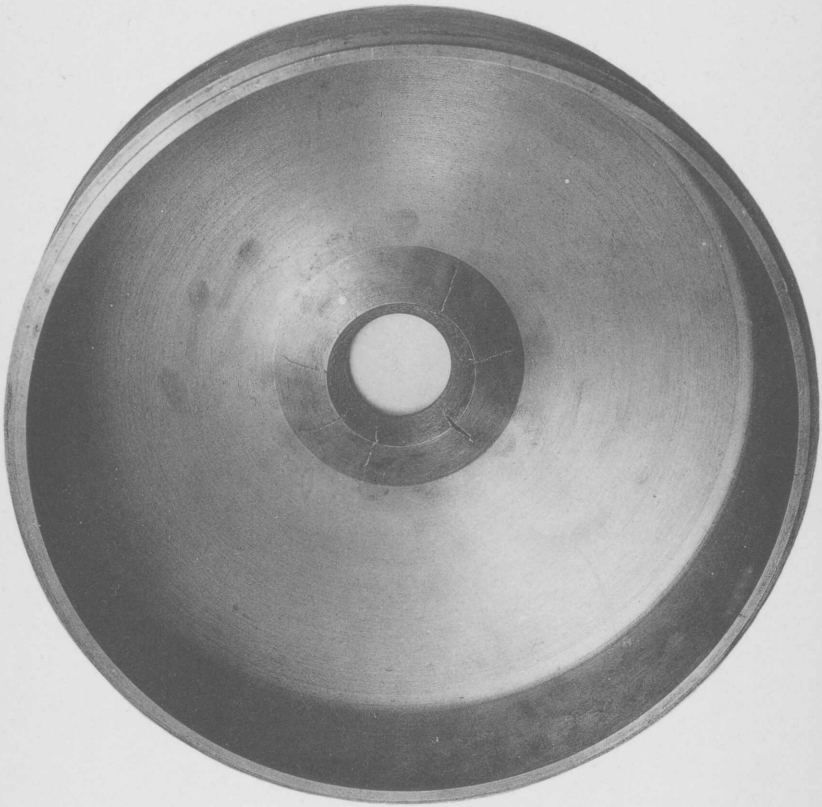
Applied loads.	Deflections, in length, at points.											
	A.	B.	C.	A¹.	B¹.	C¹.	A².	B².	C².	A³.	B³.	C³.
Lb.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2 000	.0020	.0015	.0008	.0019	.0018	.0010	.0020	.0020	.0009	.0018	.0014	.0006
3 000	.0035	.0031	.0014	.0037	.0032	.0016	.0040	.0036	.0016	.0038	.0028	.0013
4 000	.0053	.0047	.0019	.0057	.0046	.0024	.0060	.0051	.0020	.0058	.0043	.0021
5 000	.0072	.0062	.0025	.0077	.0064	.0029	.0080	.0068	.0028	.0078	.0058	.0027
6 000	.0091	.0078	.0033	.0097	.0080	.0035	.0100	.0083	.0034	.0096	.0075	.0033
7 000	.0110	.0092	.0040	.0115	.0093	.0042	.0120	.0097	.0040	.0115	.0088	.0041
8 000	.0128	.0107	.0046	.0135	.0110	.0049	.0140	.0112	.0046	.0134	.0103	.0048
9 000	.0146	.0121	.0051	.0153	.0121	.0054	.0160	.0127	.0052	.0154	.0118	.0053
10 000	.0165	.0135	.0057	.0170	.0136	.0059	.0178	.0140	.0058	.0171	.0132	.0061
11 000	.0183	.0151	.0063	.0188	.0151	.0065	.0195	.0153	.0064	.0188	.0146	.0067
12 000	.0202	.0165	.0069	.0206	.0165	.0072	.0212	.0167	.0070	.0206	.0161	.0071
13 000	.0219	.0179	.0075	.0225	.0179	.0079	.0230	.0182	.0075	.0224	.0175	.0077
14 000	.0235	.0195	.0080	.0242	.0193	.0086	.0247	.0193	.0080	.0242	.0187	.0082
15 000	.0253	.0210	.0085	.0259	.0206	.0091	.0265	.0207	.0085	.0258	.0201	.0086
16 000	.0269	.0224	.0090	.0277	.0219	.0095	.0281	.0219	.0090	.0275	.0213	.0091
17 000	.0285	.0235	.0095	.0292	.0232	.0100	.0297	.0233	.0095	.0290	.0226	.0097
1 000	0.	.0010	.0001	0.	.0003	.0003	0.	0.	0.	0.	0.	.0003

Tested by having the edge bear equally upon a flat plate.

Applied loads.	Deflections at points.		Remarks.
	Length A.	Diameter D.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0083	.0005	
10 000	.0174	.0009	
15 000	.0274	.0015	
17 000	.0308	.0016	
1 000	.0004	0.	
18 000	.0032	.0017	
19 000	.0353	.0018	
20 000	.0372	.0018	
21 000	.0391	.0019	
22 000	.0409	.0020	
23 000	.0428	.0021	
24 000	.0450	.0021	
25 000	.0466	.0022	
26 000	.0487	.0022	
27 000	.0506	.0023	
28 000	.0525	.0024	
29 000	.0542	.0024	
30 000	.0567	.0025	
1 000	.0022	−.0001	
30 000	.0569	.0024	
31 000	.0589	.0024	
32 000	.0609	.0025	
33 000	.0634	.0025	
34 000	.0654	.0026	
35 000	.0677	.0027	
36 000	.0701	.0027	
37 000	.0726	.0027	
38 000	.0749	.0027	
39 000	.0773	.0028	
40 000	.0798	.0029	
1 000	.0062	−.0001	
40 000	.0803	.0027	
41 000	.0827	.0027	
42 000	.0854	.0027	
43 000	.0881	.0028	
44 000	.0909	.0028	
45 000	.0937	.0029	
1 000	.0102	−.0006	
45 000	.0946	.0029	
46 000	.0971	.0029	
47 000	.1000	.0029	
48 000	.1027	.0021	On diameter D caliper changed.
49 000	.1060	.0022	
50 000	.1092	.0022	
1 000	.0155	−.0011	Rested under initial load 1½ hours.
50 000	.1108	.0013	
1 000	.0168	−.0025	
50 000	.0113	.0009	
51 000	.1141	.0009	
52 000	.1172	.0009	
53 000	.1206	.0009	
54 000	.1237	.0012	
55 000	{ .1280 } { .1302 }	.0012	Length A rapid deflection.
1 000	.0247	−.0026	
55 000	.1312	.0009	
56 000	.1347	.0008	
57 000	.1387	.0008	
58 000	.1429	.0009	
59 000	.1479	.0009	
60 000	.1532	.0009	
1 000	.0362	−.0026	
60 000	.1557	.0009	
61 000	.1598	.0009	
62 000	.1662	.0011	
63 000	.1723	.0011	
64 000	.1788	.0012	
65 000	.1878	.0013	
1 000	.1581	−.0020	



CRADLE HEAD NO.3.



No. 3.

APPEARANCE OF CRADLE HEAD AFTER TESTING, SHOWING RADIAL CRACKS DEVELOPED INSIDE OF HEAD.

Applied loads.	Deflections at points.		Remarks.
	Length A.	Diameter D.	
Lb.	*In.*	*In.*	
65 000	.1932	.0005	
66 000	.1992	.0004	
67 000	.2060	.0002	
68 000	.2147	.0002	
69 000	.2270	.0004	
70 000	.2387	.0004	
1 000	.0930	—.0019	Micrometer reading discontinued on length A. Rested under initial load over night.
70 000	.....	.0007	
75 000	.....	.0002	
80 000	.....	—.0023	
85 000	.....	—.0065	
90 000	.....	—.0113	
95 000	.....	—.0176	
100 000	.....	—.0231	Sharp snapping sound.
100 000	.....	.....	Ultimate strength.

Cradle head cracked (radially) between A2 and A3, also started a second crack on inside of head about 80° from first crack between A1 and A2.

Length of first or principal crack on the inside of head 2.12 in.

Center of cradle head permanently depressed 0.40 in.

There was a decided decrease in the final diameter as shown at the end of test. This was gradually reached after 70 000 lb.

No well defined elastic limit. Took decided set at 40 000 and showed marked increase after higher loads.

CRADLE HEAD NO. 3.

CIRCUMFERENCE UNSUPPORTED WITH RING.

Applied loads.	Deflections, in length, at points—											
	A.	B.	C.	A^1.	B^1.	C^1.	A^2.	B^2.	C^2.	A^3.	B^3.	C^3.
Lb.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2 000	.0004	.0003	.0002	.0003	.0003	.0002	.0003	.0001	.0001	.0001	.0002	.0001
3 000	.0008	.0006	.0003	.0007	.0006	.0004	.0006	.0002	.0002	.0002	.0003	.0002
4 000	.0011	.0009	.0004	.0012	.0009	.0006	.0009	.0005	.0003	.0005	.0005	.0003
5 000	.0015	.0011	.0006	.0016	.0011	.0008	.0012	.0007	.0005	.0008	.0008	.0005
6 000	.0018	.0015	.0007	.0019	.0014	.0009	.0014	.0009	.0006	.0011	.0010	.0006
7 000	.0022	.0018	.0008	.0023	.0016	.0010	.0015	.0011	.0007	.0013	.0013	.0007
8 000	.0025	.0021	.0010	.0026	.0018	.0012	.0017	.0013	.0008	.0016	.0015	.0008
9 000	.0028	.0024	.0012	.0028	.0021	.0013	.0019	.0015	.0009	.0019	.0017	.0010
10 000	.0032	.0028	.0013	.0031	.0025	.0014	.0023	.0017	.0010	.0022	.0019	.0011
11 000	.0035	.0030	.0014	.0035	.0028	.0016	.0027	.0019	.0011	.0025	.0023	.0012
12 000	.0038	.0031	.0015	.0038	.0031	.0017	.0030	.0021	.0012	.0029	.0026	.0013
13 000	.0041	.0034	.0016	.0041	.0032	.0018	.0033	.0023	.0013	.0032	.0028	.0014
14 000	.0044	.0036	.0017	.0044	.0033	.0019	.0036	.0025	.0014	.0035	.0030	.0016
15 000	.0047	.0039	.0018	.0047	.0036	.0020	.0039	.0027	.0016	.0038	.0033	.0018
16 000	.0050	.0041	.0019	.0050	.0040	.0022	.0042	.0029	.0017	.0041	.0035	.0019
17 000	.0053	.0044	.0020	.0053	.0043	.0022	.0045	.0031	.0018	.0044	.0037	.0020
1 000	0.	.0003	0.	0.	0.	.0001	0.	0.	0.	0.	.0003	0.
1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
17 000	.0052	.0042	.0021	.0052	.0042	.0021	.0043	.0032	.0019	.0046	.0035	.0020
1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

CRADLE HEAD NO. 3—continued.

CIRCUMFERENCE UNSUPPORTED WITH RING.

Applied loads.	Deflections, in diameter, at points—					
	D.	E.	F.	D^1.	E^1.	F^1.
Lb.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
1 000	0.	0.	0.	0.	0.	0.
2 000	.0001	.0001	0.	0.	0.	0.
3 000	.0002	.0001	0.	.0001	.0001	0.
4 000	.0003	.0002	0.	.0002	.0001	0.
5 000	.0004	.0003	0.	.0003	.0002	0.
6 000	.0005	.0004	0.	.0004	.0003	0.
7 000	.0006	.0005	0.	.0005	.0003	0.
8 000	.0007	.0006	0.	.0006	.0003	0.
9 000	.0008	.0006	0.	.0007	.0004	0.
10 000	.0010	.0007	0.	.0008	.0005	0.
11 000	.0011	.0008	0.	.0009	.0006	0.
12 000	.0012	.0009	0.	.0010	.0006	0.
13 000	.0014	.0010	0.	.0012	.0007	0.
14 000	.0015	.0010	.0001	.0013	.0007	0.
15 000	.0016	.0011	.0001	.0014	.0007	0.
16 000	.0017	.0011	.0001	.0015	.0009	0.
17 000	.0018	.0012	.0002	.0017	.0010	0.
1 000	0.	.0001	0.	−.0001	−.0001	0.
1 000	0.	0.	0.	0.	0.	0.
17 000	.0018	.0012	.0002	.0020	.0010	0.
1 000	0.	0.	0.	.0001	0.	0.

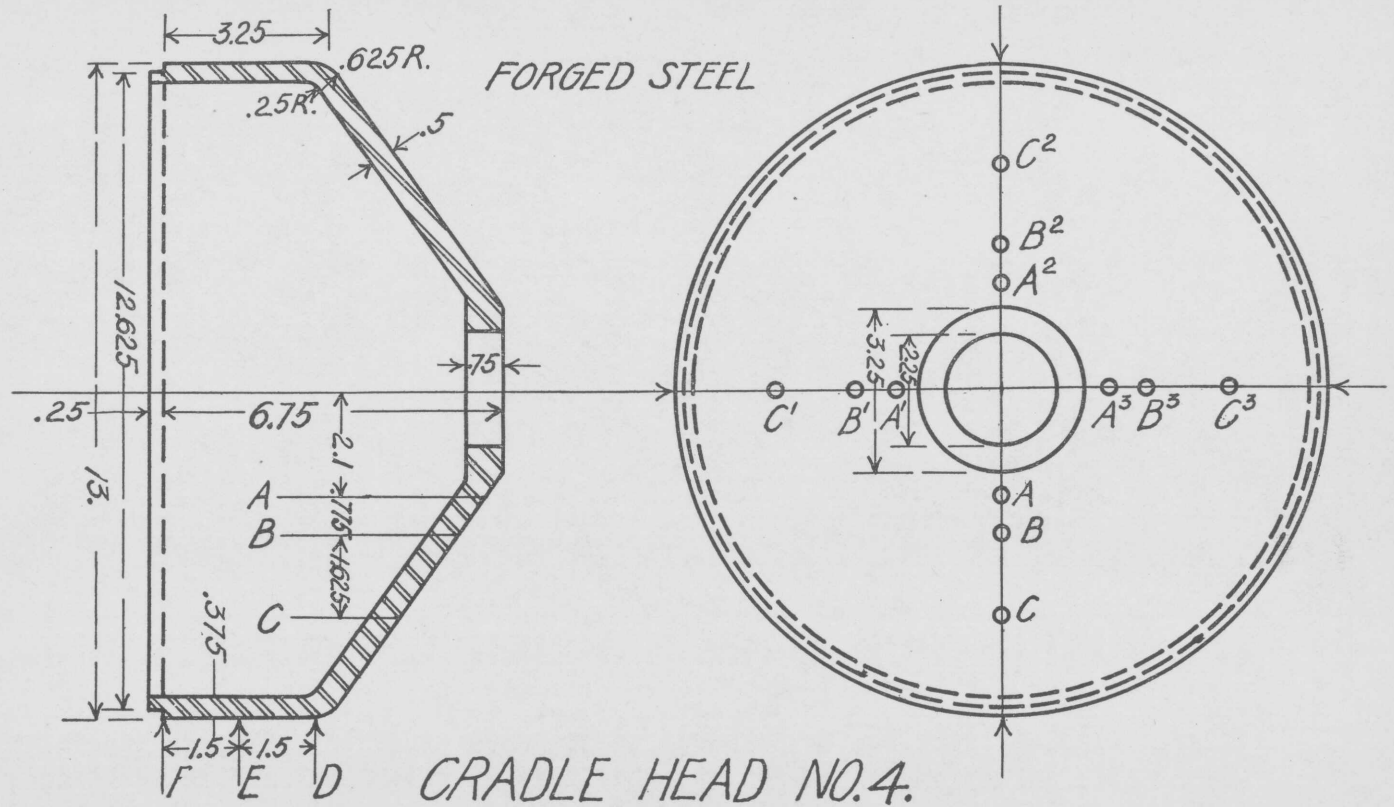
CIRCUMFERENCE SUPPORTED WITH RING.

Applied loads.	Deflections, in length, at points—											
	A.	B.	C.	A^1.	B^1.	C^1.	A^2.	B^2.	C^2.	A^3.	B^3.	C^3.
Lb.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2 000	.0004	.0003	.0001	.0004	.0003	.0003	.0004	.0001	0.	.0002	.0002	0.
3 000	.0008	.0006	.0003	.0008	.0005	.0005	.0008	.0003	.0001	.0005	.0004	.0001
4 000	.0011	.0009	.0004	.0012	.0008	.0006	.0011	.0004	.0001	.0006	.0006	.0002
5 000	.0014	.0012	.0005	.0015	.0010	.0006	.0015	.0006	.0002	.0008	.0008	.0003
6 000	.0017	.0015	.0006	.0017	.0012	.0007	.0017	.0007	.0003	.0010	.0010	.0004
7 000	.0020	.0018	.0007	.0019	.0014	.0008	.0019	.0008	.0004	.0013	.0012	.0005
8 000	.0023	.0020	.0008	.0022	.0016	.0008	.0021	.0010	.0005	.0015	.0014	.0006
9 000	.0026	.0021	.0009	.0025	.0018	.0009	.0023	.0011	.0006	.0018	.0016	.0007
10 000	.0028	.0022	.0010	.0028	.0020	.0010	.0025	.0013	.0007	.0020	.0018	.0008
11 000	.0030	.0024	.0011	.0031	.0022	.0011	.0027	.0015	.0008	.0023	.0019	.0009
12 000	.0032	.0026	.0012	.0033	.0024	.0011	.0029	.0016	.0009	.0025	.0021	.0010
13 000	.0034	.0028	.0013	.0036	.0026	.0012	.0031	.0018	.0010	.0027	.0023	.0011
14 000	.0038	.0030	.0013	.0038	.0028	.0013	.0033	.0019	.0011	.0029	.0024	.0012
15 000	.0040	.0032	.0014	.0040	.0030	.0014	.0035	.0021	.0011	.0031	.0026	.0012
16 000	.0042	.0033	.0014	.0041	.0032	.0015	.0037	.0023	.0012	.0033	.0028	.0013
17 000	.0044	.0035	.0015	.0044	.0034	.0015	.0039	.0025	.0012	.0035	.0030	.0014
1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	.0001	0.	0.
1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
17 000	.0043	.0033	.0015	.0042	.0034	.0015	.0036	.0025	.0011	.0037	.0028	.0013
1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

Tested by having the edge bear equally upon a flat plate.

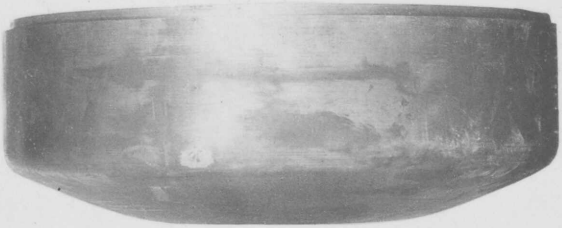
Applied loads.	Deflections at points.		
	Length A.	Diameter D.	Remarks.
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0016	.0005	
10 000	.0031	.0011	
15 000	.0047	.0018	
17 000	.0053	.0020	
1 000	.0003	0.	
20 000	.0063	.0024	
1 000	.0004	0.	
25 000	.0078	.0029	
30 000	.0093	.0034	
1 000	.0005	0.	
35 000	.0109	.0039	
40 000	.0127	.0046	
1 000	.0007	— .0002	
1 000	.0007	.0006	Rested under initial load 1½ hours.
40 000	.0128	.0054	
45 000	.0148	.0059	
50 000	.0163	.0064	
1 000	.0009	.0003	
55 000	.0180	.0069	
60 000	.0197	.0074	
1 000	.0013	.0001	
60 000	.0198	.0074	
65 000	.0213	.0079	
70 000	.0228	.0084	
1 000	.0013	— .0001	
70 000	.0028	.0085	
75 000	.0244	.0091	
80 000	.0260	.0097	
1 000	.0013	— .0001	
80 000	.0259	.0097	
81 000	.0263	.0099	
82 000	.0267	.0099	
83 000	.0269	.0100	
84 000	.0272	.0101	
85 000	.0274	.0102	
86 000	.0278	.0103	
87 000	.0281	.0104	
88 000	.0282	.0106	
89 000	.0286	.0107	
90 000	.0289	.0108	
1 000	.0017	— .0003	
90 000	.0287	.0108	
91 000	.0291	.0109	
92 000	.0294	.0110	
93 000	.0297	.0111	
94 000	.0301	.0113	
95 000	.0303	.0115	
96 000	.0307	.0116	
97 000	.0308	.0118	
98 000	.0313	.0119	
99 000	.0317	.0119	
100 000	.0318	.0120	
1 000	.0020	— .0003	
100 000	.0319	.0120	
102 000	.0325	.0123	
104 000	.0329	.0125	
106 000	.0335	.0128	
108 000	.0341	.0130	
110 000	.0349	.0132	
1 000	.0020	— .0020	
110 000	.0349	.0131	
112 000	.0354	.0134	
114 000	.0361	.0136	
116 000	.0363	.0138	
118 000	.0373	.0141	
120 000	.0380	.0144	
1 000	.0023	— .0004	
1 000	.0022	.0006	Rested under initial load 3 days.
120 000	.0382	.0148	
122 000	.0388	.0151	
124 000	.0395	.0153	
126 000	.0403	.0155	
128 000	.0409	.0157	
130 000	.0415	.0160	

Applied loads.	Deflections at points.		
	Length A.	Diameter D.	Remarks.
Lb.	*In.*	*In.*	
1 000	.0028	.0001	
130 000	.0418	.0160	
132 000	.0422	.0161	
133 000	.0425	.0162	
134 000	.0428	.0164	
135 000	.0432	.0164	
136 000	.0434	.0165	
137 000	.0438	.0167	
138 000	.0441	.0168	
139 000	.0444	.0169	
140 000	.0450	.0171	
1 000	.0030	.0001	
140 000	.0449	.0169	
142 000	.0454	.0173	
144 000	.0462	.0176	
146 000	.0468	.0177	
148 000	.0475	.0181	
150 000	.0482	.0182	
1 000	.0038	0.	
150 000	.0482	.0181	
152 000	.0490	.0186	
154 000	.0497	.0189	
156 000	.0504	.0193	
158 000	.0509	.0194	
160 000	.0519	.0198	
1 000	.0044	.0005	
160 000	.0521	.0197	
162 000	.0526	.0202	
164 000	.0536	.0204	
166 000	.0542	.0208	
168 000	.0550	.0210	
170 000	.0557	.0213	
1 000	.0057	.0005	
170 000	.0560	.0212	
172 000	.0567	.0217	
174 000	.0577	.0221	
176 000	.0585	.0225	
177 000	.0592	.0228	
178 000	.0595	.0229	
179 000	.0601	.0231	
180 000	.0606	.0233	
1 000	.0075	.0010	
180 000	.0610	.0231	
181 000	.0616	.0235	
182 000	.0621	.0237	
183 000	.0625	.0239	
184 000	.0629	.0242	
185 000	.0633	.0244	
186 000	{ .0640 .0646 }	.0246	Length A yielding.
187 000	.0651	.0248	
188 000	.0655	.0250	
189 000	.0661	.0253	
190 000	.0668	.0256	
1 000	.0100	.0021	
1 000	.0097	.0029	Rested under initial load ½ hour.
190 000	.0671	.0255	
191 000	.0678	.0264	
192 000	.0683	.0264	
193 000	.0692	.0268	
194 000	.0698	.0268	
195 000	.0702	.0271	
196 000	.0710	.0274	
197 000	.0718	.0276	
198 000	.0729	.0281	
199 000	.0741	.0287	
200 000	.0751	.0288	
1 000	.0147	.0039	
201 000	.0765	.0288	
202 000	.0774	.0298	
203 000	.0785	.0303	
204 000	.0795	.0307	
205 000	.0804	.0310	
206 000	.0815	.0314	
207 000	.0829	.0319	
208 000	.0842	.0325	
209 000	.0858	.0329	
210 000	.0880	.0339	



CRADLE HEAD NO. 4.

No. 4.



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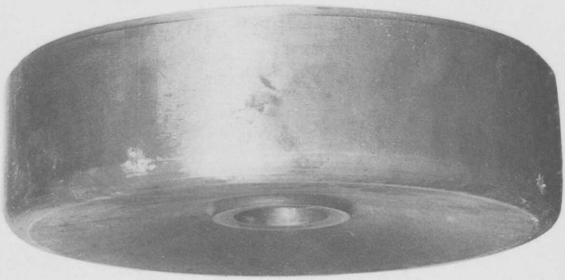

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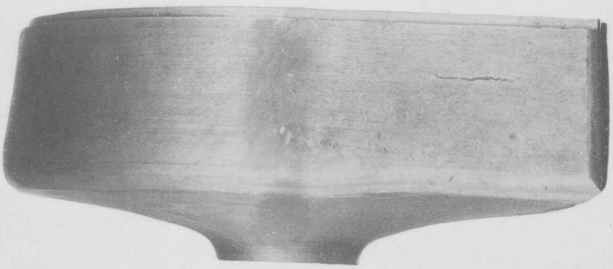


No. 1.

APPEARANCE OF CRADLE HEADS AFTER TESTING. SIDE VIEWS.

Applied loads.	Deflections at points.		
	Length A.	Diameter D.	Remarks.
Lb.	*In.*	*In.*	
1 000	.0235	.0069	
210 000	.0898	.0338	
211 000	.0917	.0346	
212 000	.0932	.0353	
213 000	.0952	.0359	
214 000	.0969	.0366	
215 000	.0991	.0377	
216 000	.1025	.0390	
217 000	.1052	.0399	
218 000	.1100	.0416	
219 000	.1132	.0427	
220 000	.1172 / .1197	.0444	Ultimate strength with fixture.
1 000	.0482	.0159	Micrometer readings discontinued on length A.
Fixture at center of cradle head was removed so as not to damage it for use in the other tests			
This fixture or bar had to be driven out of the 2¼ in. hole in cradle head, showing that the hole had become smaller.			
A pin 3⅜ in. diameter was used at center of head which was not inserted in the 2¼ in. hole and test resumed.			
1 000	.....	.0158	
188 000	.....	.....	Snapping sound.
189 200	Ultimate strength without fixture. Head yielding and load dropped to. (It would appear that fixture had supported the head.)		
135 000	.....	.....	
1 000	.....	.0473	
126 000	.....	.....	Sharp snapping sound.

Head removed from machine and test discontinued.

Cradle head cracked in seven places at edge of hole on inside of head.

Diameter at edge of hole at inside of head, 2.64 in.

Diameter at edge of hole at outside of head, 1.88 in.

No well-defined elastic limit. Sets remained without material change up to 140 000 lb., but no decided increase in sets occurred until loads reached 180 000 to 200 000 lb.

CRADLE HEAD NO. 4.

CIRCUMFERENCE UNSUPPORTED WITH RING.

Applied loads.	Deflections, in length, at points.											
	A.	B.	C.	A^1.	B^1.	C^1.	A^2.	B^2.	C^2.	A^3.	B^3.	C^3.
Lb.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2 000	.0002	.0002	.0001	.0003	.0001	.0001	.0001	.0002	.0001	.0002	.0001	.0001
3 000	.0004	.0004	.0003	.0005	.0002	.0001	.0003	.0003	.0001	.0004	.0002	.0002
4 000	.0006	.0005	.0004	.0008	.0003	.0001	.0005	.0003	.0002	.0006	.0003	.0004
5 000	.0008	.0006	.0005	.0009	.0004	.0003	.0007	.0004	.0003	.0007	.0004	.0005
6 000	.0010	.0008	.0006	.0012	.0005	.0004	.0008	.0005	.0004	.0009	.0006	.0006
7 000	.0011	.0010	.0006	.0013	.0006	.0005	.0009	.0006	.0004	.0011	.0007	.0007
8 000	.0013	.0011	.0007	.0015	.0008	.0007	.0010	.0007	.0005	.0012	.0009	.0008
9 000	.0015	.0012	.0008	.0016	.0010	.0008	.0011	.0008	.0006	.0014	.0011	.0009
10 000	.0016	.0013	.0009	.0018	.0011	.0009	.0012	.0009	.0006	.0015	.0012	.0010
11 000	.0018	.0015	.0010	.0019	.0012	.0010	.0013	.0010	.0007	.0017	.0013	.0010
12 000	.0019	.0016	.0011	.0021	.0013	.0011	.0015	.0011	.0008	.0017	.0014	.0011
13 000	.0021	.0017	.0012	.0023	.0015	.0011	.0018	.0012	.0009	.0019	.0015	.0012
14 000	.0021	.0018	.0012	.0025	.0017	.0013	.0020	.0013	.0010	.0020	.0017	.0012
15 000	.0022	.0019	.0013	.0027	.0019	.0013	.0022	.0015	.0010	.0022	.0018	.0013
16 000	.0024	.0021	.0014	.0029	.0019	.0014	.0023	.0017	.0011	.0024	.0019	.0013
17 000	.0026	.0021	.0014	.0031	.0020	.0015	.0025	.0018	.0012	.0025	.0020	.0014
1 000	0.	0.	.0001	.0002	0.	.0001	.0001	0.	0.	0.	0.	0.
1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
17 000	.0026	.0022	.0014	.0031	.0021	.0014	.0022	.0018	.0013	.0024	.0021	.0013
1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

CRADLE HEAD NO. 4—continued.

CIRCUMFERENCE UNSUPPORTED WITH RING.

Applied loads.	Deflections, in diameter, at points.					
	D.	E.	F.	D¹.	E¹.	F¹.
Lb.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
1 000	0.	0.	0.	0.	0.	0.
2 000	.0002	.0001	0.	0.	0.	0.
3 000	.0003	.0002	0.	0.	0.	0.
4 000	.0004	.0002	0.	.0001	0.	0.
5 000	.0004	.0002	0.	.0002	.0001	0.
6 000	.0005	.0003	0.	.0003	.0002	0.
7 000	.0006	.0003	.0001	.0004	.0002	0.
8 000	.0007	.0003	.0001	.0005	.0002	0.
9 000	.0007	.0004	.0001	.0006	.0002	0.
10 000	.0008	.0004	.0001	.0007	.0003	0.
11 000	.0009	.0005	.0001	.0008	.0003	0.
12 000	.0010	.0005	.0001	.0009	.0004	0.
13 000	.0010	.0005	.0001	.0009	.0004	0.
14 000	.0011	.0006	.0002	.0010	.0005	.0001
15 000	.0012	.0006	.0002	.0011	.0005	.0002
16 000	.0013	.0007	.0003	.0012	.0006	.0002
17 000	.0014	.0007	.0003	.0013	.0007	.0002
1 000	0.	0.	0.	0.	0.	0.
1 000	0.	0.	0.	0.	0.	0.
17 000	.0014	.0006	.0002	.0014	.0007	.0003
1 000	0.	0.	0.	0.	0.	0.

CIRCUMFERENCE SUPPORTED WITH RING.

Applied loads.	Deflections, in length, at points.											
	A.	B.	C.	A¹.	B¹.	C¹.	A².	B².	C².	A³.	B³.	C³.
Lb.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2 000	.0002	.0001	.0002	.0002	.0001	.0001	.0002	.0002	.0002	.0001	.0001	.0002
3 000	.0003	.0003	.0002	.0004	.0003	.0002	.0004	.0003	.0003	.0003	.0002	.0004
4 000	.0005	.0004	.0003	.0006	.0005	.0003	.0006	.0005	.0003	.0005	.0003	.0004
5 000	.0007	.0005	.0003	.0008	.0006	.0004	.0008	.0006	.0004	.0007	.0004	.0005
6 000	.0009	.0006	.0004	.0010	.0007	.0005	.0010	.0007	.0005	.0008	.0005	.0006
7 000	.0011	.0006	.0005	.0012	.0008	.0006	.0011	.0007	.0005	.0010	.0006	.0007
8 000	.0013	.0008	.0006	.0014	.0010	.0007	.0012	.0008	.0006	.0012	.0007	.0008
9 000	.0015	.0010	.0007	.0015	.0011	.0007	.0013	.0009	.0007	.0014	.0009	.0009
10 000	.0017	.0011	.0007	.0016	.0013	.0007	.0014	.0009	.0007	.0016	.0009	.0010
11 000	.0018	.0012	.0008	.0018	.0014	.0008	.0015	.0010	.0008	.0018	.0010	.0011
12 000	.0020	.0013	.0010	.0020	.0016	.0008	.0015	.0011	.0008	.0020	.0011	.0011
13 000	.0022	.0014	.0012	.0022	.0017	.0009	.0016	.0012	.0009	.0022	.0013	.0012
14 000	.0024	.0016	.0012	.0024	.0018	.0010	.0018	.0013	.0010	.0023	.0013	.0012
15 000	.0026	.0017	.0013	.0025	.0019	.0011	.0020	.0014	.0011	.0024	.0015	.0013
16 000	.0027	.0019	.0013	.0026	.0019	.0012	.0021	.0015	.0012	.0025	.0017	.0014
17 000	.0028	.0020	.0013	.0027	.0020	.0013	.0023	.0016	.0012	.0026	.0019	.0015
1 000	.0002	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
17 000	.0027	.0020	.0013	.0025	.0022	.0013	.0022	.0017	.0013	.0024	.0020	.0013
1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

Tested by having the edge bear equally upon a flat plate.

Applied loads.	Deflections at points.		Remarks.
	Length A.	Diameter D.	
Lb.	*In.*	*In.*	
1 000	0.	0.	Initial load.
5 000	.0009	.0003	
10 000	.0019	.0007	
15 000	.0029	.0010	
17 000	.0032	.0013	
1 000	0.	0.	
20 000	.0037	.0014	
1 000	—.0001	—.0001	
25 000	.0039	.0018	
30 000	.0050	.0022	
1 000	0.	—.0001	
35 000	.0059	.0027	
40 000	.0061	.0029	
1 000	0.	—.0001	
45 000	.0074	.0034	
50 000	.0079	.0038	
1 000	0.	—.0001	
55 000	.0082	.0042	
60 000	.0095	.0046	
1 000	.0002	—.0001	
65 000	.0103	.0050	
70 000	.0111	.0054	
1 000	.0002	—.0003	
75 000	.0116	.0058	
80 000	.0125	.0062	
1 000	.0002	—.0002	
85 000	.0133	.0067	
90 000	.0140	.0071	
1 000	.0002	—.0002	
95 000	.0146	.0075	
100 000	.0156	.0078	
1 000	.0004	—.0002	
105 000	.0166	.0083	
110 000	.0173	.0087	
1 000	.0005	—.0001	
115 000	.0180	.0092	
120 000	.0187	.0097	
1 000	.0006	—.0001	
125 000	.0195	.0100	
130 000	.0202	.0104	
1 000	.0006	—.0002	
135 000	.0209	.0108	
140 000	.0216	.0113	
1 000	.0006	—.0003	
1 000	.0006	.0005	
140 000	.0216	.0117	
145 000	.0224	.0120	
150 000	.0231	.0123	
1 000	.0008	—.0001	
150 000	.0231	.0121	
155 000	.0239	.0125	
160 000	.0249	.0128	
1 000	.0009	—.0004	
160 000	.0248	.0125	
165 000	.0255	.0130	
170 000	.0261	.0133	
1 000	.0011	—.0007	
170 000	.0262	.0131	
175 000	.0269	.0136	
180 000	.0276	.0140	
1 000	.0009	—.0007	
180 000	.0276	.0141	
185 000	.0282	.0148	
190 000	.0289	.0153	
1 000	.0012	—.0003	
190 000	.0290	.0153	
195 000	.0297	.0158	
200 000	.0304	.0163	
1 000	.0012	—.0001	
200 000	.0305	.0165	
205 000	.0310	.0168	
210 000	.0319	.0173	
1 000	.0013	—.0003	
210 000	.0319	.0173	
212 000	.0321	.0177	

Applied loads.	Deflections at points.		Remarks.
	Length A.	Diameter D.	
Lb.	*In.*	*In.*	
214 000	.0325	.0178	
216 000	.0327	.0179	
218 000	.0331	.0181	
220 000	.0335	.0183	
1 000	.0015	.0003	
220 000	.0334	.0183	
222 000	.0337	.0187	
224 000	.0339	.0188	
226 000	.0343	.0190	
228 000	.0347	.0192	
230 000	.0349	.0195	
1 000	.0019	.0005	
After loading cradle head to 230 000 lb. with the regular fixtures the cradle head was removed from testing machine and a plug was fitted to the 2½-in. hole in head. A pin 3.10 in. diameter was placed against the center of head and the test resumed.			
Micrometer readings on gaged length A were discontinued, as this length was inaccessible			
1 000	.....	.0003	
230 000	.....	.0196	
1 000	.....	.0005	
230 000	.....	.0195	
1 000	.....	.0006	
250 000	.....	.0213	
1 000	.....	.0006	
275 000	.....	.0244	
1 000	.....	.0010	
300 000	.....	.0283	Elastic limit above 300 000 about 310 000 lb.
1 000	.....	.0023	
Micrometer readings on diameter D, while under high loads, were discontinued and sets only taken after each increment.			
310 000	.....	.....	
1 000	.....	.0037	
1 000	.....	.0048	Rested under initial load 1 hour.
320 000	.....	.....	
1 000	.....	.0058	
330 000	.....	.....	
1 000	.....	.0068	
340 000	.....	.....	
1 000	.....	.0088	
350 000	.....	.....	
1 000	.....	.0128	
360 000	.....	.....	
1 000	.....	.0166	
370 000	.....	.....	
1 000	.....	.0216	
380 000	.....	.....	
1 000	.....	.0303	
390 000	.....	.....	
1 000	.....	.0422	
400 000	.....	.....	
1 000	.....	.0623	
410 000	.....	.....	
1 000	.....	.0603	
420 000	.....	.....	
1 000	.....	.1074	
430 000	.....	.....	
1 000	.....	.1425	
440 000	.....	.....	
1 000	.....	.2141	
446 400	.....	.....	Ultimate strength.

Cradle head expanded at diameter D to 13.39 in.

Changed the shape of cone of the head from a right line to a concaved one.

Pin at center of head embedded itself in head about 0.05 in.

7-INCH GUN, No. 97.

SPECIMENS FROM "A" HOOP.

TENSILE TESTS OF SPECIMENS FROM 7-INCH GUN NO. 97, "A" HOOP.

Marks.	Diameter.	Sectional area.	Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation in 2 in.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	In.	*Sq. in.*	*Lb.*	*Lb.*	*Per ct.*	*Per ct.*	*In. In.*	
A. T. O.	0.505	0.20	73 000	115 500	18.5	40.3	.21*, .16	Silky.
A. T. M.	.505	.20	64 500	109 000	15.5	Fractured at neck.	.05, .06	Fine granular; flaked spot at circumference.
A. T. I.	.505	.20	73 500	117 000	16.5	34.0	.21*, .12	Silky; oblique.
A. M. L.	.505	.20	66 000	113 500	20.5	43.3	.21*, .20*	Do.
A. I. L.	.505	.20	74 500	117 500	20.0	43.3	.19, .21*	Do.
A. O. L.	.505	.20	72 500	116 500	21.5	46.2	.28*, .15	Do.
B. T. O.	.505	.20	73 000	116 000	18.5	40.3	.10, .27*	Do.
B. T. I.	.505	.20	74 500	117 000	15.0	16.9	.18*, .12	Fine granular; flaked spot at circumference.
B. T. M.	.505	.20	64 500	114 000	17.0	34.0	.17*, .17*	Silky.
I. T. C.	.505	.20	74 000	117 000	18.0	43.3	.10, .26*	Do.
O. T. C.	.505	.20	74 000	116 500	19.5	40.3	.24*, .15	Do.
M. T. C.	.505	.20	65 500	94 500	Defective metal.		Fractured in head of specimen.	
L. O. B.	.505	.20	63 500	115 500	21.5	46.2	.26*, .17	Silky.
M. L. B.	505	.20	64 500	114 000	21.0	37.1	.23*, .19	Do.
L. I. B.	.505	.20	74 000	116 000	21.0	46.2	.15, .27*	Do.
O. C. L.	.505	.20	74 500	116 000	20.0	43.3	.25*, .15	Do.
I. C. L.	.505	.20	74 500	116 500	20.5	46.2	.12, .29*	Do.
M. C. L.	.505	.20	65 500	114 000	20.0	40.3	.16, .24*	Do.
A. R.	.505	.20	66 000	113 500	10.5	13.2	.11*, .10	Fine granular; fracture at seam in stem.
A. R.	.505	.20	64 000	75 000	1.5	1.8	.02*, .01	Fine granular, 80 per cent; 20 per cent at seam.
A. R.[1]	.505	.20	64 000	110 500	8.0	9.6	.08*, .08	Fine granular; flaky spot.
R. B.[1]	.505	.20	64 000	76 500	1.5	1.8	.02*, .01	Fine granular; flaky streak in stem.
R. B.[1]	.505	.20	66 500	107 000	5.0	Fractured in neck.	.04, .06	Fine granular.
R. B.[1]	.505	.20	51 000	52 500	.5	1.8	.01, .00	Fine granular, 40 per cent; serrated 60 per cent; seam in stem.
R. C.	.505	.20	66 000	115 000	15.5	20.5	.17*, .14	Fine granular, 90 per cent; silky, 10 per cent.
R. C.	.505	.20	66 000	114 000	16.5	27.4	.11, .22*	Fine granular, 60 per cent; silky, 40 per cent.
R. C.	.505	.20	61 000	113 500	15.0	20.5	.11, .19*	Fine granular, 90 per cent; silky, 10 per cent.

[1] Opened longitudinal streaks alongside of fractured places.

15-POUNDER GUN, No. 4, MODEL 1903.

SPECIMEN FROM JACKET.

68604°—H. Doc. 1089, 61-3——5

TENSILE TESTS OF SPECIMENS FROM 15-POUNDER GUN JACKET OF GUN NO. 4, MODEL 1903, WHICH DEVELOPED A CRACK 8 INCHES LONG BETWEEN GUIDES AND UNDER LUG.

Marks.	Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Lb.	*Lb.*	*Per cent.*	*Per cent.*	*In. In.*	
1	61 500	93 500	26.5	54.6	.38*, .15	Silky.
2	61 500	98 000	26.0	51.9	.26*, .26*	Do.
3	55 500	94 000	21.5	43.3	.11, .32*	Do.
4	59 000	93 500	27.5	54.6	.20, .35*	Do.
5	56 000	94 500	25.0	49.1	.15, .35*	Do.
6	67 500	103 500	20.5	37.1	.14, .27*	Do.
7	66 000	94 000	8.5	13.2	.07, .10*	Gray; amorphous; granular spot at circumference.

12-INCH GUN, No. 14.

TENSILE TESTS OF SPECIMENS FROM 12-INCH GUN NO. 14.

Marks.	Diameter.	Sectional area.	Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation in 2 in.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	In.	*Sq. in.*	*Lb.*	*Lb.*	*Per cent.*	*Per cent.*	*In.* *In.*	
L. O.	0.505	0.20	48 500	88 500	30.0	57.2	.30*, .30*	Silky.
L. I.	.505	.20	52 000	92 000	28.5	59.8	.40*, .17	Do.
L. M.	.505	.20	42 500	85 000	30.5	54.6	.23, .38*	Do.
T. O.	.505	.20	47 000	87 000	25.0	49.1	.16, .34*	Do.
T. I.	.505	.20	50 000	90 500	21.0	43.3	.16, .26*	Do.
T. M.	.505	.20	43 000	86 000	23.5	40.3	.32*, .15	Do.
R.	.505	.20	43 000	88 000	16.5	27.4	.11, .22*	Fine granular, 40 per cent; serrated, 60 per cent.
R.	.505	.20	43 000	88 000	18.5	30.4	.11, .26*	Serrated.
R.	.505	.20	43 500	88 000	15.0	16.9	.10, .20*	Granular; with flaky streak.

12-INCH W. W. MORTAR, 1908.

SPECIMENS FROM TUBE, JACKET, BREECH BUSHING, TRUNNION HOOP.

12-INCH W. W. MORTAR, 1908.

TUBE.

No. 9039.

Marks, B 3202, BT, 4 I.
Forged steel.
Diameter, 0.564 in.
Sectional area, 0.25 sq. in.
Gaged length, 3 in.

Applied loads per sq. in.	In gaged length.		Per inch.		Remarks.
	Elongation.	Set.	Elongation.	Successive elongation.	
Lb.	*In.*	*In.*	*In.*	*In.*	
1 000	0.	0.	0.	0.	
5 000	.0003	0.	.00010	.00010	
10 000	.0008	.....	.00027	.00017	
20 000	.0017	.....	.00057	.00030	
30 000	.0027	0.	.00090	.00033	
40 000	.0037	0.	.00123	.00033	10 000 to 40 000 lb. per sq. in.
45 000	.0042	0.	.00140	.00017	
50 000	.0047	.....	.00157	.00017	Modulus of elasticity=31 200 000 lb. per sq. in.
55 000	.0052	.....	.00173	.00016	
60 000	.0057	.....	.00190	.00017	
61 000	.0058	.....	.00193	.00003	
62 000	.0059	.....	.00197	.00004	
63 000	.0061	.....	.00203	.00006	
64 000	.0063	.....	.00210	.00007	
65 000	.0066	.....	.00220	.00010	Elastic limit.
66 000	.0078	.....	.00260	.00040	
67 000	.0103	.....	.00343	.00083	
68 000	.0141	.....	.00470	.00127	
69 000	.0167	.....	.00557	.00087	
70 000	.0186	.....	.00620	.00063	
100 000	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.11 in. in 3 in. = 3.7 per cent.
Elongation of inch sections, .03, .04, .04.
Position of fracture, in the neck outside.
Appearance of fracture, fine granular.

No. 9040.

Marks, B 3203, BT, 4 M.
Forged steel.
Diameter, 0.563 in.
Sectional area, 0.25 sq. in.
Gaged length, 3 in.

Applied loads per sq. in.	In gaged length.		Per inch.		Remarks.
	Elongation.	Set.	Elongation.	Successive elongation.	
Lb.	*In.*	*In.*	*In.*	*In.*	
1 000	0.	0.	0.	0.	
5 000	.0003	0.	.00010	.00010	
10 000	.0008	0.	.00027	.00017	
20 000	.0017	.....	.00057	.00030	
30 000	.0029	0.	.00097	.00040	
40 000	.0038	.0001	.00127	.00030	10 000 to 40 000 lb. per sq. in.
45 000	.0043	.0001	.00143	.00016	Modulus of elasticity = 30 000 000 lb. per sq. in.
50 000	.0049	.....	.00163	.00020	
55 000	.0054	.....	.00180	.00017	
60 000	.0060	.....	.00200	.00020	
61 000	.0062	.....	.00210	.00010	
62 000	.0064	.....	.00213	.00003	
63 000	.0067	.....	.00223	.00010	Elastic limit.
64 000	.0083	.....	.00277	.00054	
65 000	.0129	.....	.00430	.00153	
66 000	.0186	.....	.00620	.00190	
67 000	.0207	.....	.00690	.00070	
68 000	.0261	.....	.00870	.00180	
99 600	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.55 in. in 3 in. = 18.3 per cent.
Elongation of inch sections, .26*, .19, .10.
Diameter of fracture, 0.41 in. Area, 0.132 sq. in.
Contraction of area, 47.2 per cent.
Position of fracture, 1.20 in. from the neck.
Appearance of fracture, silky.

JACKET.

No. 9041.

Marks, B 3170, BT, 5 I.
Diameter, 0.564 in.
Sectional area, 0.25 sq. in.
Gaged length, 3 in.

Applied loads per sq. in.	In gaged length.		Per inch.		Set.	Remarks.
	Elongation.	Set.	Elongation.	Successive elongation.		
Lb.	*In.*	*In.*	*In.*	*In.*	*In.*	
1 000	0.	0.	0.	0.	0.	
5 000	.0003	.....	.00010	.00010	.....	
10 000	.0007	0.	.00023	.00013	0.	
20 000	.0017	.....	.00057	.00034	.....	
30 000	.0027	0.	.00090	.00033	.....	
40 000	.0037	0.	.00123	.00033	.....	10 000 to 40 000 lb. per sq. in.
45 000	.0043	0.	.00143	.00020	.....	Modulus of elasticity=30 000 000 lb. per sq. in.
50 000	.0048	.....	.00160	.00017	.....	
55 000	.0052	.....	.00173	.00013	.....	
60 000	.0059	.....	.00197	.00024	.....	
61 000	.0062	.....	.00207	.00010	.....	
62 000	.0066	.....	.00220	.00013	.....	Elastic limit.
63 000	.0076	.....	.00253	.00033	.....	
64 000	.0094	.....	.00313	.00060	.....	
65 000	.0113	.....	.00377	.00064	.....	
66 000	.0152	.....	.00507	.00130	.....	
67 000	.0171	.....	.00570	.00063	.....	
106 400	.....	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.51 in. in 3 in. = 17 per cent.
Elongation of inch sections, .10, .31*, .10.
Diameter of fracture, 0.46. Area, 0.1662 sq. in.
Contraction of area, 33.5 per cent.
Position of fracture, 1.50 in. from the neck.
Appearance of fracture, fine granular 75 per cent, silky 25 per cent.

No. 9042.

Marks, B 3199, BT, 5 O.
Diameter, 0.564 in.
Sectional area, 0.25 sq. in.
Gaged length, 3 in.

Applied loads per sq. in.	In gaged length.		Per inch.		Remarks.
	Elongation.	Set.	Elongation.	Successive elongation.	
Lb.	*In.*	*In.*	*In.*	*In.*	
1 000	0.	0.	0.	0.	
5 000	.0003	0.	.00010	.00010	
10 000	.0008	0.	.00027	.00017	
20 000	.0017	.....	.00057	.00030	
30 000	.0027	0.	.00090	.00033	
40 000	.0038	0.	.00127	.00037	10 000 to 40 000 lb. per sq. in.
45 000	.0043	0.	.00143	.00016	Modulus of elasticity=30 000 000 lb. per sq. in.
50 000	.0048	.....	.00160	.00017	
55 000	.0057	.....	.00190	.00030	
60 000	.0064	.....	.00213	.00023	
61 000	.0070	.....	.00233	.00020	Elastic limit.
62 000	.0092	.....	.00307	.00074	
63 000	.0114	.....	.00380	.00073	
64 000	.0145	.....	.00483	.00103	
65 000	.0162	.....	.00540	.00057	
66 000	.0186	.....	.00620	.00080	
67 000	.0209	.....	.00697	.00077	
106 800	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.51 in. in 3 in.=17 per cent.
Elongation of inch sections, .10, .31*, .10.
Diameter at fracture, 0.45 in. Area, 0.159 sq. in.
Contraction of area, 36.4 per cent.
Position of fracture, in middle of stem.
Appearance of fracture, silky.

Breech Bushing.

No. 9043.

Marks, B 3485, BT, 4 O.
Diameter, 0.506 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.
Stem of specimen, crooked.

Applied loads per sq. in.	In gaged length.		Per inch.		Remarks.
	Elongation.	Set.	Elongation.	Successive elongation.	
Lb.	*In.*	*In.*	*In.*	*In.*	
1 000	0.	0.	0.	0.	
5 000	.0002	0.	.00010	.00010	
10 000	.0002	.....	.00010	0.	
20 000	.0007	.....	.00035	.00025	
30 000	.0014	.....	.00070	.00035	
40 000	.0020	—.0001	.00100	.00030	10 000 to 40 000 lb. per sq. in.
45 000	.0023	.....	.00115	.00015	Modulus of elasticity=33 000 000 lb. per sq. in.
50 000	.0026	.....	.00130	.00015	
55 000	.0030	.....	.00150	.00020	
60 000	.0033	.....	.00165	.00015	
65 000	.0037	.....	.00185	.00020	
70 000	.0040	.....	.00200	.00015	
75 000	.0044	.....	.00220	.00020	
80 000	.0048	.....	.00240	.00020	
85 000	.0057	.....	.00285	.00045	
89 000	.0063	.....	.00315	.00030	Elastic limit.
90 000	.0082	.....	.00410	.00095	
91 000	.0098	.....	.00490	.00080	
92 000	.0105	.....	.00525	.00035	
93 000	.0112	.....	.00560	.00035	
94 000	.0127	.....	.00635	.00075	
95 000	.0140	.....	.00700	.00065	
126 000	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.32 in. in 2 in.=16 per cent.
Elongation of inch sections, .11, .21*.
Diameter at fracture, 0.38 in. Area, 0.1134 sq. in.
Contraction of area, 43.3 per cent.
Position of fracture, 1 inch from the neck.
Appearance of fracture, silky.

Trunnion Hoop.

No. 9044.

Marks, B 3192, BT, 4 M.
Diameter, 0.562 in.
Sectional area, 0.25 sq. in.
Gaged length, 4 in.

Applied loads per sq. in.	In gaged length.		Per inch.		Remarks.
	Elongation.	Set.	Elongation.	Successive elongation.	
Lb.	*In.*	*In.*	*In.*	*In.*	
1 000	0.	0.	0.	0.	
5 000	.0005	0.	.00012	.00012	
10 000	.0011	0.	.00027	.00015	
20 000	.0023	.....	.00057	.00030	
30 000	.0037	0.	.00092	.00035	
40 000	.0051	0.	.00127	.00035	10 000 to 40 000 lb. per sq. in.
45 000	.0059	0.	.00147	.00020	Modulus of elasticity=30 000 000 lb. per sq. in.
46 000	.0061	.....	.00152	.00005	
47 000	.0062	.....	.00155	.00003	
48 000	.0063	.....	.00157	.00002	
49 000	.0065	.....	.00162	.00005	
50 000	.0067	.....	.00167	.00005	
51 000	.0073	.....	.00182	.00015	Elastic limit.
52 000	.0137	.....	.00342	.00160	
53 000	.0185	.....	.00462	.00120	
54 000	.0207	.....	.00517	.00055	
55 000	.0244	.....	.00610	.00093	
98 400	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.74 in. in 4 in. = 18.5 per cent.
Elongation of inch sections, .10, .37*, .13, .14.
Diameter at fracture, 0.40 in. Area, 0.1257 sq. in.
Contraction of area, 49.7 per cent.
Position of fracture, 2.20 in. from the neck.
Appearance of fracture, silky.

14-INCH D. C. L. F. MODEL 1907.

SPECIMENS FROM LEFT GUN LEVER.

TENSILE TEST OF SPECIMEN TAKEN FROM LEFT GUN LEVER, 14-INCH D. C., L. F., MODEL 1907, NO. 1, BROKEN AT THE SANDY HOOK PROVING GROUND.

Dimensions:		
Width	in..	0.500
Thickness	in..	0.100
Sectional area	sq. in..	0.050
Elastic limit:		
Total	lb..	1 734
Per sq. in	lb..	34 680
Tensile strength:		
Total	lb..	3 468
Per sq. in	lb..	69 360
Elongation in 3 in	in..	0.32
	per cent..	10.7
Elongation of inch sections	in..	0.10, 0.13*, 0.09
Dimensions at fracture	in..	0.46 by 0.09
Area at fracture	sq. in..	0.414
Contraction of area	per cent..	17.2
Appearance of fracture		Fine granular.

Marks.	Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation in 2 in.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Lb.	*Lb.*	*Per cent.*	*Per cent.*	*In.* *In.*	
C1B	39 000	76 000	16.5	20.5	.16, .17*	Dull gray; amorphous.
C1C	41 500	80 500	7.0	9.5	.04, .10*	Fine granular, 60 per cent; amorphous, 40 per cent.
2B	40 000	74 500	8.0	9.5	.06, .10*	Granular; with silvery streak.
B4	39 000	76 000	19.5	30.7	.27*, .12	Silky.
A1A	40 500	78 000	9.5	9.5	.11*, .08	Granular, 80 per cent; amorphous, 20 per cent.
A1	42 000	78 000	10.0	13.2	.12*, .08	Dull gray; amorphous.
A2	41 500	79 000	12.5	16.9	.12, .13*	Dull gray; amorphous, 90 per cent; granular, 10 per cent.
C2A	42 500	73 000	5.5	9.5	.03, .08*	Dull gray; amorphous.
C2B	39 500	75 000	13.0	20.5	.15*, .11	Do.
C2	36 500	74 500	13.5	20.5	.08, .19*	Silky.
B3	39 500	72 500	7.0	13.2	.09*, .05	Silky; with trace of granulation.
A2A	39 000	75 500	15.5	20.5	.19*, .12	Silky; with small patches of granulation.
A1B	36 500	76 000	16.0	16.9	.16*, .16	Dull gray; amorphous.
A2B	40 500	65 000	4.5	9.5	.06*, .03	Granular, 80 per cent; amorphous, 20 per cent.
C1	41 500	75 000	7.5	13.2	.05, .10*	Dull gray; amorphous.
C1A	39 500	75 000	15.0	20.5	.16*, .14	Do.
B1	40 500	77 500	20.0	27.4	.23*, .17	Silky, 90 per cent; granular, 10 per cent.
[1]1	50 500	76 000	5.0	9.5	.03, .07*	Gray amorphous; in part granular.
[1]2	49 000	83 000	12.5	13.2	.09, .16	Gray; amorphous.
[2]C	42 000	74 500	18.5	27.4	.16, .21*	Silky.

[1] Air chilled at 1 600° F.

[2] Annealed at 1 600° F. for 4 hours.

TENSILE TESTS OF SPECIMENS FROM LEFT GUN LEVER 14-INCH D. C. NO. 32.

Marks.	Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation in 2 in.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Lb.	*Lb.*	*Per cent.*	*Per cent.*	*In.* *In.*	
D1	34 500	76 000	14.0	16.9	.14*, .14	Fine granular.
D2	36 500	75 500	15.0	16.9	.15, .15	Fine granular; with a darker colored spot at circ.
[1]D3	35 000	65 500	5.0	5.7	.04, .06	Do.
D4	34 000	68 000	10.0	13.2	.09, .11*	Gray; amorphous; in part granular.
E1	35 000	73 000	12.5	16.9	.10, .15*	Granular, 80 per cent; silky, 20 per cent.
E2	37 500	75 500	20.0	20.5	.21*, .19	Granular, 90 per cent; silky, 10 per cent.
E3	35 000	80 500	21.5	24.0	.23*, .20	Granular, 90 per cent; silky, 10 per cent.
E4	35 000	64 000	6.0	9.5	.05, .07*	Gray; amorphous; in part granular.
[2] E2	55 000	86 000	8.5	9.5	.08, .09*	Fine granular, 30 per cent; gray; amorphous, 70 per cent.
[2] E3	55 000	77 500	6.0	9.5	.05, .07*	Gray; amorphous.
[2] E4	56 500	93 000	9.5	9.5	.11*, .08	Fine granular, 80 per cent; gray; amorphous, 20 per cent.
[2] D2	57 500	93 500	9.0	13.2	.09*, .09	Fine granular, 70 per cent; gray; amorphous, 30 per cent.

[1] Fractured outside of gaged length.

[2] Air chilled at 1 600° F.

CAST SHELL AND SHRAPNEL.

TENSILE TESTS OF SPECIMENS TAKEN FROM FRAGMENTS OF A RUPTURED CASE OF A 4.7-INCH HIGH EXPLOSIVE SHRAPNEL.

Marks.	Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation in 2 in.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Lb.	*Lb.*	*Per cent.*	*Per cent.*	*In. In.*	
1	87 300	129 000	10.5	14.3	.13*, .08	Fine granular.
2	81 800	130 000	11.5	14.3	.14*, .09	Fine granular; gray spot.
3	56 400	129 000	13.0	19.1	.15*, .11	Fine granular; gray spot near center.
D	24 500	90 200	1.0	.98	.02*, .00	Fine granular.

TESTS UPON SPECIMENS FROM A 6-INCH CAST SHELL RECEIVED FROM FORT REVERE.

Tension Tests.

Marks.	Diameter.	Sectional area.	Tensile strength.		Appearance of fracture.
			Total.	Per sq. in.	
	In.	*Sq. in.*	*Lb.*	*Lb.*	
A6075	0.505	0.20	3 900	19 500	Medium coarse granular; dark gray.
B6075	.505	.20	3 400	17 000	Do.
C6075	.505	.20	3 800	19 000	Do.
D6075	.505	.20	3 900	19 500	Do.
E6075	.505	.20	3 300	16 500	Do.
F6075	.505	.20	3 700	18 500	Do.

Compression Tests.

These specimens were taken from cylindrical portion of shell, and had axes parallel to axis of shell.

Specimens X and Y were taken from diametrically opposite sides about midway between the base and the point.

Specimen Z was taken close to the base, in line with Y.

Marks.	Length.	Diameter.	Sectional area.	Ultimate strength.	
				Total.	Per sq. in.
	In.	*In.*	*Sq. in.*	*Lb.*	*Lb.*
X	1.504	0.798	0.50	32 200	64 400
Y	1.505	.798	.50	31 500	63 000
Z	1.507	.798	.50	28 800	57 600

Oblique shearing fractures.

STEEL CASTINGS FOR ORDNANCE WORK.

CAST STEEL FROM WATERTOWN ARSENAL STEEL PLANT.

Heat number.	Chemical composition.					Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Carbon.	Manganese.	Silicon.	Sulphur.	Phosphorus.						
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lb.*	*Lb.*	*P. ct.*	*P. ct.*	*In.* *In.*	
1872	0.45	1.05	0.274	0.051	0.060	48 000	93 500	15.5	16.9	0.17*, 0.14	Fine granular.
						49 000	94 000	20.0	24.0	.21*, .19	Fine granular, 70 per cent; silky, 30 per cent.
1873	.35	1.02	.247	.060	.070	43 500	82 500	22.5	30.7	.22, .23*	Silky.
1874	.44	.97	.247	.062	.065	50 500	86 000	12.5	13.2	.11, .14*	Fine granular, 10 per cent; silky, 90 per cent.
						43 000	78 500	27.5	40.3	.31*, .24	Silky.
1875	.35	1.01	.257	.054	.063						
1876	.30	.99	.220	.060	.063	41 000	78 000	29.0	43.3	.34*, .24	Do.
1877	.34	.98	.192	.058	.068						
1878	.46	1.05	.344	.051	.055	48 000	94 500	17.5	20.5	.19*, .16	Fine granular, 50 per cent; silky, 50 per cent.
1879	.33	1.05	.267	.055	.050	42 000	79 500	18.0	16.9	.16, .20*	Do.
						42 000	81 500	23.5	27.4	.28*, .19	Do.
1880	.30	.94	.240	.054	.046	37 000	74 000	30.5	43.3	.23, .28*	Silky.
1881	.26	.95	.190	.046	.043						
1882	.34	.90	.223	.051	.044	35 500	73 000	27.5	40.3	.32*, .23	Do.
1883	.28	1.04	.226	.054	.050						
1884	.28	.97	.242	.051	.050						
1885	.42	1.07	.274	.048	.044	41 500	88 500	22.5	30.7	.22, .23*	Fine granular, 40 per cent; silky, 60 per cent.
						55 500	98 500	18.0	27.4	.15, .21*	Silky.
1886	.30	.98	.150	.058	.053	40 500	74 000	28.0	43.3	.28*, .28*	Do.
1887	.28	.95	.222	.058	.054						
1888	.31	1.05	.266	.064	.054	41 500	76 000	21.5	20.5	.22*, .21	Fine silky.
1889	.29	1.12	.224	.065	.068						
1890	.24	1.06	.230	.068	.046	37 500	72 500	29.5	40.3	.36*, .23	Silky.
1891	.41	1.02	.300	.048	.044	45 000	88 000	23.0	27.4	.23*, .23*	Silky, 70 per cent; granular, 30 per cent.
1892	.41	1.04	.335	.060	.047	50 500	91 500	20.5	27.4	.16, .25*	Silky, 90 per cent; granular, 10 per cent.
1893	.28	1.08	.232	.062	.050	45 000	78 500	20.0	20.5	.20*, .20	Lamellar, 40 per cent; granular, 60 per cent.
1894	.27	.99	.198	.050	.051	42 500	74 000	27.0	34.0	.27*, .27*	Silky.
1895	.23	.59	.188	.052	.048						
1896	.29	1.10	.205	.053	.050	48 500	77 500	14.0	13.2	.13, .15*	Fine granular, 60 percent; silky, 40 per cent.
						45 500	79 500	26.5	40.3	.32*, .21	Silky.
1897	.32	1.02	.214	.058	.046	45 500	78 000	14.0	16.9	.11, .17*	Do.
						45 500	80 000	26.0	34.0	.30*, .22	Do.
1898	.31	1.10	.235	.059	.050	47 500	81 000	23.0	27.4	.27*, .19	Do.
1899	.26	.96	.212	.066	.051						
1900	.27	.90	.225	.056	.046						
1901	.40	1.04	.280	.060	.042	49 500	90 500	22.0	27.4	.25*, .19	Do.
1902	.28	1.10	.235	.062	.043						
1903	.27	1.10	.219	.057	.048	48 500	79 000	19.0	20.5	.22*, .16	Do.
						45 500	77 500	27.0	40.3	.34*, .20	Do.
1904	.25	.97	.192	.062	.044						
1905	.31	1.09	.224	.057	.046						
1906	.33	1.10	.214	.065	.044	49 000	78 000	13.0	13.2	.12, .14*	Lamellar, 90 per cent; granular, 10 per cent.
						45 000	79 000	21.5	27.4	.22*, .21*	Silky.
1907	.24	1.03	.211	.062	.042						
1908	.27	1.10	.206	.068	.047						
1909	.43	.93	.245	.062	.047						
1910	.39	1.17	.166	.062	.053	48 500	82 500	14.0	16.9	.13, .15*	Fine granular, 40 per cent; lamellar, 60 per cent.
						46 000	78 500	19.5	24.0	.18, .21*	Silky, 50 per cent; lamellar, 50 per cent.

Cast steel from Watertown Arsenal steel plant—Continued.

Heat number.	Chemical composition.					Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Carbon.	Manganese.	Silicon.	Sulphur.	Phosphorus.						
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lb.*	*Lb.*	*P. ct.*	*P. ct.*	*In. In.*	
1911	0.29	1.12	0.205	0.069	0.051	48 500	85 500	15.0	16.9	0.16*, 0.14	Fine granular, 50 per cent; silky, 50 per cent.
	.....	.....	.....	.....	.....	48 500	86 000	11.0	13.2	.12*, .10	Fine granular, 50 per cent; lamellar, 50 per cent.
	.....	.....	.....	.....	.....	48 500	81 500	26.0	37.1	.29*, .23	Silky.
1912	.28	1.10	.200	.062	.048	44 000	78 500	28.0	40.3	.31*, .25	Do.
1913	.26	1.22	.202	.068	.052	45 500	78 500	20.5	20.5	.22*, .19*	Fine granular, 40 per cent; silky, 60 per cent.
	.....	.....	.....	.....	.....	46 000	77 500	26.0	30.7	.26*, .26*	Silky.
1914	.31	1.20	.202	.069	.049	.....	.....	.....	.....	.....	
1915	.29	1.12	.220	.069	.050	.....	.....	.....	.....	.....	
1916	.29	1.14	.227	.069	.049	.....	.....	.....	.....	.....	
1917	.29	1.11	.238	.069	.056	.....	.....	.....	.....	.....	
1918	.49	1.11	.300	.060	.052	48 500	96 500	11.0	13.2	.12*, .10	Fine granular.
	.....	.....	.....	.....	.....	50 500	90 500	22.0	27.4	.24*, .20	Silky.
1919	.33	1.25	.243	.049	.050	52 500	86 000	17.5	24.0	.19*, .16	Do.
1920	.31	1.06	.210	.054	.047	.....	.....	.....	.....	.....	
1921	.30	1.14	.222	.051	.047	.....	.....	.....	.....	.....	
1922	.28	1.03	.210	.051	.048	.....	.....	.....	.....	.....	
1923	.28	1.11	.231	.050	.049	45 500	82 000	25.0	37.1	.27*, .23*	Do.
1924	.30	1.11	.222	.050	.049	41 000	79 500	26.5	40.3	.21, .32*	Do.
1925	.29	1.13	.272	.046	.049	.....	.....	.....	.....	.....	
1926	.30	.84	.241	.048	.044	43 500	74 500	20.0	24.0	.17, .23*	Do.
1927	.29	.84	.206	.056	.045	41 000	75 500	28.0	40.3	.36*, .20	Do.
1928	.25	.86	.213	.053	.043	.....	.....	.....	.....	.....	
1929	.23	.83	.188	.047	.042	.....	.....	.....	.....	.....	
1930	.53	1.00	.240	.058	.038	53 500	93 000	17.5	20.5	.19*, .16	Do.
1931	.29	.78	.212	.041	.037	.....	.....	.....	.....	.....	
1932	.30	.71	.215	.046	.038	.....	.....	.....	.....	.....	
1933	.23	.76	.185	.047	.044	.....	.....	.....	.....	.....	
1934	.24	.79	.215	.054	.038	44 000	75 500	28.0	43.3	.21, .35*	Do.
1935	.27	.80	.258	.051	.041	43 000	75 000	28.0	40.3	.35*, .21	Do.
1936	.41	.83	.322	.046	.041	48 500	84 000	25.0	34.0	.31*, .19	Do.
1937	.26	.81	.156	.050	.054	38 500	71 000	31.5	49.1	.36*, .27	Do.
1938	.30	.96	.200	.051	.051	44 000	79 500	26.0	37.1	.22, .30*	Do.
1939	.44	.86	.252	.055	.044	51 000	91 000	15.0	16.9	.13, .17*	Fine granular, 85 per cent; silky, 15 per cent.
1940	.44	.93	.274	.053	.047						
	.....	.....	.....	.....	.....	52 500	85 500	18.5	20.5	.20*, .17	Fine granular, 70 per cent; silky, 30 per cent.
1941	.39	.84	.250	.047	.047	45 500	84 000	20.0	24.0	.15, .35*	Fine granular, 85 per cent; silky, 15 per cent.
1942	.38	.83	.280	.047	.045	.....	.....	.....	.....	.....	
1943	.28	.98	.240	.047	.042	.....	.....	.....	.....	.....	
1944	.32	.98	.200	.054	.049	48 500	79 500	15.5	16.9	.14, .17*	Fine granular, 30 per cent; silky, 70 per cent.
	.....	.....	.....	.....	.....	51 000	79 000	11.0	13.2	.10, .12*	Fine granular, 90 per cent; silky, 10 per cent.
1945	.33	.97	.210	.054	.039	46 000	81 000	22.0	30.7	.20, .24*	Silky.
1946	.28	.86	.150	.056	.041	.....	.....	.....	.....	.....	
1947	.33	1.01	.246	.049	.041	.....	.....	.....	.....	.....	
1948	.24	.89	.211	.047	.045	52 500	94 000	21.5	27.4	.26*, .17	Do.
1949	.43	1.06	.356	.051	.042	.....	.....	.....	.....	.....	
1950	.36	1.00	.275	.049	.047	49 000	83 500	24.0	30.7	.20, .28*	Do.
1951	.33	.92	.238	.043	.039	.....	.....	.....	.....	.....	
1952	.37	1.03	.266	.051	.040	51 000	88 000	21.0	27.4	.25*, .17	Do.
1953	.40	1.00	.285	.046	.046	.....	.....	.....	.....	.....	
1954	.31	.94	.242	.051	.048	.....	.....	.....	.....	.....	
1955	.30	1.06	.248	.051	.047	47 500	81 000	24.0	30.7	.28*, .20	Do.
1956	.41	1.00	.245	.051	.047	52 000	106 500	9.0	9.5	.08, .10*	Fine granular.
	.....	.....	.....	.....	.....	54 500	91 500	18.0	27.4	.16, .20*	Silky.
1957	.30	.87	.192	.036	.051	.....	.....	.....	.....	.....	
1958	.29	.95	.200	.057	.048	.....	.....	.....	.....	.....	
1959	.35	.93	.250	.053	.051	.....	.....	.....	.....	.....	

Cast steel from Watertown Arsenal steel plant—Continued.

Heat number.	Chemical composition.					Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Carbon.	Manganese.	Silicon.	Sulphur.	Phosphorus.						
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lb.*	*Lb.*	*P. ct.*	*P. ct.*	*In. In.*	
1960	0.40	0.97	0.376	0.044	0.044	48 000	85 500	21.0	30.7	0.23*, 0.19	Silky, with trace of granulation.
1961	.43	.96	.292	.046	.047	.....	.....	.....	.....	.....	
1962	.44	.98	.224	.045	.046	.....	.....	.....	.....	.....	
1963	.37	1.00	.274	.048	.047	50 000	86 000	22.5	27.4	.28*, .17	Fine granular, 40 per cent; silky, 60 per cent.
1964	.33	.95	.210	.040	.040	.....	.....	.....	.....	.....	
1965	.25	.89	.240	.045	.048	.....	.....	.....	.....	.....	
1966	.31	.90	.375	.047	.046	50 500	86 500	19.5	24.0	.19, .20*	Fine granular, 70 per cent; silky, 30 per cent.
1967	.30	.99	.330	.049	.050	45 500	78 000	13.0	16.9	.13*, .13	Silky, with trace of granulation.
						43 500	74 500	28.5	43.3	.29*, .28	Silky.
1968	.28	.91	.333	.045	.043	44 000	96 000	20.0	27.4	.17, .23*	Fine granular, 90 per cent; silky, 10 per cent.
1969	.25	.97	.214	.046	.050						
1970	.28	.92	.244	.048	.049	40 500	75 000	24.5	30.7	.22, .27*	Silky, 95 per cent; granular, 5 per cent.
1971	.33	.80	.215	.040	.049	40 500	74 000	28.0	40.3	.28*, .28*	Silky.
1972	.37	.84	.245	.044	.040	39 500	79 000	24.0	30.7	.27*, .21	Do.
1973	.36	.79	.255	.041	.044	.....	.....	.....	.....	.....	
1974	.31	.67	.215	.048	.050	41 000	83 000	24.0	30.7	.26*, .22*	Do.
1975	.34	.80	.349	.047	.040						
1976	.29	.72	.245	.040	.040	34 500	72 000	30.0	46.2	.32*, .28	Do.
1977	.38	.80	.250	.050	.048	41 300	79 600	23.5	39.3	.30*, .17	Do.
1978	.30	.75	.225	.045	.053	30 000	65 000	31.5	51.9	.23, .40*	Do.
						37 500	71 000	31.5	51.9	.22, .41*	Do.
1979	.29	.78	.185	.047	.048	31 500	67 500	28.5	49.1	.36*, .21	Do.
						41 000	75 000	31.0	51.9	.40*, .22	Do.
1980	.32	.71	.195	.048	.055	35 000	70 000	30.5	46.2	.22, .39*	Do.
1981	.32	.89	.175	.048	.057						
1982	.31	.72	.185	.047	.057	.....	.....	.....	.....	.....	
1983	.33	.79	.215	.045	.057	33 000	70 000	31.5	46.2	.28, .35*	Do.
						41 500	72 000	29.0	46.2	.23, .35*	Do.
1984	.39	.88	.276	.048	.055	45 500	83 000	21.5	27.4	.21, .22*	Silky, with trace of granulation.
						55 500	88 000	26.5	46.2	.33*, .20	Silky.
1985	.33	.79	.200	.046	.046	32 000	70 500	32.5	43.3	.41*, .24	Silky.
						38 500	74 000	31.0	49.1	.23, .39*	Do.
1986	.35	.75	.200	.043	.049	39 000	73 000	27.0	40.3	.21, .33*	Do.
1987	.36	.77	.220	.049	.050						
1988	.33	.80	.180	.053	.048	34 500	71 500	26.0	34.0	.22, .30*	Do.
1989	.38	.72	.185	.057	.055						
						45 500	77 000	20.0	30.7	.16, .34*	Do.
1990	.35	.74	.215	.054	.050	.....	.....	.....	.....	.....	
1991	.35	.77	.210	.052	.049	50 500	101 500	5.0	.....	.05, .05	Silky; fractured at fillet.
						45 500	80 000	25.0	30.7	.26*, .24	Silky.
1992	.35	.84	.186	.040	.048	34 000	72 500	20.5	30.7	.21*, .20	Silky; with bright spot at center.
						47 000	83 500	19.5	24.0	.20, .19	Silky.
1993	.37	.82	.215	.053	.049	37 000	78 500	22.5	34.0	.27*, .18	Do.
1994	.36	.74	.200	.053	.052	37 500	77 000	26.5	34.0	.32*, .21	Do.
1995	.33	.84	.257	.047	.054						
1996	.36	.84	.262	.057	.049	47 000	93 000	16.0	20.5	.17*, .15	Fine granular.
1997	.39	.87	.285	.057	.046						
1998	.37	.87	.348	.052	.045	48 500	84 000	12.0	16.9	.11, .13*	Silky, 55 per cent; granular, 45 per cent.
	.....	.....	.....	.....	.....	50 000	93 500	18.0	20.5	.19*, .36*	Fine granular, 90 per cent; silky, 10 per cent.
1999	.35	.89	.200	.049	.047	45 000	78 500	20.5	24.0	.21*, .20	Silky.
2000	.40	.88	.211	.047	.055	49 000	87 000	13.5	13.2	.14*, .13	Silky, 20 per cent; granular; 80 per cent.
						45 500	73 000	29.5	43.3	.35*, .24	Fine silky.
2001	.33	.85	.185	.050	.055	40 500	73 500	27.5	46.2	.34*, .21	Silky.

Cast steel from Watertown Arsenal steel plant—Continued.

Heat number.	Chemical composition.					Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Carbon.	Manganese.	Silicon.	Sulphur.	Phosphorus.						
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lb.*	*Lb.*	*P. ct.*	*P. ct.*	*In* *In.*	
2002	0.35	0.90	0.234	0.060	0.050	42 000	79 500	18.0	20.5	0.19*, 0.17	Silky, 15 per cent; granular, 85 per cent.
2003	.34	.85	.227	.050	.049						
2004	.37	.86	.285	.057	.054	50 000	90 000	20.5	27.4	.23*, .18	Silky, with trace of granulation.
2005	.35	.90	.233	.048	.054						
2006	.38	.90	.295	.047	.056	54 000	96 000	15.5	20.5	.15, .16*	Silky, 20 per cent; granular, 80 per cent.
2007	.35	.90	.....	.050	.047	48 500	82 500	13.0	16.9	.14*, .12	Silky, 70 per cent; granular, 30 per cent.
.....	.....	.....	.....	.....	.....	47 000	78 500	24.0	30.7	.26*, .22	Dull silky.
2008	.34	.83	.....	.048	.048	44 500	77 500	25.0	34.0	.30*, .20	Granular, 90 per cent; silky, 10 per cent.
2009	.36	.84	.....	.052	.048						
2010	.34	1.02	.....	.054	.053	48 500	87 000	22.5	27.4	.28*, .17	Silky.
2011	.37	.80	.....	.049	.045						
2012	.35	.88	.....	.052	.047	48 000	91 000	20.5	24.0	.23*, .18	Fine granular, 80 per cent; silky, 20 per cent.
2013	.33	.81	.....	.054	.046						
2014	.34	.79	.....	.049	.047	48 500	89 000	15.5	16.9	.17*, .14	Fine granular, 60 per cent; silky, 40 per cent.
.....	.....	.....	.....	.....	.....	44 500	78 500	25.5	40.3	.18, .33*	Silky.
2015	.36	.97	.....	.050	.044	49,000	98 500	10.5	13.2	.11*, .10	Fine granular, 85 per cent; silky, 15 per cent.
.....	.....	.....	.....	.....	.....	43 500	79 000	23.5	27.4	.22, .25*	Silky.
2016	.37	.80	.....	.047	.050	43 500	83 500	14.0	13.2	.13, .15*	Silky, 15 per cent; granular, 85 per cent.
2017	.36	.95	.....	.047	.045						
.....	.....	.....	.....	.....	.....	46 500	85 500	10.0	13.2	.10*, .10	Fine granular, 80 per cent; silky, 20 per cent.
.....	.....	.....	.....	.....	.....	52 500	88 500	23.0	34.0	.28*, .18	Silky.
2018	.33	.93	.....	.051	.051	40 000	80 000	26.0	37.1	.30*, .22	Do.
2019	.34	.95	.....	.048	.047						
2020	.38	.85	.....	.052	.050	.....	.....	.....	.....	.....	
2021	.35	.98	.....	.055	.045	.....	.....	.....	.....	.....	
2022	.45	.95	.....	.053	.048	79 000	109 500	9.0	9.5	.10*, .08	Fine granular.
.....	.....	.....	.....	.....	.....	54 500	92 500	17.5	24.0	.19*, .16	Fine granular, 80 per cent; silky, 20 per cent.
2023	.37	1.05	.....	.....	.....	.....	.....	.....	.....	.....	
2024	.38	.80	.....	.....	.....	37 000	75 000	24.5	37.1	.18, .31*	Dull silky.
2025	.35	.95	.....	.....	.....						
2026	.38	1.09	.....	.....	.....	44 500	81 500	21.5	27.4	.23*, .20*	Silky, with trace of granulation.
2027	.37	.95	.....	.....	.....						
2028	.39	.85	.....	.....	.....	47 000	86 000	21.0	27.4	.17, .25*	Do.
2029	.35	.85	.....	.....	.....						
2030	.38	.84	.....	.....	.....	43 500	79 000	23.0	30.7	.26*, .20	Do.
2031	.35	.89	.....	.....	.....						
2032	.38	.90	.....	.....	.....	49 000	76 000	9.0	13.2	.07, .11*	Dull silky.
2033	.36	.92	.....	.....	.....	52 000	76 500	24.0	27.4	.25*, .23	Silky.
2034	.38	.86	.....	.....	.....	45 500	86 000	15.5	16.9	.14, .17*	Silky, 40 per cent; granular, 60 per cent.
.....	.....	.....	.....	.....	.....	56 500	102 500	12.5	16.9	.12, .13*	Silky, 10 per cent; granular, 90 per cent.
.....	.....	.....	.....	.....	.....	48 500	80 500	24.0	30.7	.19, .29*	Silky.
2035	.37	.80	.....	.....	.....	43 500	79 500	21.5	27.4	.16, .27*	Do.
2036	.33	.91	.....	.....	.....						
2037	.37	.90	.....	.....	.....	40 000	73 500	26.0	27.4	.24, .28*	Do.
2038	.35	.89	.....	.....	.....	50 000	90 500	14.0	16.9	.11, .17*	Silky, 10 per cent; granular, 90 per cent.
2039	.34	.99	.....	.....	.....						
.....	.....	.....	.....	.....	.....	40 500	74 000	24.0	27.4	.28*, .20	Silky.
2040	.44	.90	.....	.....	.....	41 500	82 500	11.5	13.2	.11, .12*	Granular, with silky spot at circumference.
2041	.35	.87	.....	.....	.....						
.....	.....	.....	.....	.....	.....	47 000	75 000	21.5	24.0	.25*, .18	Silky.

Cast steel from Watertown Arsenal steel plant—Continued.

Heat number.	Chemical composition.					Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Carbon.	Manganese.	Silicon.	Sulphur.	Phosphorus.						
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lb.*	*Lb.*	*P. ct.*	*P. ct.*	*In.* *In.*	
2042	0.39	0.85	.....	.....	.....	43 500	85 500	19.0	27.4	0.13, 0.25*	Silky, 50 per cent; fine granular, 50 per cent.
2043	.37	.90	.....	.....	.....	.....	.....	.....	.....	.....	
2044	.34	.90	.....	.....	.....	31 500	69 000	29.5	40.3	.26, .33*	Silky.
2045	.33	.85	.....	.....	.....						
	.....	.....	.....	.....	.....	45 500	82 000	24.5	37.1	.21, .28*	Silky, with trace of granulation.
2046	.36	.83	.....	.....	.....	34 000	71 100	29.5	39.5	.26*, 33*	Silky.
	.....	.....	.....	.....	.....	40 500	72 500	30.5	46.2	.30*, .31*	Do.
2047	.40	.93	.....	.....	.....	45 500	85 500	10.0	13.2	.08, .12*	Silky, 20 per cent; granular, 80 per cent.
2048	.38	.99	.....	.....	.....						
	.....	.....	.....	.....	.....	37 000	77 000	24.5	34.0	.31*, .18	Silky.
2049	.35	.96	.....	.....	.....	42 500	84 000	17.0	16.9	.18*, .16	Granular, silky spot at circumference.
2050	.40	.93	.....	.....	.....						
	.....	.....	.....	.....	.....	38 500	72 500	28.0	43.3	.33*, .23	Silky.
2051	.41	.93	.....	.....	.....	50 500	82 500	22.0	27.4	.20, .24*	Silky, 40 per cent; granular, 60 per cent.
2052	.36	.90	.....	.....	.....						
2053	.33	.80	.....	.....	.....	35 000	69 000	29.5	40.3	.36*, .23	Silky.
	.....	.....	.....	.....	.....	43 000	82 000	15.0	27.4	.12, .18*	Do.
2054	.39	.84	.....	.....	.....	39 500	73 000	26.0	37.1	.20, .32*	Do.
2055	.37	.86	.....	.....	.....	37 000	73 000	25.0	30.7	.22, .28*	Do.
2056	.38	.91	.....	.....	.....						
2057	.30	.90	.....	.....	.....	38 500	76 000	25.5	34.0	.25*, .26*	Do.
2058	.34	.98	.....	.....	.....						
2059	.33	1.03	.....	.....	.....	40 500	79,000	15.0	20.5	.12, .18*	Granular, 50 per cent; silky, 50 per cent.
2060	.30	.84	.....	.....	.....						
2061	.33	.90	.....	.....	.....	40 800	74 500	14.5	15.3	.15*, .14	Granular.
2062	.35	.80	.....	.....	.....						
	.....	.....	.....	.....	.....	42 000	78 500	14.5	16.9	.14, .15*	Fine granular, 75 per cent; silky, 25 per cent.
2063	.35	1.02	.....	.....	.....	39 000	77 500	23.5	34.0	.27*, .20	Silky.
2064	.35	.98	.....	.....	.....	.....	.....	.....	.....	.....	
2065	.40	.86	.....	.....	.....	.....	.....	.....	.....	.....	
2066	.36	.80	.....	.....	.....	35 000	74 500	26.5	37.1	.32*, .21	Do.
2067	.36	.90	.....	.....	.....						
	.....	.....	.....	.....	.....	39 500	78 000	20.0	27.4	.25*, .15	Do.
2068	.37	.92	.....	.....	.....	39 500	77 000	25.0	37.1	.30*, .20	Do.
2069	.33	.90	.....	.....	.....						
2070	.42	.93	.....	.....	.....	44 000	83 500	18.5	20.5	.20*, .17	Granular; silky spot at circumference.
2071	.39	.98	.....	.....	.....						
	.....	.....	.....	.....	.....	73 500	109 000	12.5	20.5	.17*, .08	Silky, 60 per cent; granular, 40 per cent.
2072	.36	.94	.....	.....	.....	35 000	72 000	25.0	37.1	.29*, .21	Silky.
2073	.36	.89	.....	.....	.....	39 000	56 500	6.0	9.5	.03, .09*	Dull silky, 70 per cent; spongy, 30 per cent.
2074	.39	.86	.....	.....	.....						
	.....	.....	.....	.....	.....	36 000	70 500	28.5	40.3	.23, .34*	Silky.
2075	.38	.80	.....	.....	.....	40 000	74 000	27.5	40.3	.32*, .23	Do.
2076	.32	.81	.....	.....	.....						
2077	.37	.75	.....	.....	.....	38 500	73 500	26.5	37.1	.23, .30*	Do.
2078	.36	.80	.....	.....	.....						
	.....	.....	.....	.....	.....	38 500	73 000	24.5	30.7	.20, .29*	Do.
	.....	.....	.....	.....	.....	41 500	74 500	23.5	34.0	.17, .30*	Do.
	.....	.....	.....	.....	.....	42 000	77 500	24.0	34.0	.18, .30*	Do.
2079	.33	.88	.....	.....	.....	33 000	70 000	26.5	37.1	.22, .31*	Do.
2080	.33	.95	.....	.....	.....						
	.....	.....	.....	.....	.....	40 500	74 000	28.5	43.3	.24, .33*	Do.
2081	.33	.78	.....	.....	.....	33 500	69 500	28.5	37.1	.27, .30*	Do.
	.....	.....	.....	.....	.....	45 000	76 000	24.5	34.0	.20, .29*	Do.
2082	.34	.92	.....	.....	.....	.....	.....	.....	.....	.....	
2083	.35	.88	.....	.....	.....	35 000	74 500	22.0	24.0	.26*, .18	Do.

Cast steel from Watertown Arsenal steel plant—Continued.

Heat number.	Chemical composition.					Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Carbon.	Manganese.	Silicon.	Sulphur.	Phosphorus.						
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lb.*	*Lb.*	*P. ct.*	*P. ct.*	*In* *In.*	
2084	0.40	0.92	.....	.....	.....	42 500	80 500	19.5	24.0	0.15, 0.24*	Silky.
2085	.36	.84	.....	.....	.....						
2086	.34	.85	.....	.....	.....	31 000	68 000	30.0	43.3	.28, .32*	Do.
2087	.35	1.04	.....	.....	.....						
			.....	.....	.....	40 500	75 500	27.0	34.0	.21, .33*	Do.
2088	.34	1.00	.....	.....	.....						
2089	.37	.85	.....	.....	.....	33 500	75 500	25.5	37.1	.28*, .23*	Do.
			.....	.....	.....	45 000	82 500	28.0	40.3	.22, .34*	Do.
2090	.34	.92	.....	.....	.....	30 000	68 000	29.5	43.3	.38*, .21	Do.
2091	.30	.89	.....	.....	.....						
			.....	.....	.....	34 500	71 000	28.0	37.1	.23, .33*	Do.
			.....	.....	.....	46 500	77 000	15.0	20.5	.13, .17*	Dull gray amorphous; with granular patches.
2092	.35	.91	.....	.....	.....	34 500	68 500	25.5	37.1	.24*, .27*	Silky.
			.....	.....	.....	44 000	73 500	25.5	37.1	.28*, .23	Do.
2093	.35	.88	.....	.....	.....	34 500	71 000	28.0	37.1	.23, .33*	Do.
2094	.32	.91	.....	.....	.....						
			.....	.....	.....	50 500	81 500	21.5	27.4	.20, .23*	Do.
2095	.34	.95	.....	.....	.....	34 000	75 500	24.5	34.0	.19, .30*	Do.
2096	.35	.92	.....	.....	.....						
			.....	.....	.....	45 500	80 000	21.5	30.7	.21*, .22*	Dull gray; amorphous.
2097	.39	.94	.....	.....	.....	42 500	80 500	25.0	27.4	.25*, .25*	Silky.
2098	.34	.97	.....	.....	.....						
2099	.34	.94	.....	.....	.....	35 000	72 500	28.0	37.1	.32*, .24	Do.
2100	.35	.91	.....	.....	.....						
2101	.33	.95	.....	.....	.....						
2102	.35	.91	.....	.....	.....						
2103	.37	.85	.....	.....	.....	37 500	79 000	19.5	24.0	.18, .21*	Silky, 40 per cent; granular, 60 per cent.
2104	.34	.94	.....	.....	.....						
2105	.33	.92	.....	.....	.....						
2106	.32	.99	.....	.....	.....	42 000	74 000	17.5	20.5	.20*, .15	Silky.
2107	.35	.84	.....	.....	.....	32 500	72 000	29.0	46.2	.37*, .21	Do.
2108	.30	.95	.....	.....	.....						
			.....	.....	.....	43 500	80 000	18.5	27.4	.17, .20*	Gray amorphous.
2109	.34	.84	.....	.....	.....	32 500	68 500	35.5	40.3	.28, .43*	Silky.
2110	.32	.88	.....	.....	.....						
			.....	.....	.....	42 000	78 500	17.0	27.4	.20*, .17	Do.
2111	.34	.85	.....	.....	.....	35 000	72 000	24.0	27.4	.20, .28*	Do.
2112	.38	.83	.....	.....	.....						
2113	.35	.85	.....	.....	.....						
2114	.36	.82	.....	.....	.....						
2115	.35	.75	.....	.....	.....						
2116	.37	.80	.....	.....	.....	34 500	72 000	31.0	40.3	.38*, .24	Do.
2117	.35	.84	.....	.....	.....						
			.....	.....	.....	45 000	83 000	19.0	24.0	.17, .21*	Do.
2118	.34	.86	.....	.....	.....	38 500	70 500	25.0	40.3	.34*, .16	Do.
2119	.33	.85	.....	.....	.....						
2120	.34	.85	.....	.....	.....	35 000	69 500	26.5	34.0	.32*, .21	Do.
2121	.35	.85	.....	.....	.....						
			.....	.....	.....	32 500	69 000	26.0	34.0	.21, .31*	Do.
			.....	.....	.....	43 000	73 500	22.0	30.7	.18, .26*	Do.
2122	.38	.89	.....	.....	.....	31 500	71 000	27.5	43.3	.35*, .20	Do.
2123	.36	.98	.....	.....	.....						
			.....	.....	.....	44 500	78 500	22.0	24.0	.24*, .20	Do.
2124	.34	.90	.....	.....	.....	45 000	75 000	28.0	43.3	.36*, .20	Do.
2125	.33	.87	.....	.....	.....						
2126	.32	.88	.....	.....	.....	48 000	78 000	21.5	37.1	.30*, .13	Do.
2127	.32	.98	.....	.....	.....						
2128	.32	.75	.....	.....	.....	30 000	68 500	27.0	40.3	.22, .32*	Silky; small silvery spot near center.
2129	.37	.84	.....	.....	.....						
			.....	.....	.....	45 500	79 500	22.5	27.4	.20, .25*	Silky.
2130	.32	.80	.....	.....	.....						
2131	.34	.65	.....	.....	.....	33 000	73 000	27.0	43.3	.19, .35*	Do.
2132	.31	.81	.....	.....	.....						
			.....	.....	.....	45 500	82 500	18.5	24.0	.16, .21*	Silky; with light colored patches.

Cast steel from Watertown Arsenal steel plant—Continued.

Heat number.	Chemical composition.					Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.		Appearance of fracture.
	Carbon.	Manganese.	Silicon.	Sulphur.	Phosphorus.							
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lb.*	*Lb.*	*P. ct.*	*P. ct.*	*In.*	*In.*	
2133	0.31	0.60	.....	.....	.....	34 000	66 000	9.5	16.9	0.08,	0.11*	Granular; sand spot near circumference.
2134	.30	.81	.....	.....	.....							
.....	.....	.....	.....	.....	.....	43 500	75 500	22.5	27.4	.20,	.25*	Dull gray; amorphous.
2135	.30	.65	.....	.....	.....	40,000	70,000	29.0	40.3	.35*,	.23	Silky.
2136	.29	.78	.....	.....	.....							
2137	.31	.62	.....	.....	.....	42 000	70 000	26.0	46.2	.30*,	.22	Do.
2138	.30	.84	.....	.....	.....							
2139	.29	.50	.....	.....	.....	47 000	68 500	29.0	46.2	.33*,	.25	Do.
.....	.....	.....	.....	.....	.....	53 500	76 000	16.0	20.5	.14,	.18*	Dull gray; amorphous.
2140	.....	.....	.....	.....	.....	48 500	76 000	11.0	20.5	.08,	.12*	Amorphous, 40 per cent; lamellar, 60 per cent, with silver spots.
.....	.....	.....	.....	.....	.....	34 000	69 000	30.5	43.3	.33*,	.28*	Silky.
2141	.30	.93	.....	.....	.....	37 500	73 500	25.0	34.0	.31*,	.19	Do.
2142	.30	.83	.....	.....	.....							
2143	.28	.80	.....	.....	.....	36,000	69,500	27.0	46.2	.38*,	.16	Do.
2144	.30	.87	.....	.....	.....							
2145	.28	.94	.....	.....	.....	36 500	71 000	29.0	46.0	.24,	.34*	Do.
2146	.28	.70	.....	.....	.....							
2147	.29	.70	.....	.....	.....	45 500	70 000	30.5	46.2	.24,	.37*	Do.
2148	.29	.70	.....	.....	.....	29 500	61 000	31.5	49.1	.23,	.40*	Do.
.....	.....	.....	.....	.....	.....	31 000	61 000	32.0	49.1	.40*,	.24	Do.
.....	.....	.....	.....	.....	.....	40 500	70 000	28.5	37.1	.24,	.33*	Silky; oblique.
2149	.31	.86	.....	.....	.....	43 000	74 500	27.5	43.3	.23,	.32*	Silky.
2150	.30	.84	.....	.....	.....							
2151	.30	.87	.....	.....	.....	45 500	72 000	20.5	37.1	.07,	.34*	Do.
2152	.29	.92	.....	0.045	0.045	47 500	77 000	23.5	30.7	26*,	.21	Do.
2153	.28	.87	.....	.043	.044							
2154	.28	.75	.....	.055	.048	40 500	74 000	23.5	37.1	.15,	.32*	Do.
2155	.27	.87	.....	.048	.047							
2156	.30	.80	.....	.045	.045	37 500	72 000	27.5	43.3	.35*,	.20	Do.
2157	.33	.93	.....	.048	.048	33 000	71 000	26.5	37.1	.33*,	.20	Silky; with silvery specks.
.....	.....	.....	.....	.....	.....	33 500	70 500	27.0	40.3	.20,	.34*	Silky.
.....	.....	.....	.....	.....	.....	45 500	80 500	15.0	27.4	.18*,	.12	Gray; amorphous.
2158	.33	.76	.....	.045	.045							
2159	.31	.88	.....	.044	.040	40 000	78 500	21.0	27.4	.17,	.25*	Silky.
2160	.30	.90	.....	.044	.044							
2161	.33	.89	.....	.046	.042	36 000	74 500	27.0	43.3	.17,	.37*	Do.
2162	.32	.90	.....	.045	.044							
2163	.31	.85	.....	.045	.045	42 000	79 500	25.5	30.7	.30*,	.21	Do.
2164	.35	.88	.....	.046	.044	45 000	86 000	19.5	20.5	.17,	.22*	Silky, 40 per cent; granular, 60 per cent.
2165	.34	.80	.....	.....	.....	27 500	64 500	33.5	51.9	.22,	.45*	Dull gray; amorphous.
.....	.....	.....	.....	.....	.....	40 500	75 500	30.0	43.3	.33*,	.27	Silky.
2166	.35	.88	.....	.....	.....							
2167	.33	.83	.....	.....	.....	40 500	79 000	24.0	40.3	.33*,	.15	Do.
2168	.33	.83	.....	.....	.....							
2169	.33	1.02	.....	.....	.....	33 500	73 000	29.0	43.3	.34*,	.24	Do.
.....	.....	.....	.....	.....	.....	45 000	83 500	22.0	24.0	.20,	.24*	Do.
2170	.34	.91	.....	.....	.....	41 500	80 000	22.0	37.1	.15,	.29*	Silky; with silvery speck at center.
2171	.30	.97	.....	.....	.....							
2172	.38	.98	.....	.....	.....	43 500	85 500	19.0	24.0	.20*,	.18	Granular, 80 per cent; silky, 20 per cent.
.....	.....	.....	.....	.....	.....	80 500	122 000	10.5	16.9	.08,	.13*	Granular, with silky spot at circumference.
.....	.....	.....	.....	.....	.....	72 000	107 000	11.5	13.2	.13*,	.10	Fine granular, 70 per cent; amorphous, 30 per cent.
.....	.....	.....	.....	.....	.....	42 000	84 000	11.0	13.2	.12*,	.10	Granular.

Cast steel from Watertown Arsenal steel plant—Continued.

Heat number.	Chemical composition.					Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Carbon.	Manganese.	Silicon.	Sulphur.	Phosphorus.						
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lb.*	*Lb.*	*P. ct.*	*P. ct.*	*In.* *In.*	
2172	.....	.....	.....	.....	.....	70 000	103 000	11.5	16.9	0.12*, 0.11	Fine granular, 50 per cent; amorphous, 50 per cent.
	.....	.....	.....	.....	.....	65 000	97 000	9.0	9.5	.09*, .09	Fine granular, 80 per cent; silky, 20 per cent.
	.....	.....	.....	.....	.....	45 000	85 500	25.5	43.3	.28, .23	Silky.
	.....	.....	.....	.....	.....	34 000	73 000	28.0	37.1	.22, .34*	Do.
2173	0.33	0.88	.....	.....	.....	42 000	79 500	16.0	20.5	.18*, .14	Gray; amorphous.
2174	.33	.84	.....	.....	.....	35 000	72 000	32.0	43.3	.30*, .34*	Silky.
2175	.34	.95	.....	.....	.....						
2176	.34	.75	.....	.....	.....	51 000	84 000	18.0	43.3	.27*, .09	Do.
2177	.31	.93	.....	.....	.....						
2178	.31	.71	.....	.....	.....	56 000	83 000	21.0	34.0	.15, .27*	Do.
2179	.31	.83	.....	.....	.....						
2180	.31	.90	.....	.....	.....	31 500	68 000	27.5	49.1	.37*, .18	Do.
	.....	.....	.....	.....	.....	58 000	88 500	23.5	51.9	.31*, .16	Do.
2181	.31	.81	.....	.....	.....	44 500	79 000	28.0	37.1	.32*, .24	Silky; with two light spots.
2182	.30	.75	.....	.....	.....	58 000	77 000	14.5	40.3	.25*, .04	Silky.
2183	.31	.73	.....	.....	.....						
	.....	.....	.....	.....	.....	35 000	72 000	16.5	20.5	.12, .21*	Silky; with silvery specks at circumference.
2184	.32	.72	.....	.....	.....	35 500	75 000	26.5	34.0	.20, .33*	Silky.
2185	.30	.83	.....	.....	.....						
2186	.33	.72	.....	.....	.....	43 500	79 500	24.5	37.1	.27*, .22	Do.
2187	.30	.75	.....	.....	.....						
2188	.30	.76	.....	.....	.....	36 500	71 500	29.0	46.2	.34*, .24	Do.
2189	.31	.72	.....	.....	.....						
2190	.31	.82	.....	.....	.....	44 000	80 500	17.0	20.5	.20,* .14	Do.
2191	.32	.92	.....	.....	.....	37 000	76 500	24.0	34.0	.19, .29*	Silky; with silvery specks at center.
2192	.33	.87	.....	.....	.....	37 500	78 500	23.0	30.7	.18, .28*	Silky.
2193	.32	.93	.....	.....	.....						
2194	.31	.86	.....	.....	.....	42 000	79 000	25.5	34.0	.33*, .18	Do.
2195	.32	.93	.....	.....	.....						
2196	.32	.80	.....	.....	.....	59 500	100 000	9.5	13.2	.11*, .08	Fine granular; silky spot near circumference.
2197	.32	.95	.....	.....	.....						
	.....	.....	.....	.....	.....	42 000	90 500	14.0	16.9	.13, .15*	Fine granular, 85 per cent; silky, 15 per cent.
	.....	.....	.....	.....	.....	49 500	85 000	23.0	34.0	.20, .26*	Silky.
2198	.32	.85	.....	.....	.....	42 000	82 000	25.0	37.1	.22, .28*	Do.
2199	.33	.85	.....	.....	.....						
2200	.33	.93	.....	.....	.....	50 000	95 500	9.0	9.5	.08, .10*	Fine granular; silky spot at circumference.
	.....	.....	.....	.....	.....	44 500	88 500	18.5	20.5	.17, .20*	Fine granular, 70 per cent; silky, 30 per cent.
2201	.32	.90	.....	.....	.....	.....	.....	.....	.....	.....	.....
2202	.32	.83	.....	.....	.....	43 500	83 500	25.5	43.3	.15, .36*	Silky.
2203	.31	.85	.....	.....	.....						
2204	.33	.80	.....	.....	.....	44 500	85 000	23.0	37.1	.25*, .21	Do.
2205	.32	.88	.....	.....	.....						
2206	.33	.84	.....	.....	.....	58 500	87 500	21.0	43.3	.32*, .10	Do.
2207	.33	.91	.....	.....	.....						
2208	.31	.73	.....	.....	.....	41 000	80 000	28.0	46.2	.21, .35*	Do.
2209	.32	.88	.....	.....	.....						
2210	.32	.85	.....	.....	.....	39 000	76 000	27.5	40.3	.33*, .22	Do.
	.....	.....	.....	.....	.....	39 500	75 500	27.5	40.3	.24, .31*	Do.
2211	.33	1.00	.....	.....	.....	36 500	78 000	27.0	49.1	.35*, .19	Do.
2212	.34	.90	.....	.....	.....	56 500	86 000	3.0	5.7	.03, .03	Fine granular.
2213	.35	.99	.....	.....	.....						
	.....	.....	.....	.....	.....	46 500	86 000	5.0	.....	.05, .05	Granular; fractured in threaded end at 3 blowholes.
	.....	.....	.....	.....	.....	48 000	84 000	27.5	43.3	.33*, .22	Silky.

Cast steel from Watertown Arsenal steel plant—Continued.

Heat number.	Chemical composition.					Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Carbon.	Manganese.	Silicon.	Sulphur.	Phosphorus.						
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lb.*	*Lb.*	*P. ct.*	*P. ct.*	*In* *In.*	
2214	0.34	0.90				51 000	97 000	17.5	24.0	0.21*, 0.14	Fine granular, 70 per cent; silky, 30 per cent.
2215	.35	1.05									
2216	.38	.96				45 000	82 500	22.5	37.1	.29*, .16	Silky.
2217	.36	1.04									
2218	.34	.90				50 500	81 000	22.0	30.7	.25*, .19	Do.
2219	.35	.99									
						55 500	83 500	23.5	37.1	.27*, .20	Silky, with light spot.
2220	.33	1.05				47 500	91 000	14.5	16.9	.13, .16*	Granular.
2221	.35	.93				50 500	93 500	18.5	27.4	.17, .20*	Silky.
2222	.35	.95									
2223	.36	.97				48 500	89 000	25.0	46.2	.31*, .19	Do.
2224	.35	.96									
2225	.34	1.08				48 000	89 500	20.0	24.0	.20*, .20*	Silky; with light spot near circumference.
2226	.34	.95									
2227	.36	.90				44 000	87 500	21.0	30.7	.17*, .25*	Silky.
2228	.32	.93									
2229	.33	1.00				38 500	76 500	30.5	46.2	.37*, .24	Do.
2230	.34	.92				63 000	122 500	10.0	13.2	.08, .12*	Granular; silky spot at circumference.
2231	.33	1.01									
						45 500	100 000	18.5	24.0	.15, .22*	Fine granular; silky spot at circumference.
2232	.35	1.03				52 000	88 500	23.0	27.4	.25*, .21*	Silky, oblique.
2233	.34	.90									
2234	.33	.90				42 000	80 000	26.0	37.1	.34*, .18	Silky.
2235	.34	.93									
2236	.33	.95				50 500	95 000	12.5	16.9	.11, .14*	Fine granular; silky spot at circumference.
2237	.33	.92									
2238	.35	.98				43 500	82 500	22.5	30.7	.26*, .19	Silky.
2239	.34	.98				49 500	86 000	24.5	40.3	.17, .32*	Do.
2240	.35	.96									
2241	.33	1.00				43 000	83 500	23.0	37.1	.32*, .14	Do.
2242	.33	.98									
2243	.34	.95				49 500	81 500	25.0	49.1	.14, .36*	Do.
2244	.33	.97									
2245	.35	.98				45 500	84 000	20.5	30.7	.25*, .16	Silky; with trace of granulation.
2246	.33	.98									
						40 000	79 000	23.0	37.0	.25*, .21	Silky.
2247	.32	.99				65 500	101 000	20.0	51.9	.10, .30*	Do.
2248	.33	.98				[1]51 000	115 500	7.5	9.5	.06, .09*	Granular.
2249	.34	.98									
						45 000	111 000	9.0	9.5	.10, .08	Do.
						46 000	82 500	22.5	34.0	.21, .24*	Silky; with trace of granulation.
2250	.34	.97				53 500	96 000	18.0	27.4	.14, .22*	Silky.
2251	.33	.96									
2252	.35	.86				38 500	75 500	28.0	40.3	.30*, .26*	Do.
2253	.33	.92									
2254	.32	.90				46 000	94 500	19.5	27.4	.23*, .16	Silky, oblique.
2255	.31	.95									
2256	.33	.90				35,000	72 000	20.0	24.0	.21,* .19	Gray amorphous.
2257	.35	.98									
2258	.34	1.01				43 500	79 500	25.0	37.1	.23, .27*	Silky; with trace of granulation.
2259	.34	1.03				49 000	87 500	22.5	34.0	.22, .23*	Silky.
2260	.32	1.00									
2261	.33	.94				56 500	96 500	19.0	24.0	.19*, .19	Silky, 40 per cent; granular, 60 per cent
2262	.33	.92									
2263	.34	.92				49 500	87 500	21.5	27.4	.16, .27*	Silky, 60 per cent; granular, 40 per cent.
2264	.32	1.00									
2265	.35	.96				51 500	91 500	18.0	24.0	.15, .21*	Silky, 50 per cent; fine granular, 50 per cent.
2266	.33	.94									

[1] Elastic limit not well defined.

Cast steel from Watertown Arsenal steel plant—Continued.

Heat number.	Chemical composition.					Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Carbon.	Manganese.	Silicon.	Sulphur.	Phosphorus.						
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lb.*	*Lb.*	*P. ct.*	*P. ct.*	*In* *In.*	
2267	0.34	0.97	.....	.....	.....	44 000	82 500	25.5	34.0	0.19, 0.32*	Silky.
2268	.35	.95	.....	.....	.....	40 500	77 000	24.0	34.0	.20, .28*	Do.
2269	.36	.92	.....	.....	.....	47 500	87 500	22.5	34.0	.22*, .23*	Do.
2270	.36	.91	.....	.....	.....						
2271	.33	.94	.....	.....	.....	40 000	82 000	24.5	34.0	.28*, .21	Silky, with trace of granulation.
2272	.37	1.02	.....	.....	.....						
2273	.35	.91	.....	.....	.....	53 500	95 500	16.5	20.5	.18*, .15	Silky.
2274	.38	.99	.....	.....	.....						
2275	.39	.92	.....	.....	.....	55 000	98 500	15.5	20.5	.13, .18*	Granular, 80 per cent; silky, 20 per cent.
2276	.38	1.01	.....	.....	.....						
2277	.35	.95	.....	.....	.....	55 000	92 500	15.5	20.5	.18*, .13	Silky.
2278	.37	.96	.....	.....	.....	48 000	87 000	20.5	30.7	.17, .24*	Do.
2279	.36	.92	.....	.....	.....	45 500	84 000	24.5	40.3	.20, .29*	Do.
2280	.35	.88	.....	.....	.....						
2281	.36	.91	.....	.....	.....	47 000	84 500	27.0	40.3	.30*, .24	Do.
2282	.35	.94	.....	.....	.....						
2283	.35	.86	.....	.....	.....	44 500	80 500	23.5	34.0	.29*, .18	Do.
2284	.34	.88	.....	.....	.....						
2285	.35	.84	.....	.....	.....	40 500	77 000	25.5	37.1	.19, .32*	Silky, oblique.
2286	.36	.91	.....	.....	.....						
2287	.34	.85	.....	.....	.....	36 000	73 500	26.5	37.1	.28*, .25	Silky.
2288	.33	.95	.....	.....	.....	39 000	77 000	23.0	27.4	.18, .28*	Silky, oblique.
2289	.32	1.00	0.245	0.033	0.053	43 000	81 000	28.0	46.2	.28*, .28*	Silky.
2290	.32	.92	.250	.036	.050						
2291	.33	.89	.275	.035	.049	39 500	78 500	26.0	37.1	.23, .29*	Do.
2292	.32	.90	.235	.035	.046						
2293	.32	.90	.156	.038	.049	47 000	87 500	21.0	27.4	.22*, .20	Do.
2294	.32	.89	.280	.036	.045						
2295	.31	.91	.190	.042	.041	32 000	68 500	31.5	46.2	.25, .38*	Do.
2296	.35	1.04	.150	.036	.044						
						40 500	75 500	31.0	49.1	.22, .40*	Do.
2297	.35	.95	.....	.....	.....						
2298	.35	.92	.....	.....	.....	45 500	87 000	25.5	43.3	.18, .33*	Do.
2299	.33	.96	.....	.....	.....						
2300	.32	.93	.....	.....	.....	41 500	87 500	23.0	37.1	.26*, .20	Do.
2301	.32	.95	.....	.....	.....						
2302	.35	.91	.....	.....	.....	47 500	88 500	23.0	37.1	.22, .24*	Do.
2303	.33	.92	.....	.....	.....						
2304	.33	.92	.....	.....	.....	49 500	84 000	21.5	40.5	.11, .32*	Do.
2305	.34	.93	.....	.....	.....						
2306	.33	.94	.....	.....	.....	57 000	94 000	17.0	24.0	.18*, .16	Gray, amorphous.
2307	.32	.92	.....	.....	.....	50 500	84 000	24.5	34.0	.30*, .19	Silky.
2308	.33	1.02	.....	.....	.....	76 000	95 500	18.0	30.7	.23*, .13	Do.
2309	.32	.98	.....	.....	.....						
2310	.34	.89	.....	.....	.....	50 500	90 000	25.0	34.0	.24, .26*	Silky, oblique.
2311	.32	.90	.....	.....	.....						
2312	.32	.90	.....	.....	.....	75 500	101 500	16.0	30.7	.09, .23*	Silky; with trace of granulation.
2313	.34	1.04	.....	.....	.....						
2314	.33	.96	.....	.....	.....	74 000	95 000	13.5	27.4	.09, .18*	Silky.
2315	.32	1.00	.....	.....	.....						
						53 500	92 500	15.0	20.5	.17*, .13	Do.
2316	.33	1.03	.....	.....	.....						
2317	.32	1.01	.....	.....	.....	58 000	94 000	17.5	20.5	.15, .20*	Do.
2318	.34	.95	.....	.....	.....						
2319	.33	.87	.....	.....	.....						
2320	.35	.83	.....	.....	.....	49 500	88 500	21.5	34.0	.21*, .22*	Fine granular, 50 per cent; silky, 50 per cent.
2321	.32	.90	.....	.....	.....						
2322	.32	.86	.....	.....	.....	49 500	94 000	20.0	27.4	.24*, .16	Silky; with trace of granulation.
2323	.34	.81	.....	.....	.....						
2324	.33	.79	.....	.....	.....	52 500	96 000	19.5	30.7	.20*, .19*	Silky, 80 per cent; fine granular, 20 per cent.
2325	.32	1.12	.....	.....	.....						
2326	.33	.85	.....	.....	.....						
2327	.34	1.15	.....	.....	.....	42 000	86 000	16.0	24.0	.19*, .13	Silky.
2328	.34	.95	.....	.....	.....	48 000	87 000	22.0	34.0	.19, .25*	Silky; with trace of granulation.
						45 500	83 000	26.5	37.1	.33*, .20	Silky.

[1] Elastic limit not well defined.

Cast steel from Watertown Arsenal steel plant—Continued.

Heat number.	Chemical composition.					Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Carbon.	Manganese.	Silicon.	Sulphur.	Phosphorus.						
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lb.*	*Lb.*	*P. ct.*	*P. ct.*	*In.* *In.*	
2329	0.34	1.06	.....	.....	.....	53 000	96 500	22.5	34.0	0.28*, 0.27	Fine granular, 40 per cent; silky, 60 per cent.
2330	.35	.95	.....	.....	.....						
2331	.34	.97	.....	.....	.....	50 500	91 500	16.5	27.4	.15, .18*	Silky.
2332	.37	.85	.....	.....	.....						
2333	.36	.82	.....	.....	.....	.....	.....	.....	.....	.....	
2334	.35	.85	.....	.....	.....	49 500	90 000	23.0	37.1	.17, .29*	Silky; with trace of granulation.
2335	.34	.90	.....	.....	.....						
2336	.33	.87	.....	.....	.....	48 000	90 000	23.5	30.1	.29*, .18	Silky.
2337	.36	.96	.....	.....	.....						
2338	.34	.90	.....	.....	.....	43 500	80 500	22.5	30.7	.23*, .22	Silky, 40 per cent; fine granular, 60 per cent.
2339	.35	.96	.....	.....	.....	.....	.....	.....	.....	.....	
2340	.36	1.0	.....	.....	.....	.....	.....	.....	.....	.....	
2341	.34	1.04	.....	.....	.....	52 000	93 000	18.0	24.0	.20*, .16	Silky.
2342	.35	.98	.....	.....	.....						
2343	.36	.97	.....	.....	.....	53 000	94 000	17.5	24.0	.15, .20*	Silky, 40 per cent; fine granular, 60 per cent.
2344	.35	1.02	.....	.....	.....						
2345	.36	1.13	.....	.....	.....	[1]58 000	92 500	16.5	30.7	.23*, .10	Silky.
2346	.34	.90	.....	.....	.....						
2347	.34	.95	.....	.....	.....	53 500	95 000	19.0	30.7	.23*, .15	Do.
2348	.35	1.06	.....	.....	.....						
2349	.36	1.0	.....	.....	.....	44 500	80 000	24.0	34.0	.30*, .18	Do.
2350	.35	1.11	.....	.....	.....	.....	.....	.....	.....	.....	
2351	.35	.75	.....	.....	.....	.....	.....	.....	.....	.....	
2352	.39	.70	.....	.....	.....	67 500	126 000	14.0	9.5	.06, .08*	Fine granular.
2353	.43	.88	.....	.....	.....						
	.....	.....	.....	.....	.....	47 000	105 500	16.0	16.9	.18*, .14	Granular.
	.....	.....	.....	.....	.....	49 500	89 500	21.0	24.0	.17, .25*	Silky, 50 per cent; granular, 50 per cent.
2354	.45	.86	.....	.....	.....	53 000	100 000	12.0	13.2	.13, .11	Fine granular, silky spot at circumference.
2355	.42	.86	.....	.....	.....	46 000	87 500	22.5	34.0	.16, .25*	Silky; with trace of granulation.
2356	.41	.84	.....	.....	.....	55 500	100 500	16.0	20.5	.20*, .12	Fine granular, silky spot at circumference.
2357	.40	.87	.....	.....	.....						
2358	.38	.81	.....	.....	.....	50 500	94 000	18.5	24.0	.15, .22*	Silky, 30 per cent; granular, 70 per cent.
2359	.40	.83	.....	.....	.....						
2360	.41	1.0	.....	.....	.....	49 000	81 500	20.5	27.4	.24*, .17	Silky.
2361	.38	.99	.....	.....	.....	38 500	76 000	26.0	34.0	.35*, .17	Silky, oblique.
2362	.39	.88	.....	.....	.....	50 500	88 500	20.0	27.4	.27*, .13	Do.
2363	.40	1.0	.....	.....	.....						
2364	.39	.83	.....	.....	.....	50 500	92 500	16.5	27.4	.20*, .13	Silky.
2365	.37	.97	.....	.....	.....						
2366	.41	.90	.....	.....	.....	58 000	90 000	21.0	34.0	.23*, .19	Do.
2367	.36	.84	.....	.....	.....						
2368	.35	1.0	.....	.....	.....	49 000	90 500	22.5	34.0	.20, .25*	Silky; with trace of granulation.
2369	.39	1.01	.....	.....	.....	.....	.....	.....	.....	.....	
2370	.37	.96	.....	.....	.....	.....	.....	.....	.....	.....	
2371	.36	.98	.....	.....	.....	63 500	100 500	17.5	24.0	.13, .22*	Silky.
2372	.38	.97	.....	.....	.....						
2373	.35	.80	.....	.....	.....	45 500	85 500	21.0	34.0	.24*, .18	Do.
2374	.35	.84	.....	.....	.....						
2375	.36	.94	.....	.....	.....	61 500	108 500	16.0	20.5	.15, .17*	Fine granular; silky spot at circumference.
2376	.37	1.02	.....	.....	.....						
2377	.37	.91	.....	.....	.....	52 500	97 500	20.0	27.4	.20*, .20*	Silky, 50 per cent; granular, 50 per cent.
2378	.35	.82	.....	.....	.....						
2379	.36	.93	.....	.....	.....	48 500	85 000	18.5	20.5	.17, .20*	Silky.
2380	.36	.92	.....	.....	.....	50 000	92 000	21.0	27.4	.17, .25*	Silky, 30 per cent; granular, 70 per cent.

[1] Elastic limit not well defined.

Cast steel from Watertown Arsenal steel plant—Continued.

Heat number.	Chemical composition.					Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Carbon.	Manganese.	Silicon.	Sulphur.	Phosphorus.						
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lb.*	*Lb.*	*P. ct.*	*P. ct.*	*In.* *In.*	
2381	0.38	0.88	.....	.....	.....	50 500	96 000	20.0	34.0	0.14, 0.26*	Silky; with trace of granulation.
2382	.35	.90	.....	.....	.....						
2383	.35	.86	.....	.....	.....	54 000	96 500	8.0	9.5	.07, .09*	Fine granular.
2384	.36	.90	.....	.....	.....						
2385	.35	.95	.....	.....	.....	49 000	92 500	21.0	30.7	.20, .22*	Silky, 60 per cent; granular, 40 per cent.
2386	.37	.86	.....	.....	.....						
2387	.36	.83	.....	.....	.....	58 000	100 000	14.5	20.5	.12, .17*	Silky.
2388	.36	.89	.....	.....	.....						
.....	.....	.....	.....	.....	.....	54 000	100 000	16.0	20.5	.14, .18*	Fine granular, 85 per cent; silky, 15 per cent.
2389	.35	.88	.....	.....	.....	46 500	83 500	24.0	40.3	.31*, .17	Silky.
2390	.32	1.12	.....	.....	.....	50 000	82 000	24.5	34.0	.27*, .22	Do.
.....	.....	.....	.....	.....	.....	48 000	84 500	23.0	43.3	.33*, .13	Do.
2391	.38	.87	.....	.....	.....	50 500	89 500	21.0	30.7	.16, .26*	Do.
2392	.37	.86	.....	.....	.....						
2393	.32	.89	.....	.....	.....	48 000	84 500	16.5	23.9	.18*, .15*	Gray; amorphous.
2394	.35	.93	.....	.....	.....						
2395	.33	.86	.....	.....	.....	64 500	100 500	16.5	24.0	.14, .19*	Fine granular, 50 per cent; silky, 50 per cent.
2396	.40	1.15	.....	.....	.....						
2397	.40	.91	.....	.....	.....	53 500	94 000	12.5	20.5	.14*, .11	Fine granular, 60 per cent; silky, 40 per cent.
2398	.33	1.0	.....	.....	.....						
2399	.33	.....	.....	.....	.....	47 500	90 500	24.0	34.0	.28*, .20	Silky; trace of granulation.
2400	.36	.87	.....	.....	.....	49 000	90 500	20.5	37.1	.14, .27*	Silky.
2401	.31	.87	.....	.....	.....						
2402	.41	.95	.....	.....	.....	55 500	97 000	19.0	27.4	.23*, .15	Silky, 60 per cent; granular, 40 per cent.
2403	.32	.89	.....	.....	.....						
2404	.37	.88	.....	.....	.....	53 000	99 500	17.0	20.5	.17, .17	Silky, 25 per cent; granular, 75 per cent.
2405	.30	.99	.....	.....	.....						
2406	.31	.90	.....	.....	.....	50 500	96 000	17.0	20.5	.14, .20*	Gray; amorphous.
2407	.40	1.03	.....	.....	.....						
2408	.37	1.11	.....	.....	.....	.....	.....	.....	.....	.....	
2409	.38	1.15	.....	.....	.....	48 000	93 000	20.0	27.4	.26*, .14	Silky.
2410	.38	.88	.....	.....	.....						
2411	.33	.81	.....	.....	.....	48 500	91 000	12.5	20.5	.15*, .10	Gray; amorphous.
2412	.36	.94	.....	.....	.....						
2413	.40	1.06	.....	.....	.....	52 500	97 000	21.5	40.3	.14, .29*	Silky.
2414	.37	.78	.....	.....	.....						
2415	.39	.94	.....	.....	.....	45 500	87 500	14.0	16.9	.17*, .11	Silky; with a streak of granulation across the fracture at center.
2416	.29	.80	.....	.....	.....						
2417	.32	.82	.....	.....	.....	49 000	86 000	11.5	19.3	.14, .09	Silky; with trace of granulation.
.....	.....	.....	.....	.....	.....	44 500	78 000	27.0	43.3	.23, .31*	Silky.
2418	.31	.86	.....	.....	.....	40 500	77 500	25.0	34.0	.26*, .24	Do.
.....	.....	.....	.....	.....	.....	61 500	99 000	24.0	46.2	.33*, .15	Do.
2419	.32	1.06	.....	.....	.....	35 500	81 000	22.5	30.7	.20, .25*	Silky; oblique.
2420	.38	.90	.....	.....	.....	55 000	98 000	16.0	24.0	.20*, .12	Silky; with trace of granulation.
2421	.37	1.0	.....	.....	.....						
2422	.38	.80	.....	.....	.....	39 000	78 000	21.5	27.4	.22*, .21	Silky.
2423	.30	.81	.....	.....	.....						
2424	.33	.76	.....	.....	.....	51 000	81 000	15.0	20.5	.12, .18*	Gray; amorphous.
2425	.34	.86	.....	.....	.....						
2426	.32	.86	.....	.....	.....	44 500	85 000	21.0	27.4	.24*, .18	Gray; amorphous, 60 per cent; granular, 40 per cent.
2427	.34	.87	.....	.....	.....						

STEEL FORGINGS FOR ORDNANCE WORK.

FORGED STEEL FROM WATERTOWN ARSENAL.

Smith Shop.

Marks.	Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.		Appearance of fracture.
	Lb.	*Lb.*	*Per ct.*	*Per ct.*	*In.*	*In.*	
221F	43 500	95 000	20.0	37.1	0.11,	0.29*	Silky.
221F-2	41 000	90 500	23.0	37.1	.34*,	.12	Do.
231F	74 000	113 500	14.0	37.1	.06,	.22*	Do.
237F	51 000	78 500	30.0	62.2	.39*,	.21	Do.
237F-2	60 500	100 500	18.0	43.3	.08,	.28*	Do.
271F	62 500	104 500	22.5	49.1	.23*,	.22*	Do.
271F-2	88 000	114 000	21.0	54.6	.29*,	.13	Do.
271F-3	93 500	129 500	18.0	49.1	.18*,	.18*	Do.
271F-4	119 000	135 500	16.5	46.2	.18*,	.15*	Do.
272F	56 000	79 500	26.5	59.8	.20,	.33*	Do.
272F-2	61 000	86 500	24.5	66.9	.39*,	.10	Do.
272F-3	78 000	99 500	21.5	64.6	.35*,	.08	Do.
292F	72 500	117 000	20.0	40.3	.17,	.23*	Do.
292F-2	118 000	138 500	17.5	51.9	.10,	.25*	Silky; serrated.
293F	64 000	101 500	22.0	51.9	.10,	.34*	Silky.
293F-2	120 500	137 000	17.5	49.1	.28*,	.07	Silky; serrated.
295F	83 000	105 500	20.0	59.8	.26*,	.14	Silky.
295F-2	107 000	129 000	12.0	51.9	.02,	.22*	Do.
295F-3	97 000	113 000	15.5	51.9	.04,	.27*	Do.
295F-4	114 000	131 000	14.0	57.2	.24*,	.04	Do.
296F	73 000	104 500	22.5	49.1	.12,	.33*	Silky; cup shaped.
296F-2	84 000	112 000	21.5	59.8	.33*,	.10	Silky.
297F	71 000	97 000	20.0	57.2	.33*,	.07	Do.
297F-2	150 000	175 000	8.0	27.4	.14*,	.02	Do.
298F	35 000	80 500	30.0	51.9	.38*,	.22	Do.
301F	48 000	93 000	20.0	43.3	.10,	.30*	Do.
304F	53 000	103 500	21.0	40.3	.25*,	.17	Do.
304F-2	51 500	104 500	17.5	37.1	.10,	.25*	Do.
308F	118 000	149 000	9.0	27.4	.14*,	.04	Granular; silky spot at circumference.
308F-2	96 000	129 000	12.5	37.1	.07,	.18*	Silky; in part granular.
308F-3	79 500	113 000	14.0	43.3	.06,	.22*	Silky.
308F-4	83 000	108 000	16.5	46.2	.08,	.25*	Do.
308F-5	72 500	97 500	21.0	54.6	.09,	.33*	Do.
312F	71 000	120 000	21.5	49.1	.14,	.29*	Do.
313F	72 000	125 000	14.5	34.0	.21*,	.08	Granular; silky center.
313F-2	66 000	107 000	21.0	57.2	.09,	.33*	Silky.
321F	78 000	122 500	11.5	23.9	.16*,	.07	Granular; silky center.
321F-2	66 500	106 000	20.0	43.3	.18,	.22*	Silky.
325F	61 000	104 500	23.0	49.1	.14,	.32*	Do.
325F-2	60 000	94 500	28.5	62.2	.38*,	.19	Silky; cup shaped.
325F-3	84 500	109 000	24.5	62.2	.12,	.37*	Silky; cup shaped; serrated.
326F	77 500	107 500	24.5	62.2	.16,	.33*	Silky; cup shaped.
337F	74 000	107 500	22.5	51.9	.22*,	.23*	Silky.
338F	67 000	100 500	25.0	59.8	.15,	.35*	Do.
339F	71 500	105 000	24.0	54.6	.35*,	.13	Do.
340F	66 000	99 000	25.0	62.2	.37*,	.13	Do.
341F	69 000	100 000	25.0	62.2	.36*,	.14	Do.
342F	73 500	105 000	24.0	59.8	.35*,	.13	Do.
343F	65 500	100 000	24.5	49.1	.25*,	.24*	Do.
345F	68 500	133 000	13.5	24.0	.09,	.18*	Silky; with trace of granulation.
345F-2	78 000	140 500	14.0	34.0	.20*,	.08	Silky; opened seam in center.
350F	71 500	104 000	24.5	54.6	.36*,	.13	Silky.
377F	49 000	76 500	33.5	64.6	.41*,	.26	Fine silky.
386F	74 500	121 500	17.5	37.1	.20*,	.15	Silky.
388F	54 500	95 500	21.0	40.3	.30*,	.12	Do.
389F	117 500	136 000	15.0	54.6	.04,	.26*	Do.
389F-2	72 500	101 500	27.0	62.2	.40*,	.14	Do.
390F	56 000	90 500	24.0	57.2	.11,	.37*	Do.
391F	74 000	117 000	20.0	46.2	.21*,	.19	Silky; cup shaped.
392F	48 500	76 500	27.0	64.6	.42*,	.13	Silky.
392F-2	63 000	100 500	19.0	51.9	.30*,	.08	Do.
408F	78 500	118 500	12.5	20.5	.15*,	.10	Fine granular; silky center.
408F-2	63 000	99 500	18.5	40.3	.11,	.26*	Silky.
418F	50 500	67 500	22.0	54.6	.37*,	.07	Do.
418F-2	51 000	84 000	26.0	49.1	.38*,	.14	Do.
418F-3	40 500	83 500	26.0	43.3	.17,	.35*	Do.
418F-4	51 000	84 000	26.5	57.2	.17,	.36*	Do.
501F	35 500	63 000	34.0	54.6	.34*,	.34*	Do.
525F	35 500	64 500	34.5	54.6	.40*,	.29	Do.
557F	49 000	95 500	21.5	37.1	.29*,	.14	Do.
559F	49 000	100 000	17.0	27.4	.24*,	.10	Fine granular, 10 per cent; silky, 90 per cent.
562F	53 000	97 500	21.5	43.3	.12,	.31*	Silky.
563F	46 000	82 500	30.5	59.8	.43*,	.18	Do.

Forged steel from Watertown Arsenal—Continued.

SMITH SHOP—Continued.

Marks.	Elastic limit per sq. in.	Tensile. Strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Lb.	*Lb.*	*Per ct.*	*Per ct.*	*In.* *In.*	
574F	70 000	114 000	20.5	49.1	0.10, 0.31*	Silky.
588F	63 000	110 500	18.0	30.7	.25*, .11	Do.
639F	64 000	95 000	24.5	54.6	.12, .37*	Do.
643F	35 000	71 500	30.5	59.8	.43*, .18	Do.
643F-2	57 000	101 500	18.0	37.1	.11, .25*	Do.
643F-3	53 000	94 000	23.5	49.1	.32*, .15	Do.
647F	88 500	113 000	21.5	59.8	.33*, .10	Do.
647F-2	141 000	159 500	13.0	49.1	.10, .16*	Do.
653F	51 000	92 000	24.0	40.3	.15, .33*	Do.
653F-2	48 000	103 500	16.0	24.0	.21*, .11	Fine granular, 60 per cent; silky, 40 per cent.
653F-3	94 500	147 500	12.0	20.5	.13*, .11	Fine granular; silky center.
653F-4	68 500	116 500	19.5	40.3	.28*, .11	Silky.
655F	51 000	93 000	21.0	43.3	.30*, .12	Do.
655F-2	51 000	109 000	17.0	20.5	.21*, .13	Fine granular; silky center.
655F-3	102 500	156 500	8.5	20.5	.04, .13*	Do.
655F-4	73 000	122 500	17.5	40.3	.28*, .07	Silky.
660F	46 000	102 500	18.5	24.0	.15, .22*	Fine granular, 90 per cent; silky, 10 per cent.
660F-2	74 500	120 500	20.0	40.3	.26*, .14	Silky.
667F	47 500	101 500	21.0	30.7	.23*, .19	Fine granular, 50 per cent; silky, 50 per cent.
704F	36 500	66 000	34.0	57.2	.23, .45*	Silky.
704F-2	100 500	120 000	18.0	54.6	.07, .29*	Fine silky; serrated.
704F-3	66 000	93 000	25.5	59.8	.14, .37*	Silky.
696F	48 500	107 000	16.0	24.0	.18*, .14	Fine granular; silky center.
696F-2	73 500	123 000	19.0	40.3	.24*, .14	Silky.
729F	73 000	108 500	22.5	54.6	.10, .35*	Do.
794F	62 000	87 500	29.5	62.2	.43*, .16	Do.
796F	76 000	113 000	21.5	46.2	.12, .31*	Do.
801F	74 000	121 000	18.5	49.1	.29*, .08	Do.
802F	56 000	94 500	22.5	43.3	.20, .25*	Do.
859F	54 000	88 500	22.0	46.2	.12, .32*	Do.
867F	51 000	95 000	21.5	34.0	.16, .27*	Do.
874F	40 500	68 000	29.0	59.8	.16, .42*	Do.
874F-2	39 500	70 000	33.5	59.8	.46*, .21	Do.
874F-3	41 000	75 000	28.5	59.8	.42*, .15	Do.
874F-4	40 500	68 500	32.0	64.6	.42*, .22	Do.
874F-5	73 500	104 500	18.0	51.9	.08, .28*	Do.
882F	44 500	102 000	16.5	27.4	.22*, .11	Fine granular; silky spot at circumference.
888F	71 500	117 000	21.0	46.2	.16, .26*	Silky.
898F	51 000	87 500	22.0	43.3	.14, .30*	Do.
899F	68 500	117 500	11.5	34.0	.11, .12*	Silky; with trace of granulation.
899F-2	85 500	122 500	18.0	49.1	.10, .26*	Silky.
899F-3	130 500	149 500	14.0	37.1	.10, .18*	Do.
901F	90 000	112 000	13.5	46.2	.03, .24*	Do.
901F-2	130 000	144 500	9.5	30.7	.03, .16*	Silky; seam in stem.
901F-3	121 500	137 500	14.5	49.1	.23*, .06	Silky.
904F	70 000	117 500	19.5	43.3	.13, .26*	Do.
905F	47 500	86 000	24.0	37.1	.19, .29*	Do.
905F-2	55 000	87 500	26.0	57.2	.39*, .13	Silky; cup shaped.
916F	78 500	113 000	19.5	51.9	.29*, .10	Silky.
929F	81 000	115 500	21.0	49.1	.12, .30*	Do.
945F	116 000	135 500	14.5	34.0	.11, .18*	Do.
945F-2	78 000	110 000	21.0	49.1	.11, .31*	Silky; seam in stem.
962F	98 500	123 000	17.5	54.6	.07, .28*	Silky.
963F	115 000	144 000	18.0	43.3	.10, .26*	Do.
966F	51 000	84 500	24.0	51.9	.12, .36*	Do.
967F	45 500	86 000	23.5	49.1	.11, .36*	Fine silky.
967F-2	65 000	96 500	4.5	5.7	.04, .05*	Fine granular; opened seam in stem.
967F-3	65 500	100 500	20.5	46.2	.28*, .13	Fine silky.
972F	50 500	85 500	24.0	57.2	.38*, .10	Do.
972F-2	76 000	119 000	15.5	40.3	.06, .25*	Silky.
972F-3	63 000	111 500	18.0	37.1	.24*, .12	Silky, 60 per cent; fine granular, 40 per cent.
977F	88 500	107 500	21.5	51.9	.33*, .10	Fine silky; serrated.
982F	34 000	65 000	34.0	59.8	.20, .48*	Silky.
982F-2	39 500	64 000	24.5	64.6	.40*, .09	Fine silky.
1018F	46 500	96 000	21.5	37.1	.28*, .15	Silky; interspersed with fine-granular.
1018F-2	76 000	106 500	21.0	54.6	.34*, .08	Silky; serrated.
1018F-3	101 500	130 000	16.5	40.3	.25*, .08	Silky.
1019F	45 000	90 000	23.0	37.1	.31*, .15	Silky; trace of granulation.

Forged steel from Watertown Arsenal—Continued.

SMITH SHOP—Continued.

Marks.	Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Lb.	*Lb.*	*Per ct.*	*Per ct.*	*In.* *In.*	
1020F	88 500	121 000	17.5	49.1	0.08, 0.27*	Silky.
1024F	52 500	103 000	19.0	34.0	.26*, .12	Silky, 50 per cent; fine granular, 50 per cent.
1028F	70 000	99 000	25.0	59.8	.38*, .12	Fine silky, serrated.
1030F	65 000	109 000	20.0	46.2	.30*, .10	Silky.
1030F-2	85 500	118 000	18.5	40.3	.26*, .11	Do.
1038F	48 500	88 500	21.5	46.2	.33*, .10	Do.
1040F	67 500	96 500	22.0	51.9	.09, .35*	Fine silky.
1042F	49 500	84 000	24.0	46.2	.12, .36*	Silky.
1046F	50 000	93 500	23.0	40.3	.16, .30*	Do.
1048F	109 000	127 000	15.0	46.2	.06, .24*	Fine silky; cup shaped.
1048F-2	70 500	104 500	25.0	62.2	.40*, .10	Fine silky.
1052F	68 500	100 000	23.0	40.3	.31*, .15	Do.
1052F-2	76 000	112 000	18.5	27.4	.14, .23*	Silky.
1055F	58 500	120 500	14.5	24.0	.19*, .10	Fine granular, 90 per cent; silky, 10 per cent.
1055F-2	109 500	142 000	11.5	27.4	.10, .13*	Fine granular; silky center.
1055F-3	64 500	123 500	15.0	27.4	.10, .20*	Fine silky.
1058F	60 500	100 500	23.0	43.0	.13, .33*	Silky.
1060F	126 500	146 500	11.5	27.4	.17*, .06	Do.
1060F-2	111 500	131 500	18.5	51.9	.30*, .07	Silky; serrated.
1069F	86 500	128 500	15.5	37.1	.23*, .08	Fine granular; silky center.
1069F-2	98 000	137 000	13.5	27.4	.07, .20*	Do.
1078F	49 500	92 000	23.5	40.3	.19, .28*	Silky.
1103F	48 500	89 500	25.5	43.0	.19, .32*	Do.
1128F	58 000	101 500	17.0	30.7	.24*, .10	Silky, 70 per cent; fine granular, 30 per cent.
1129F	53 000	85 500	27.5	49.1	.18, .37*	Silky.
1151F	94 500	117 500	23.5	57.2	.15, .32*	Silky; serrated.
1152F	55 000	103 500	16.5	34.0	.10, .23*	Silky, 90 per cent; fine granular, 10 per cent.
1285F	49 500	98 500	19.0	34.0	.25*, .13	Silky; trace of granulation.
1286F	45 000	79 500	30.5	54.6	.37*, .24	Silky.
1322F	40 500	78 000	25.0	59.8	.11, .39*	Fine silky.
1322F-2	66 000	101 500	23.0	51.9	.35*, .11	Silky.
1336F	55 500	98 000	18.0	24.0	.12, .24*	Do.
1336F-2	46 000	83 500	24.0	51.9	.11, .37*	Do.
1337F	150 000	164 000	12.0	49.1	.02, .22*	Fine silky.
1337F-2	141 000	152 000	14.0	43.3	.23*, .05	Do.
1338F	129 000	154 500	15.5	57.2	.11, .39*	Do.
1339F	75 500	103 500	23.5	57.2	.35*, .12	Do.
1342F	75 500	108 000	21.0	51.9	.10, .32*	Fine silky; cup shaped.
1345F	79 500	109 000	19.0	57.2	.06, .32*	Fine silky; serrated.
1346F	78 500	106 000	22.5	62.2	.35*, .10	Do.
1347F	83 000	115 000	19.0	27.4	.06, .32*	Silky.
1347F-2	91 500	122 000	6.5	9.5	.05, .08*	Silky; oblique.
1347F-3	83 000	111 500	16.5	34.0	.24*, .09	Do.
1349F	95 000	118 000	20.0	51.9	.30*, .10	Fine silky; serrated.
1352F	60 500	99 000	26.5	57.2	.39*, .14	Fine silky.
1352F-2	110 600	135 600	16.5	50.0	.06, .27*	Fine silky; serrated.
1353F	47 500	85 000	25.0	37.1	.28*, .22	Silky.
1353F-2	47 500	93 500	21.0	34.0	.16, .26*	Silky; trace of granulation.
1355F	55 000	95 000	25.0	54.6	.32*, .18	Silky.
1357F	55 500	93 500	12.0	16.9	.14*, .10	Lamellar, 70 per cent; granular, 30 per cent.
1357F-2	41 500	55 500	2.5	5.7	.01, .04*	Granular.
1357F-3	66 000	108 000	13.5	20.5	.16*, .11	Fine granular; with silky spot at circumference.
1357F-4	70 500	117 500	16.0	30.7	.14, .18*	Fine granular; silky center.
1358F	50 500	100 500	17.5	24.0	.21*, .14	Fine granular, 80 per cent; silky, 20 per cent.
1358F-2	70 500	115 500	16.0	34.0	.22*, .10	Fine granular; silky center.
1359F	68 500	99 500	18.0	27.4	.23*, .13	Lamellar; opened a seam along the stem.
1360F	71 000	111 000	19.0	34.0	.14, .24*	Fine granular; silky center.
1361F	85 000	124 000	16.0	34.0	.13, .19*	Silky.
1362F	138 000	152 500	9.0	16.9	.12*, .06	Do.
1362F-2	119 000	139 500	14.5	43.3	.06, .23*	Silky; serrated.
1363F	127 000	150 000	9.5	24.0	.04, .15*	Silky.
1363F-2	129 000	151 000	12.0	37.1	.04, .20*	Do.
1363F-3	125 000	145 000	13.0	37.1	.20*, .06	Silky; serrated.
1364F	48 000	94 500	21.0	37.1	.27*, .15	Silky.
1365F	116 500	148 500	8.0	16.9	.09*, .07	Fine granular.
1365F-2	75 000	105 000	23.5	59.8	.24*, .23	Silky.
1367F	40 500	82 500	24.0	49.1	.12, .36*	Do.

Forged steel from Watertown Arsenal—Continued.

SMITH SHOP—Continued.

Marks.	Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Lb.	*Lb.*	*Per ct.*	*Per ct.*	*In.* *In.*	
1367F-2	52 000	96 500	23.0	40.3	0.30*, 0.16	Silky.
1384F	43 500	87 500	23.0	30.7	.21, .25*	Do.
1384F-2	54 500	96 500	22.0	37.1	.30*, .14	Do.
1405F	76 000	108 000	22.0	62.2	.34*, .10	Silky; serrated.
1407F	49 500	96 500	18.5	30.7	.10, .27*	Silky, 30 per cent; granular, 70 per cent.
1441F	106 000	132 000	16.0	43.3	.07, .25*	Silky; serrated.
1443F	68 500	91 000	22.5	59.8	.18, .27*	Silky.
1443F-2	76 000	103 500	20.0	43.3	.11, .29*	Do.
1443F-3	58 500	88 000	21.5	57.2	.34*, .09	Fine silky.
1444F	60 000	118 000	21.5	40.3	.30*, .13	Fine granular; silky center.
1445F	53 500	85 000	30.5	54.6	.41*, .20	Silky.
1448F	131 500	153 000	12.5	27.4	.07, .18*	Do.
1463F	45 500	87 500	19.0	49.1	.28*, .10	Do.
1463F-2	45 000	89 500	23.0	34.0	.21, .25*	Do.
1463F-3	52 000	101 500	20.0	37.1	.26*, .14	Silky, 60 per cent; granular, 40 per cent.
1532F	53 500	85 000	23.5	37.1	.24*, .23*	Silky.
1532F-2	76 000	103 500	18.0	54.6	.31*, .05	Silky; cup shaped.
1F	49 500	80 500	26.0	54.6	.39*, .13	Silky.
1F-2	49 000	84 500	27.5	49.1	.32*, .23	Do.
1F-3	50 500	87 000	27.5	54.6	.17, .38*	Do.
1F-4	65 500	99 500	23.0	59.8	.11, .35*	Do.
69F	49 500	100 500	17.5	37.1	.27*, .08	Do.
78F	105 000	142 000	11.5	27.4	.05, .18*	Fine granular; silky center.
78F-2	108 500	145 000	12.5	27.4	.18*, .07	Silky, 60 per cent; granular, 40 per cent.
78F-3	89 500	132 000	12.5	30.7	.07, .18*	Fine granular; silky center.
78F-4	116 000	152 500	5.0	9.5	.04, .06*	Fine granular; silky spot at circumference.
78F-5	96 500	137 000	11.5	20.5	.15*, .08	Fine granular; silky spot near center.
78F-6	99 500	141 500	9.0	20.5	.14*, .04	Do.
79F	48 500	71 000	30.0	51.9	.40*, .20	Silky.
80F	41 500	75 500	31.5	54.6	.26, .37*	Do.
115F	109 000	138 500	14.5	43.3	.05, .24*	Do.
115F-2	82 500	110 000	21.0	59.8	.09, .33*	Fine silky; cup shaped.
117F	47 500	89 500	26.0	51.9	.40*, .12	Silky.
117F-2	74 000	110 500	19.5	43.3	.26*, .13	Do.
126F	45 500	80 000	31.5	57.2	.25, .38*	Do.
128F	48 500	96 500	17.5	37.1	.26*, .09	Do.
177F	45 500	92 500	21.0	40.3	.10, .32*	Do.
201F	44 500	86 000	17.0	43.3	.08, .26*	Do.
201F-2	50 500	90 500	22.0	37.1	.31*, .13	Gray; amorphous.
206F	57 500	84 500	29.5	62.2	.23, .36*	Silky; cup shaped.
8514F	56 800	101 100	22.0	46.7	.23*, .21*	Silky.
8515F-3	61 500	106 500	24.0	49.1	.32*, .16	Do.
8518F-3	68 000	107 500	22.0	49.1	.22*, .22*	Do.
8516F	55 500	99 000	23.0	49.1	.25*, .21*	Do.
8520F	54 500	104 500	20.0	43.3	.30*, .10	Do.
8521F	58 000	110 500	21.5	43.3	.29*, .14	Do.
8757F	56 000	103 000	23.0	49.1	.13, .33*	Do.
8758F	58 000	105 500	24.0	54.6	.36*, .12	Do.
8522F-3	56 500	98 500	24.0	54.6	.14, .34*	Do.
8523F-3	56 000	101 500	21.5	46.2	.12, .31*	Do.
8524F-3	64 500	107 500	21.5	46.2	.30*, .13	Do.
2321	82 500	105 000	23.5	59.8	.36*, .11	Do.
2321	71 000	96 500	25.5	64.6	.12, .39*	Do.

Forged steel from Watertown Arsenal—Continued.

Smith Shop.

EXPERIMENTAL TESTS.

Marks.	Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Lb.	*Lb.*	*Per ct.*	*Per ct.*	*In.* *In.*	
A123	91 500	121 500	19.0	46.2	.19*, .19*	Fine silky.
A123–2	91 000	118 500	18.5	51.9	.09, .28*	Silky.
A123–3	104 000	129 000	14.0	40.3	.17*, .11	Do.
A123–4	125 000	134 500	19.5	57.2	.30*, .09	Silky; serrated.
A123–5	75 000	108 500	25.5	57.2	.30*, .21	Fine silky; cup shaped.
A123–6	83 500	110 500	21.5	57.2	.19, .24*	Fine silky.
A123–7	80 500	109 500	21.5	54.6	.22* .21*	Do.
A123–8	110 500	129 500	20.0	57.2	.09 .31*	Silky; serrated.
A123–9	70 500	113 500	19.5	40.3	.29*, .10	Fine silky.
A123–10	116 500	135 000	17.5	51.9	.06, .29*	Silky; serrated.
A123–11	76 000	107 000	25.0	59.8	.18, .32*	Fine silky.
A123–12	65 000	106 500	23.0	49.1	.15, .31*	Do.
A123–13	75 500	105 000	22.5	62.2	.08, .37*	Fine silky; cup shaped.
A123–14	79 000	108 500	23.0	59.8	.33*, .13	Do.
A123–15	72 500	111 000	25.0	51.9	.28*, .22*	Do.
A123–16	80 500	110 000	22.0	57.2	.12, .32*	Fine silky.
A123–17	78 500	110 000	22.5	54.6	.35*, .10	Silky; serrated.
A123–18	80 000	110 500	22.0	54.6	.32*, .12	Silky.
A123–19	75 000	106 000	21.0	59.8	.36*, .06	Do.
A123–20	83 000	106 500	20.0	51.9	.24*, .16	Do.
A123–21	79 000	109 000	22.0	59.8	.10, .34*	Silky; serrated.
A123–22	79 500	109 000	22.0	57.2	.10, .34*	Do.
A123–23	67 500	111 500	18.5	37.1	.15, .22*	Silky, 80 per cent; fine granular, 20 per cent.
A123–24	66 000	105 000	22.0	43.0	.21*, .23*	Silky.
A123–A	96 000	121 500	24.0	51.9	.30*, .18	Silky; serrated.
A123–A	71 000	116 000	18.5	37.1	.25*, .12	Fine silky.
A123–A–2	89 000	118 500	18.0	49.1	.27*, .09	Silky.
A123–A–3	106 500	135 500	12.0	37.1	.12*, .12	Silky; cup shaped.
A123–B	75 500	109 500	21.0	49.1	.32*, .10	Fine silky.
A123–C	72 000	104 500	23.5	51.9	.33*, .14	Do.
F. S. 1	50 500	73 500	26.5	51.9	.17, .36*	Silky.
F. S. 2	50 500	73 500	27.0	54.6	.40*, .14	Do.
F. S. 3	56 500	75 000	28.5	54.6	.18, .39*	Do.
F. S. 1	65 500	98 000	22.5	40.3	.16, .29*	Do.
F. S. 2	67 000	98 000	23.5	43.3	.16, .31*	Do.
F. S. 3	69 000	99 000	23.5	43.3	.14, .33*	Do.
F. S. 1	81 000	110 500	20.5	57.2	.08, .33*	Do.
F. S. 2	76 000	107 000	21.5	57.2	.10, .33*	Silky; cup shaped.
F. S. 3	77 000	108 000	20.5	57.2	.09, .32*	Do.
Gun steel	54 000	107 500	17.0	27.4	.14, .20*	Silky, 90 per cent; granular, 10 per cent.
967A	59 500	90 500	26.0	59.8	.12, .40*	Fine silky; cup shaped.
967B	55 500	110 500	17.5	34.0	.14, .21*	Silky, 70 per cent; granular, 30 per cent.
929A	67 000	88 500	26.0	46.2	.28*, .24	Fine silky.
929B	65 000	86 000	28.5	51.9	.35*, .22	Do.
A	67 500	99 000	25.5	49.1	.21, .30*	Silky.
B	30 000	59 500	17.5	27.4	.13, .22*	Silky; opened oblique checks along the stem.
A–2	113 500	137 000	13.5	43.3	.23*, .04	Silky.

Forged steel from Watertown Arsenal—Continued.

SMITH SHOP—Continued.

EXPERIMENTAL TESTS FOR STUDENT OFFICERS.

Marks.	Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Lb.	*Lb.*	*Per ct.*	*Per ct.*	*In.* *In.*	
1732 FRA-1	54 000	95 000	26.0	49.1	.35*, .17	Silky.
1732 FRAA-1	51 000	95 500	24.5	46.2	.29*, .20	Do.
1732 FLB-1	53 500	98 000	19.5	43.3	.30*, .09	Do.
1732 FLBB-1	53 500	96 500	25.0	49.1	.16, .34*	Do.
1732 FRAA-2	55 500	90 500	25.0	43.3	.17, .33*	Do.
1732 FLBB-2	56 000	93 000	23.5	46.2	.15, .32*	Do.
1732 FRAA-3	52 000	95 000	21.5	46.2	.12, .31*	Do.
1732 FLBB-3	54 000	98 000	22.0	46.2	.32*, .12	Do.
1732 FRA-2	46 000	88 000	24.0	37.1	.31*, .17	Do.
1732 FLB-2	47 000	91 000	22.0	40.3	.14, .30*	Do.
1732 FRA-3	49 500	87 500	25.0	49.1	.16, .36*	Do.
1732 FRAA-4	56 000	89 500	25.0	49.1	.36*, .16	Do.
1732 FLB-3	49 500	88 500	22.0	46.2	.13, .31*	Do.
1732 FLBB-4	59 000	91 500	24.5	49.1	.14, .35*	Do.
1733 FLA-1	64 000	99 000	21.5	43.3	.31*, .12	Do.
1733 FRA-1	71 500	98 500	25.0	49.1	.15, .35*	Do.
1733 FLB-1	58 500	98 000	22.0	46.2	.32*, .12	Do.
1733 FRB-1	56 500	99 500	22.5	47.4	.22*, .23*	Do.
1733 FLC-1	57 500	98 000	20.5	43.3	.31*, .10	Do.
1733 FRC-1	54 000	101 500	20.0	40.3	.20*, .20*	Do.
1733 FRD-1	54 100	98 700	21.0	47.4	.30*, .12	Do.
1733 FLD-1	55 000	101 000	20.5	43.3	.11, .30*	Do.
1733 FLA-2	50 500	92 000	22.5	40.3	.14, .31*	Do.
1733 FRA-2	50 500	92 500	26.5	40.3	.19, .34*	Do.
1733 FLB-2	52 000	91 500	23.5	37.1	.24*, .23*	Do.
1733 FRB-2	54 500	92 000	24.5	40.3	.31*, .18	Do.
1733 FLC-2	54 000	91 000	23.5	43.3	.30*, .17	Do.
1733 FRC-2	54 500	94 000	22.5	37.1	.15, .30*	Do.
1733 FLD-2	53 500	93 500	24.0	43.3	.20, .28*	Do.
1733 FRD-2	51 000	91 500	25.0	43.3	30*, 20	Do
1733 FLA-3	60 500	97 000	25 0	46.2	.35*, .15	Do.
1733 FRA-3	56 000	94 000	25.0	49.1	.31*, .19	Do.
1733 FLB-3	58 900	96 300	23.5	47.4	.15, .32*	Do.
1733 FRB-3	56 000	97 500	24.5	46.2	.15, .34*	Do.
1733 FLC-3	60 500	99 000	25.0	43.3	.34*, .16	Do.
1733 FRC-3	60 500	96 500	24.5	46.2	.35*, .14	Do.
1733 FLD-3	59 500	96 500	24.0	46.2	.35*, .13	Do.
1733 FRD-3	55 000	96 500	27.5	46.2	.35*, .20	Do.
1733 FLA-4	71 000	111 000	19.5	46.2	.28*, .11	Silky; flaw in specimen.
1733 FRA-4	74 000	116 000	19.5	43.3	.13, .26*	Silky.
1733 FLB-4	76 000	115 500	20.0	46.2	.10, .30*	Do.
1733 FRB-4	76 000	113 500	19.5	46.2	.10, .29*	Do.
1733 FLC-4	76 500	119 000	17.0	37.1	.08, .26*	Do.
1733 FRC-4	73 500	115 500	19.5	46.2	.09, .30*	Do.
1733 FLD-4	74 500	118 500	18.0	34.0	.18*, .18	Do.
1733 FRD-4	76 500	119 000	17.0	37.1	.08, .26*	Do.
1733 FLD-5	81 000	119 500	17.5	43.3	.24*, .11	Do.
1733 FRD-5	87 500	127 500	13.5	34.0	.06, .21*	Do.
1733 FLA-6	77 200	114 600	15.0	51.0	.05, .25*	Do.
1733 FRA-6	76 400	112 300	18.0	54.4	.28*, .08	Do.
1733 FLB-6	72 000	109 400	20.0	53.3	.10, .30*	Do.
1733 FRB-6	92 400	131 400	12.0	39.9	.19*, .05	Silky, 90 per cent; granular, 10 per cent.
1733 FLC-6	80 400	121 800	13.0	43.7	.04, .22*	Silky.
1733 FRC-6	90 000	127 400	12.0	19.8	.09, .15*	Fine granular 90 per cent; silky, 10 per cent.
1733 FLD-6	78 800	121 800	16.0	47.4	.22*, .10	Silky.
1733 FRD-6	90 000	125 000	15.0	39.9	.23*, .07	Do.
1733 FRA-7	76 400	108 300	21.0	51.0	.27*, .15	Do.
1733 FRB-7	78 000	119 500	17.5	40.3	.26*, .09	Do.
1733 FRC-7	79 500	115 500	19.0	46.2	.29*, .09	Do.
1733 FRD-7	75 000	115 500	18.0	43.3	.22*, .14	Do.
1733 FLA-7	73 500	109 500	20.0	49.1	.10, .30*	Do.
1733 FLB-7	69 500	105 000	23.0	49.1	.33*, .13	Silky; cup shaped.
1733 FLC-7	73 200	113 100	21.5	47.4	.27*, .16	Silky.
1733 FLD-7	81 500	121 000	17.5	40.3	.26*, .09	Do.
1733 FRA-8	54 500	85 000	28.5	57.2	.18, .39*	Do.
1733 FRB-8	55 500	86 000	28.5	54.6	.28*, .29*	Do.
1733 FRC-8	60 500	90 500	26.0	59.8	.14, .38*	Do.
1733 FRD-8	56 000	88 500	28.0	51.9	.18, .38*	Do.
1733 FLA-8	57 000	91 500	28.0	62.2	.20, .36*	Do.
1733 FLB-8	56 000	87 500	24.5	54.6	.12, .37*	Do.

Forged steel from Watertown Arsenal—Continued.

Smith Shop—Continued.

EXPERIMENTAL TESTS FOR STUDENT OFFICERS—Continued.

Marks.	Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Lb.	*Lb.*	*Per ct.*	*Per ct.*	*In.* *In.*	
1733 FLC-8	56 000	86 500	27.5	54.6	.39*, .16	Silky.
1733 FLD-8	56 000	87 500	29.5	57.2	.41*, .18	Do.
1733 FRA-9	55 000	84 500	29 5	62.2	.17, .42*	Do.
1733 FRB-9	56 000	82 500	30.5	59.8	.24, .37*	Silky; cup shaped.
1733 FRC-9	55 000	83 000	30,0	59.8	.32*, .28	Silky.
1733 FRD-9	53 000	90 500	26.0	49.1	.33*, .19	Do.
1733 FLA-9	56 000	88 500	23.5	49.1	.13, .34*	Silky; cup shaped.
1733 FLB-9	56 000	90 500	26.0	51.9	.37*, .15	Silky.
1733 FLC-9	54 500	84 500	29.0	57.2	.40*, .18	Do.
1733 FLD-9	56 000	85 000	29.0	54.6	.40*, .18	Do.
1733 FCA	64 000	99 500	23.0	43.3	.13, .33*	Do.
1733 FCB	59 000	97 500	24.0	46.2	.15, .35*	Do.
1733 FWC	61 000	97 500	24.5	49.1	.34*, .15	Do.
1733 FWD	61 000	97 000	23.0	51.9	.34*, .12	Do.
1733 FCA-1	54 000	85 000	26.0	46.2	.29*, .23*	Do.
1733 FCB-1	55 000	84 500	26.0	46.2	.29*, .23*	Do.
1733 FWC-1	54 500	84 500	26.0	46.2	.18, .34*	Do.
1733 FWD-1	52 500	86 000	26.5	43.3	.20, .33*	Do.
1733 FCA-2	79 500	124 500	13.5	27.4	.07, .20*	Fine silky.
1733 FCB-2	90 000	135 500	7.5	20.5	.02, .13*	Fine granular; silky center.
1733 FWC-2	80 000	115 000	21.0	51.9	.26*, .16	Silky.
1733 FWD-2	85 500	116 500	18.5	51.9	.09, .28*	Do.
1733 FCA-3	113 000	133 000	16.0	49.1	.27*, .05	Do.
1733 FCB-3	88 500	117 000	15.5	51.9	.03, .28*	Do.
1733 FWC-3	113 500	132 000	16.0	51.9	.05, .27*	Silky; serrated.
1733 FWD-3	105 000	128 500	15.0	43.0	.06, .24*	Silky.
1733 FCA-4	84 200	124 500	16.0	45.4	.07, .25*	Do.
1733 FCB-4	82 100	125 500	15.5	42.3	.06, .25*	Do.
1733 FWD-4	121 900	143 900	11.0	29.6	.05, .17*	Silky; with trace of granulation.
1733 FCA-5	62 500	90 500	29.5	57.2	.37*, .22	Fine silky; cup shaped.
1733 FCB-5	65 000	92 500	30.0	62.2	.18, .42*	Fine silky.
1733 FWC-5	65 000	93 000	28.5	62.2	.39*, .18	Do.
1733 FWD-5	74 000	100 500	25.5	62.2	.37*, .14	Fine silky; cup shaped.

BRONZE FOR ORDNANCE WORK.

BRONZE FROM WATERTOWN ARSENAL FOUNDRY.

Marks.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Lb.	*Per cent.*	*Per cent.*	*In.* *In.*	
299	71 000	22.5	34.0	.15, .30*	Light yellow.
300	70 500	23.0	40.3	.33*, .13	Light yellow; oblique.
1320	57 500	8.0	9.5	.07, .09*	Light yellow.
1325	56 000	6.0	9.5	.07*, .05	Do.
1327	56 000	9.5	13.2	.09, .10*	Light yellow and lavender.
1335	60 500	23.5	27.4	.22, .25*	Light yellow.
1345	52 000	9.5	16.9	.11*, .08	Light yellow and lavender.
1355	58 000	13.5	20.5	.15*, .12	Do.
1359	58 500	15.0	20.5	.16*, .14	Do.
1381	55 000	8.5	16.9	.10*, .07	Do.
1384	58 500	12.5	16.9	.12*, .13*	Do.
1388	57 500	16.5	16.9	.15, .18*	Do.
1392	57 000	13.5	20.5	.14*, .13	Do.
1396	62 500	17.5	20.5	.20*, .15	Light yellow; oblique.
1472	62 000	20.5	24.0	.22*, .19	Light yellow.
1542	69 000	36.5	34.0	.34, .39*	Light yellow; oblique.
1543	67 500	36.5	34.0	.34, .39*	Light yellow and lavender; oblique.
1572	58 000	16.0	20.5	.15, .17*	Light yellow and lavender.
1658	65 500	36.5	40.3	.32, .41*	Light yellow and lavender; oblique.
1659	65 500	39.5	37.1	.41*, .38	Light yellow; slight lavender; oblique.
1681	62 700	12.0	30.7	.10, .14*	Light yellow and lavender.
1697	59 700	23.0	27.4	.25*, .21	Do.
1785	57 500	14.0	30.7	.13, .15*	Light yellow.
1822	56 000	13.0	16.9	.11, .15*	Light yellow and lavender.
1897	67 500	40.0	37.1	.36, .44*	Light yellow; oblique.
1915	66 000	40.0	40.3	.40*, .40	Light yellow.
1933	59 500	26.5	24.0	.27*, .26	Lavender.
1944	62 000	22.0	20.5	.22, .22*	Light yellow.
1996	67 000	38.0	34.0	.36*, .40	Do.
2016	67 500	42.5	40.3	.50*, .35	Light yellow; oblique.
2036	54 500	16.0	16.9	.19*, .13	Lemon, lavender, and yellow.
2047	63 000	17.0	13.2	.20*, .14	Light yellow and lavender.
2054	68 000	38.0	34.0	.41*, .35	Light yellow; oblique.
2074	67 500	41.0	34.0	.41*, .41	Light yellow.
2104	66 500	26.5	27.4	.25, .28*	Do.
2108	65 500	44.0	37.1	.44*, .44	Light yellow; oblique.
2136	66 500	42.5	40.3	.40, .45*	Do.
2162	67 500	34.0	30.7	.32, .36*	Do.
2166	69 500	41.0	37.1	.41*, .41*	Do.
2190	67 000	40.0	40.3	.40*, .40*	Light yellow.
2222	65 000	22.0	24.0	.23*, .21	Do.
2226	68 500	39.5	37.1	.43*, .36	Light yellow; oblique.
2250	68 500	35.0	30.7	.33, .37*	Light yellow.
2304	70 000	25.5	24.0	.25, .26*	Do.
2330	66 000	44.0	46.2	.51*, .37	Do.
2346	62 000	19.5	24.0	.21*, .18	Light yellow and lavender.
2374	68 000	41.0	37.1	.41*, .41*	Light yellow; oblique.
2383	65 500	26.0	27.4	.23, .29*	Light yellow.
2399	69 000	40.0	37.1	.36, .44*	Do.
2410	65 500	19.0	24.0	.18*, .20	Light yellow and lavender.
2437	64 500	21.0	24.0	.19, .23*	Light yellow.
2443	69 500	24.5	24.0	.23, .26*	Do.
2473	68 000	34.5	30.7	.34*, .35*	Do.
2479	65 500	29.0	27.4	.30*, .28	Do.
2509	67 500	31.5	37.1	.37*, .26	Do.
2517	57 500	12.5	13.2	.14*, .11	Do.
2538	66 000	37.0	30.7	.39*, .35	Do.
2545	59 000	19.0	20.5	.19*, .19*	Do.
2567	67 000	38.5	33.0	.38*, .39*	Light yellow; oblique.
2575	59 500	12.5	16.9	.11, .14*	Light yellow.
2596	67 000	38.0	40.3	.38*, .38*	Do.
2601	68 500	31.5	30.7	.31*, .32*	Do.
2610	62 500	22.5	20.5	.22*, .23*	Do.
2686	64 000	21.5	20.5	.21*, .22*	Do.
2708	65 800	40.0	42.3	.37, .43*	Light yellow; oblique.
2712	64 000	28.5	27.4	.28*, .29*	Light yellow.
2724	64 000	29.0	30.7	.29*, .29*	Do.
2812	69 000	33.0	34.0	.33*, .33*	Do.
2816	64 500	32.5	30.7	.30, .35*	Do.
2820	66 000	40.5	40.3	.36, .45*	Light yellow; oblique.
2830	66 000	29.0	34.0	.29*, .29*	Do.
2839	64 500	24.0	30.7	.26*, .22	Light yellow.
2843	66 500	37.0	34.0	.38*, .36	Do.
2846	64 500	23.0	27.4	.25*, .21	Do.
2850	68 000	36.0	37.1	.36*, .36*	Do.
2854	67 500	35.0	37.1	.40*, .30	Do.
2858	67 500	35.0	34.0	.35*, .35*	Do.

Bronze from Watertown Arsenal foundry—Continued.

Marks.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Lb.	*Per cent.*	*Per cent.*	*In.* *In.*	
2861	60 500	33.0	34.0	.33*, .33*	Light yellow.
2875	66 000	40.0	40.3	.40*, .40*	Do.
2882	61 000	27.0	34.0	.24, .30*	Do.
2904	65 500	27.0	30.7	.24, .30*	Do.
2907	60 000	31.5	30.7	.29, .34*	Do.
2960	61 500	41.5	40.3	.46*, .37	Do.
2995	66 000	24.0	27.4	.22, .26*	Do.
3000	56 500	11.0	13.2	.08, .14*	Light yellow and lavender.
3019	69 000	32.0	30.7	.34*, .30	Light yellow.
3024	55 500	7.5	9.5	.06, .09*	Light yellow and lavender.
3040	62 500	44.0	46.2	.50*, .38	Light yellow.
3043	62 000	8.5	9.5	.10*, .07	Do.
3057	62 500	14.5	24.0	.17*, .12	Light yellow and lavender.
3071	70 000	35.0	37.1	.36*, .34	Light yellow.
3074	66 500	33.0	30.7	.31, .35*	Light yellow; oblique.
3077	64 000	22.0	24.0	.23*, .21	Light yellow.
3091	64 500	41.0	40.3	.40*, .42*	Do.
3094	56 000	13.5	24.0	.12, .15*	Do.
3122	67 000	43.0	46.2	.39, .47*	Do.
3125	68 000	35.0	37.1	.40*, .30	Do.
3128	64 500	38.5	37.1	.41*, .36	Do.
3132	67 500	33.5	34.0	.30, .37*	Do.
3136	60 500	11.5	16.9	.13*, .10	Do.
3156	66 000	35.0	37.1	.32, .38*	Do.
3174	58 500	18.0	27.4	.22*, .14	Light yellow and lavender.
3186	60 500	20.5	27.4	.17, .24*	Do.
3206	68 500	26.5	30.7	.24, .29*	Light yellow.
3210	63 000	13.5	16.9	.12, .15*	Light yellow and lavender.
3234	70 000	35.5	34.0	.37*, .34*	Light yellow.
3240	63 000	19.0	27.4	.21*, .19	Do.
3262	61 000	10.0	16.9	.09, .11*	Do.
3291	67 500	23.5	27.4	.25*, .22	Do.
3295	62 500	11.5	16.9	.13*, .10	Do.
3320	67 000	33.0	34.0	.35*, .31	Do.
3325	64 500	26.5	30.7	.27*, .26*	Do.
3339	65 000	27.0	27.4	.26, .28*	Do.
3361	69 000	35.5	34.0	.35*, .36*	Do.
3366	65 000	24.5	27.4	.27*, .22	Do.
3371	69 500	27.5	27.4	.30*, .25	Do.
3373	69 000	33.0	30.7	.31, .35*	Do.
3391	68 000	31.0	27.4	.29, .33*	Do.
3395	52 500	7.5	16.9	.05, .10*	Light yellow, 90 per cent; lavender, 10 per cent.
3410	63 000	14.5	13.2	.13, .16*	Light yellow.
3418	62 500	13.5	16.9	.12, .15*	Do.
3428	56 000	11.0	20.5	.13*, .09	Light yellow and lavender.
3429	57 500	12.5	16.9	.11, .14*	Do.
3446	52 500	5.0	5.7	.04, .06*	Do.
3455	63 000	18.0	16.9	.20*, .16	Light yellow; oblique.
3521	57 000	14.0	24.0	.11, .17*	Light yellow and lavender.
3566	56 000	6.0	9.5	.08*, .04	Light yellow.
3637	59 000	11.0	16.9	.12*, .10	Light yellow and lavender.
3665	59 000	14.0	20.5	.15*, .13	Light yellow and lemon.
3670	58 000	13.5	9.5	.15*, .12	Light yellow and lavender.
3690	58 500	8.5	13.2	.09*, .08	Do.
3756	59 500	9.5	13.2	.10*, .09	Light yellow.
3822	59 500	10.0	13.2	.11*, .09	Do.
3840	69 000	30.5	34.0	.35*, .26	Do.
3847	56 000	10.5	13.2	.10, .11	Light yellow and lavender.
3865	57 000	14.5	20.5	.14*, .15*	Do.
3881	59 500	10.5	9.5	.12*, .09	Do.
3886	57 500	14.0	13.2	.15*, .13	Light yellow.
3906	57 500	9.0	13.2	.07, .11*	Do.
3922	65 000	11.0	13.2	.12*, .10	Do.
3926	59 500	13.0	16.9	.15*, .11	Light yellow and lavender.
3952	57 500	11.5	16.9	.12*, .11	Do.
3968	58 500	10.0	13.2	.12*, .08	Light yellow, coarse granular.
3975	61 000	14.0	16.9	.16*, .12	Do.
4000	57 500	11.5	16.9	.10, .13*	Light yellow and lavender.
4016	59 000	14.0	16.9	.12, .16*	Do.
4021	61 000	16.0	24.0	.20*, .12	Light yellow.
4039	62 000	17.5	24.0	.19*, .16	Light yellow and lavender.
4061	61 000	13.5	13.2	.15*, .12	Do.
4066	62 500	16.0	20.5	.15, .17*	Do.
4088	60 500	11.5	13.2	.13*, .10	Do.
4106	60 500	10.0	13.2	.09, .11*	Light yellow.
4111	62 500	21.0	24.6	.19, .23*	Do.

Bronze from Watertown Arsenal foundry—Continued.

Marks.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.		Appearance of fracture.
	Lb.	*Per cent.*	*Per cent.*	*In.*	*In.*	
4129	58 000	9.5	16.9	.07,	.12*	Light yellow and lavender.
4147	59 000	8.5	9.5	.11*,	.06	Light yellow.
4151	66 000	24.5	24.0	.23,	.26*	Do.
4170	58 000	13.5	16.9	.11,	.16*	Light yellow and lavender.
4189	57 500	10.5	9.5	.09,	.12*	Light yellow.
4193	64 000	23.0	24.0	.20,	.26*	Light yellow and lavender.
4222	60 000	16.5	16.9	.18*,	.15	Light yellow; oblique.
4250	65 500	21.5	20.5	.23*,	.20	Do.
4262	59 500	14.0	16.9	.12,	.16*	Light yellow and lavender.
4271	66 000	23.0	20.5	.25*,	.21	Light yellow and lemon.
4277	60 500	15.0	24.0	.15,	.15	Light yellow and lavender.
4288	66 500	40.5	40.3	.36,	.45*	Light yellow; oblique.
4295	66 500	38.5	57.1	.37*,	.40*	Light yellow.
4300	62 500	16.5	24.0	.14,	.19*	Do.
4331	66 500	25.5	30.7	.23,	.28*	Light yellow and lemon.
4357	60 500	20.5	30.7	.20,	.25*	Light yellow.
4398	66 500	41.5	43.3	.41*,	.42*	Do.
4413	66 000	42.0	57.1	.42*,	.42*	Light yellow; oblique.
4416	66 000	39.5	34.0	.41*,	.38*	Do.
4421	66 000	29.0	30.7	.26,	.32*	Light yellow.
4422	69 000	35.0	34.0	.37*,	.33	Do.
4423	66 000	25.5	30.7	.23,	.28*	Do.
4433	64 000	31.0	34.0	.29,	.33*	Do.
4492	68 000	35.0	57.1	.39*,	.31	Do.
4501	64 000	27.0	30.7	.25,	.29*	Do.
4534	65 000	25.5	27.4	.28*,	.23	Do.
4537	67 500	21.0	24.0	.22*,	.20	Do.
4563	67 500	43.0	49.1	.50*,	.36	Light yellow; oblique.
4568	67 000	42.0	43.3	.42*,	.42*	Light yellow.
4581	68 000	20.0	27.4	.19,	.21*	Do.
4601	70 000	30.0	30.7	.28,	.32*	Do.
4606	64 500	23.0	20.5	.23*,	.23*	Do.
4607	61 500	19.0	27.4	.22*,	.16	Do.
4611	68 500	31.5	30.7	.29,	.34*	Do.
4614	60 000	14.5	20.5	.12,	.17*	Light yellow and lavender.
4626	61 000	21.0	27.4	.22*,	.20	Light yellow.
4629	61 000	17.5	20.5	.19*,	.16	Do.
4641	67 000	39.0	37.1	.38,	.40*	Do.
4644	62 500	16.0	20.5	.17*,	.15	Do.
4661	51 500	10.0	20.5	.09,	.11*	Light yellow and lavender.
4667	60 500	16.5	24.0	.14,	.19*	Do.
4682	58 500	13.0	20.5	.11,	.15*	Light yellow.
4688	65 500	23.0	27.4	.20,	.26*	Do.
4703	60 500	10.5	16.9	.09,	.12*	Do.
4711	60 500	17.5	24.0	.15,	.20*	Do.
4723	65 500	17.5	27.4	.19*,	.16	Do.
4738	62 500	18.0	30.7	.17*,	.09	Do.
4746	61 000	11.5	20.5	.10,	.13*	Do.
4762	54 600	11.0	22.4	.09,	.13*	Do.
4767	60 500	22.5	30.7	.21,	.24*	Do.
4787	58 200	16.0	26.0	.18*,	.14	Do.
4793	56 000	10.0	20.5	.09,	.11*	Do.
4807	64 000	19.0	27.4	.20*,	.18	Do.
4813	60 000	11.5	20.5	.14*,	.09	Do.
4830	59 000	17.5	20.5	.15,	.20*	Do.
4836	54 000	10.5	13.2	.12*,	.09	Light yellow and lavender.
4850	58 500	14.5	16.9	.12,	.17*	Light yellow.
4860	61 500	18.0	20.5	.17,	.19*	Do.
4867	58 000	11.0	16.9	.09,	.13*	Do.
4876	60 000	18.0	16.9	.17,	.19*	Light yellow and lavender.
4887	61 500	24.0	27.4	.22,	.26*	Light yellow.
4912	61 500	26.0	24.0	.26*,	.26*	Do.
4924	62 500	22.5	20.5	.25*,	.20	Do.
4933	62 500	8.5	16.9	.10*,	.07	Do.
4938	57 500	9.5	13.2	.08,	.11*	Do.
4941	62 500	16.0	20.5	.16*,	.16*	Do.
4962	61 500	19.0	20.5	.17,	.21*	Do.
4950	57 500	20.5	20.5	.17,	.24*	Light yellow and lavender.
4975	60 500	19.5	20.5	.17,	.22*	Light yellow.
4983	60 500	23.5	24.0	.21,	.26*	Do.
4995	57 100	11.0	18.8	.10,	.12*	Do.
5007	57 500	14.0	16.9	.15*,	.13	Light yellow and lavender.
5024	59 000	14.0	16.9	.12,	.16*	Light yellow.
5038	56 500	13.0	16.9	.14*,	.12	Do.
5048	58 500	16.0	20.5	15,	.17*	Do.
5055	63 000	14.0	16.9	13,	.15*	Do.
5062	61 000	13.0	16.9	11,	.15*	Do.

Bronze from Watertown Arsenal foundry—Continued.

Marks.	Tensile strentgh per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Lb.	*Per cent.*	*Per cent.*	*In.* *In.*	
5071	58 500	13.5	16.9	.11, .16*	Light yellow.
5081	58 000	11.0	16.9	.12*, .10*	Do.
5084	50 500	4.5	13.2	.06*, .03	Do.
					Light yellow; dark spot at circumference.
5089	57 000	11.0	16.9	.13*, .09	Light yellow.
5091	59 000	15.0	16.9	.16*, .14	Do.
5095	57 500	11.5	16.9	.13*, .10	Do.
5097	57 500	11.5	16.9	.14*, .09	Do.
5100	63 500	18.5	20.5	.19*, .18	Do.
5110	62 500	24.0	27.4	.26*, .22	Light yellow and lavender.
5116	62 000	11.0	16.9	.12*, .10	Do.
5119	54 000	9.5	16.9	.07, .12*	Do.
5137	58 000	16.0	16.9	.16, .16*	Do.
5142	64 500	25.0	24.0	.26*, .24	Do.
5153	60 500	18.5	20.5	.18, .19*	Do.
5158	62 000	24.5	27.4	.22, .27*	Do.
5171	65 500	13.0	16.9	.13*, .13	Do.
5187	64 000	23.5	24.0	.25*, .22	Do.
5195	45 500	17.5	20.5	.19*, .16	Do.
5196	49 500	10.0	9.5	.08, .12*	Lavender and lemon yellow.
5202	65 000	39.5	34.0	.40*, .39	Light yellow.
5216	61 500	24.5	27.4	.23, .26*	Do.
5240	58 500	16.0	20.5	.18*, .14	Light yellow; dark spot near circumference.
5245	62 500	17.0	20.5	.15, .19*	Light yellow.
5248	65 500	16.5	16.9	.16, .17*	Do.
5279	59 500	19.5	20.5	.18, .21*	Do.
5306	60 500	21.0	24.0	.23*, .19	Do.
5317	60 000	24.0	27.4	.22, .26*	Do.
5348	64 500	21.5	24.0	.21, .22*	Do.
5358	60 500	17.0	20.5	.15, .19*	Do.
5388	55 500	11.0	16.9	.12*, .10	Do
5396	62 500	25.0	24.0	.25*, .25*	Do.
5406	60 500	28.0	24.0	.26, .30*	Do.
5419	62 000	26.0	27.4	.26*, .26	Do.
5428	59 500	33.0	30.7	.36*, .30	Do.
5443	60 500	30.5	30.7	.29, .32*	Do.
5474	61 500	31.5	30.7	.36*, .27	Do.
5478	57 000	16.0	20.5	.15, .17*	Do.
5482	64 000	18.0	20.5	.17, .19*	Do.
5502	64 500	23.0	24.0	.25*, .21	Do.
5518	65 500	16.5	20.5	.17*, .16	Do.
5536	69 000	24.5	24.0	.25*, .24	Do.
5538	60 500	29.0	27.4	.31*, .27	Do.
5546	66 000	16.0	16.9	.14, .18*	Do.
5561	63 000	11.5	16.9	.10, .13*	Do.
5573	65 500	22.0	20.5	.23*, .21	Do.
5585	62 000	19.0	24.0	.21*, .17	Do.
5597	64 500	18.5	20.5	.17, .20*	Do.
5617	64 000	20.0	24.0	.20*, .20*	Do.
5625	62 500	15.0	20.5	.17*, .13	Do.
5631	55 000	10.0	9.5	.09, .11*	Light yellow; dark spot near circumference.
5640	65 000	23.0	24.0	.22*, .24*	Light yellow.
5646	62 000	21.5	24.0	.24*, .19	Do.
5654	65 000	24.5	24.0	.23, .26*	Do.
5680	60 500	23.0	20.5	.21, .25*	Do.
5685	60 000	21.0	20.5	.19, .23*	Do.
5698	65 000	20.0	20.5	.19, .21*	Do.
5706	60 500	17.0	20.5	.19*, .15	Do.
5710	61 500	14.0	20.5	.14*, .14*	Do.
5724	60 500	14.0	16.9	.15*, .13	Do.
5730	58 500	14.5	20.5	.15*, .14	Do.
5734	59 000	14.0	16.9	.16*, .12	Do.
5738	61 000	21.5	20.5	.21, .22*	Do.
5742	62 000	17.5	20.5	.18*, .17	Do.
5746	62 500	13.0	16.9	.12, .14*	Do.
5750	62 000	11.5	16.9	.11, .12	Do.
5760	63 000	12.5	16.9	.14*, .11	Do.
5570	62 000	21.0	24.0	.19, .23*	Do.
5776	60 500	23.0	24.0	.21, .25*	Do.
5783	63 000	25.0	24.0	.23, .27*	Do.
5790	63 000	18.5	20.5	.19*, .18	Do.
5796	64 500	26.0	24.0	.23, .29*	Do.
5801	59 500	13.5	16.9	.15*, .12	Light yellow and lavender.
5806	63 000	28.5	27.4	.31*, .26	Light yellow.
5811	60 000	10.0	9.5	.12*, .08	Light yellow and lavender.

Bronze from Watertown Arsenal foundry—Continued.

Marks.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Lb.	*Per cent.*	*Per cent.*	*In.* *In.*	
5821	60 500	11.5	13.2	.11, .12*	Light yellow.
5826	56 000	10.5	13.2	.11*, .10 .21*, .18	Light yellow; dark spot at circumference.
5831	61 000	19.5	20.5		Light yellow.
5839	62 500	22.5	24.0	.21, .24*	Do.
5846	62 500	18.5	20.5	.20*, .17	Do.
5851	61 500	10.0	13.2	.08, .12*	Do.
5856	59 500	8.5	9.5	.07, .10*	Do.
5864	57 500	15.0	20.5	.13, .17*	Do.
5869	65 000	14.0	16.9	.12, .16*	Do.
5876	59 500	11.0	13.2	.11, .11*	Do.
5881	64 500	20.5	24.0	.21*, .20	Do.
5886	59 000	18.5	24.0	.20*, .17	Light yellow and lavender.
5893	60 500	26.5	27.4	.28*, .25	Light yellow.
5899	67 000	20.0	20.5	.21*, .19	Do.
5904	63 000	18.5	20.5	.20*, .17	Do.
5909	62 500	11.0	13.2	.09, .12*	Do.
5914	62 500	20.0	24.0	.22*, .18	Do.
5923	62 000	27.0	30.7	.25, .29*	Do.
5928	61 000	19.0	20.5	.17, .21*	Do.
5933	62 500	25.0	24.0	.26*, .24	Do.
5948	57 500	17.0	20.5	.19*, .15	Do.
5952	60 500	23.5	27.4	.26*, .21	Do.
5957	60 500	19.0	20.5	.17, .21*	Do.
5962	59 500	20.5	24.0	.21*, .20*	Do.
5966	54 000	10.5	16.9	.09, .12*	Light yellow; dark spot at circumference.
5974	64 000	16.5	16.9	.18*, .15	Light yellow.
5979	64 500	25.0	24.0	.27*, .23	Do.
5985	64 000	16.0	16.9	.18*, .14	Do.
5990	65 000	14.5	16.9	.14, .15*	Do.
5995	63 000	22.0	24.0	.23*, .21	Do.
6003	63 000	16.5	20.5	.15, .18*	Do.
6008	65 500	17.0	20.5	.16, .18*	Do.
6015	66 000	16.5	20.5	.18*, .15	Do.
6023	43 000	4.0	5.7	.05*, .03	Lavender.
6023–2	34 500	3.0	1.8	.02, .04*	Light yellow and lavender.
6029	51 500	7.0	13.2	.06, .08*	Light yellow; dark spot at circumference.
6033	65 000	19.5	20.5	.20*, .19*	Light yellow.
6037	60 500	18.5	24.0	.16, .21*	Light yellow and lavender.
6041	62 500	24.0	24.0	.23, .25*	Light yellow.
6047	58 000	6.0	5.7	.05, .07*	Do.
6071	60 000	9.5	9.5	.09, .10*	Do.
6093	61 500	13.0	16.9	.12, .14*	Do.
6111	60 500	18.5	24.0	.20*, .17	Light yellow and lavender.
6141	64 000	25.0	24.0	.27*, .23	Light yellow.
6163	58 500	17.5	24.0	.16, .19*	Do.
6179	67 000	11.5	13.2	.13*, .10	Do.
6205	61 000	18.5	20.5	.17, .20*	Do.
6235	65 500	21.0	20.5	.20, .22*	Do.
6243	45 500	6.0	9.5	.08*, .04	Do.
6271	65 500	37.5	37.1	.36*, .39*	Do.
6307	63 000	18.5	20.5	.20*, .17	Do.
6341	41 500	7.5	9.5	.10*, .05	Light yellow and lemon yellow.
6341–2	44 000	7.0	13.2	.09*, .05	Do.
6367	59 000	11.5	20.5	.10, .13*	Light yellow.
6395	61 000	16.5	20.5	.15, .18*	Light yellow and lavender.
6415	43 000	6.0	9.5	.04, .08*	Light yellow and lemon yellow.
6415–2	43 000	7.0	9.5	.08*, .06	Light yellow.
6441	58 500	13.0	20.5	.12, .14*	Light yellow and lavender.
6470	59 000	14.0	20.5	.12, .16*	Do.
6490	53 000	6.0	9.5	.05, .07*	Light Yellow
6516	60 000	14.0	16.9	.15*, .13	Light yellow and lavender.
6562	60 500	11.0	20.5	.12*, .10	Light yellow.
6584	64 000	16.0	16.9	.14, .18*	Do.
6618	60 500	12.0	13.2	.13*, .11	Do.
6638	62 500	18.0	20.5	.15, .21*	Do.
6680	59 000	14.0	16.9	.10, .18*	Do.
6702	60 500	14.5	20.5	.15*, .14	Do.
6732	59 000	12.5	16.9	.10, .15*	Do.
6756	60 000	7.5	13.2	.09*, .06	Do.
6784	59 500	7.0	13.2	.08*, .06	Do.
6810	57 000	13.0	16.9	.10, .16*	Do.
6834	60 500	14.0	16.9	.13, .15*	Do.
6908	61 500	16.0	16.9	.18*, .14	Do.
6936	65 500	12.5	13.2	.10, .15*	Do.
6976	50 500	3.0	9.5	.04*, .02	Do.

Bronze from Watertown Arsenal foundry—Continued.

Marks.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Lb.	*Per cent.*	*Per cent.*	*In.* *In.*	
7024	39 000	5.0	9.5	.07*, .03	Light yellow and golden yellow.
7024–2	47 500	8.5	13.2	.10*, .07	Light yellow and lemon yellow.
7048	64 000	12.5	16.9	.14*, .11	Light yellow.
7084	59 000	12.0	16.9	.12*, .12*	Do.
7110	62 500	17.5	20.5	.19*, .16	Do.
7148	61 000	19.0	20.5	.20*, .18	Do.
7172	62 000	23.5	30.7	.25*, .22	Do.
7202	64 500	19.5	20.5	.21*, .18	Do.
7228	54 500	5.0	13.2	.04, .06*	Do.
7260	61 000	7.5	13.2	.09*, .06	Do.
7284	64 500	43.0	51.9	.38, .48*	Uniform light yellow.
7290	60 000	9.5	13.2	.11*, .08	Light yellow.
7320	60 500	16.0	20.5	.16*, .16*	Do.
7345	61 500	14.0	16.9	.12, .16*	Do.
7371	58 500	11.0	16.9	.09, .13*	Do.
7397	58 500	13.5	20.5	.11, .16*	Do.
7425	60 500	18.0	24.0	.19*, .17	Do.
7449	59 000	17.0	24.0	.20*, .14	Do.
7461	64 500	13.0	16.9	.11, .15*	Do.
7490	60 000	13.0	16.9	.14*, .12	Do.
7511	62 500	17.5	20.5	.15, .20*	Do.
7539	62 000	15.0	16.9	.16*, .14	Do.
7563	54 500	10.0	16.9	.08, .12*	Do.
7591	60 500	15.0	20.5	.14, .16*	Do.
7617	64 500	19.5	20.5	.18, .21*	Do.
7645	60 500	19.0	24.0	.21*, .17	Do.
7671	61 000	11.5	16.9	.11, .12*	Do.
7700	59 000	15.5	20.5	.17*, .14	Light yellow and lavender.
7722	48 000	6.5	13.2	.06, .07*	Light yellow and lavender, with silvery-gray metal at circumference.
7753	59 000	23.0	24.0	.27*, .19	Light yellow.
7777	61 500	22.5	24.0	.25*, .20	Do.
7782	59 500	17.0	20.5	.15, .19*	Do.
7812	58 500	15.5	20.5	.18*, .13	Light yellow and lavender.
7838	58 000	18.0	27.4	.15, .21*	Light yellow.
7868	59 500	15.0	16.9	.16*, .14	Do.
7895	45 500	5.0	9.5	.06*, .04	Do.
7931	60 000	18.0	20.5	.20*, .16	Do.
7958	61 500	17.5	24.0	.19*, .16	Do.
7984	62 000	16.0	20.5	.15, .17*	Do.
8020	62 000	8.5	16.9	.07, .10*	Do.
8051	62 500	18.0	24.0	.17, .19*	Do.
8076	65 000	39.0	40.3	.39*, .39*	Uniform light yellow; oblique.
8088	59 500	12.0	16.9	.10, .14*	Light yellow.
8116	62 500	13.5	20.5	.16*, .11	Do.
8140	62 000	19.5	24.0	.18, .21*	Do.
8170	61 500	22.0	24.0	.25*, .19	Do.
8194	64 500	10.5	9.5	.11*, .10	Do.
8222	62 500	18.0	24.0	.18*, .18*	Do.
8250	61 500	18.5	24.0	.21*, .16	Light yellow and lavender.
8269	57 500	16.0	20.5	.14, .18*	Light yellow.
8287	64 500	20.5	20.5	.19, .22*	Do.
8304	60 800	22.5	21.8	.20, .25*	Do.
8324	60 200	26.0	23.9	.27*, .25	Do.
8330	60 400	24.0	23.0	.22, .26*	Do.
8345	61 200	14.0	16.3	.11, .17*	Do.
8367	61 400	26.0	25.2	.23, .29*	Do.
8373	64 400	11.0	11.6	.10, .12*	Do.
8388	64 000	19.0	18.6	.20*, .18*	Do.
8410	62 000	18.0	20.8	.16, .20*	Do.
8416	62 600	13.0	14.0	.12, .14*	Do.
8430	63 400	26.0	25.2	.25, .27*	Do.
8451	59 800	32.5	29.5	.30, .35*	Do.
8477	64 400	25.0	25.2	.27*, .23	Do.
8487	62 200	13.5	16.3	.12, .15*	Do.
8517	58 400	13.0	16.3	.10, .16*	Light yellow and lavender.
8546	53 800	9.5	11.6	.07, .12*	Light yellow.
8580	63 000	15.0	14.0	.17*, .13	Do.
8610	60 400	15.0	14.0	.18*, .12	Do.
8646	63 000	15.5	11.6	.16, .15	Do.
8678	62 000	24.0	23.0	.21, .27*	Do.
8688	61 800	22.5	18.6	.23, .22	Do.
8711	60 600	22.0	27.4	.23*, .21	Lavendar and light yellow.
8730	62 400	38.0	33.6	.36, .40*	Uniform light yellow; oblique.
8744	62 800	31.0	25.2	.28, .34*	Light yellow.
8765	62 600	43.5	37.7	.45*, .42	Uniform light yellow; oblique.
8769	56 800	15.5	18.6	.13, .18*	Light yellow.
8788	62 000	26.0	25.2	.29*, .23	Do.

Bronze from Watertown Arsenal foundry—Continued.

Marks.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Lb.	*Per cent.*	*Per cent.*	*In.* *In.*	
8821	64 200	23.5	23.0	.21, .26*	Light yellow; oblique.
8851	61 000	23.5	23.0	.25*, .22	Light yellow.
8873	62 400	24.5	23.0	.25*, .24	Do.
8910	64 200	41.0	39.6	.41*, .41*	Light yellow; uniform.
8912	62 200	28.0	35.7	.27, .29*	Light yellow.
8938	60 600	16.0	20.8	.13, .19*	Do.
8985	61 000	26.5	25.2	.28*, .25	Do.
9009	61 000	16.0	16.3	.15, .17*	Do.
9041	60 200	21.0	20.8	.23*, .19	Do.
9079	60 600	22.0	23.0	.20, .24*	Do.
9097	63 000	17.5	16.3	.20*, .15	Do.
9127	60 000	15.0	18.6	.18*, .12	Do.
9154	61 000	15.0	11.0	.16, .14	Do.
9164	60 800	18.5	20.8	.21*, .16	Do.
9170	65 000	40.0	37.7	.41*, .39*	Light yellow; uniform; oblique.
9174	64 800	26.0	29.5	.25*, .27*	Light yellow.
9203	64 200	15.0	16.3	.16*, .14*	Do.
9232	58 200	7.5	9.3	.06, .09*	Do.
9262	57 000	12.0	11.6	.11, .13*	Do.
9293	61 600	9.5	11.6	.10*, .09	Do.
9321	61 000	14.0	14.0	.14*, .14*	Do.
9359	64 000	40.0	37.7	.40*, .40*	Light yellow; uniform.
9363	63 200	15.0	16.3	.13, .17*	Light yellow.
9385	58 800	10.5	11.6	.09, .12*	Do.
9413	44 600	10.5	9.3	.13*, .08	Light yellow and lemon yellow.
9443	60 800	17.5	14.0	.18, .17	Light yellow.
9473	61 000	16.0	18.6	.19*, .13	Do.
9499	58 000	11.5	11.6	.10, .13*	Light yellow and lavender.
9529	61 000	20.0	20.8	.22*, .18	Do.
9567	54 000	16.5	18.6	.14, .19*	Light yellow.
9599	48 000	11.5	11.6	.14*, .09	Light yellow and lemon yellow.
9641	60 400	16.5	16.3	.15, .18*	Light yellow.
9671	60 600	23.0	25.2	.23*, .23*	Light yellow and lavendar.
9713	66 200	15.5	11.6	.16, .15	Light yellow.
9745	61 400	16.5	18.6	.17*, .16*	Do.
9785	64 600	12.5	14.0	.11, .14*	Do.
9809	64 600	27.0	25.2	.26, .28*	Do.
9835	64 200	22.0	23.0	.22*, .22	Do.
9857	63 800	24.0	20.8	.27*, .21	Do.
9881	61 000	19.5	18.6	.22*, .17	Light yellow and lavender.
9890	60 800	22.0	20.8	.24*, .20	Light yellow.
9924	57 600	10.5	11.6	.10, .11*	Do.
9954	63 600	11.0	11.6	.10, .12*	Do.
9975	63 600	38.0	35.7	.35, .41*	Light yellow; uniform.
9977	63 800	13.0	14.0	.14*, .12	Light yellow.
10007	60 000	20.0	18.6	.21*, .19	Do.
10017	60 000	28.0	27.4	.30, .26	Do.
10030	62 800	21.5	23.0	.20, .23*	Light yellow and lavender.
10060	61 200	22.5	23.0	.22, .23*	Light yellow.
10071	50 000	11.0	11.6	.13*, .09	Light yellow and lemon yellow.
10077	62 600	21.5	20.8	.22, .21	Light yellow.
10081	61 400	12.5	14.0	.15*, .10	Do.
10085	54 400	6.0	6.9	.05, .07	Do.
10107	63 600	12.5	14.0	.11, .14*	Do.
10122	61 000	19.5	6.9	.17, .22*	Do.
10136	56 400	7.5	6.9	.09*, .06	Do.
10158	61 000	24.5	23.0	.25*, .24*	Do.
10166	64 600	26.0	25.2	.26*, .26*	Do.
10182	63 200	21.5	23.0	.23*, .20	Do.
10198	64 000	23.0	23.0	.20, .26*	Do.
10215	63 000	16.0	18.6	.14, .18*	Do.
10234	66 800	19.0	16.3	.19, .19*	Do.
10248	64 400	18.5	18.6	.17, .20*	Do.
10268	60 400	15.5	18.6	.14, .17*	Do.
10276	63 200	38.5	33.6	.37, .40*	Light yellow; uniform; oblique.
10290	64 000	39.5	35.7	.40*, .39*	Do.
10300	63 400	37.0	31.6	.40*, .34	Do.
10309	64 200	38.5	35.7	.42*, .35	Do.
10312	64 400	36.0	33.6	.41*, .31	Light yellow; uniform.
10316	59 800	29.0	29.5	.26, .32*	Light yellow.
10370	62 800	40.5	35.7	.38, .43*	Light yellow; uniform; oblique.
10377	63 000	20.5	18.6	.21*, .20*	Light yellow.
10422	60 800	17.5	20.8	.20*, .15	Light yellow and lavender.
10430	64 200	22.0	23.0	.23*, .21	Light yellow.
10446	65 200	40.0	33.6	.40*, .40*	Light yellow; uniform.
10449	62 400	19.0	20.8	.22*, .16	Light yellow and lavender.
10466	63 000	20.5	20.8	.22*, .19	Do.
10489	60 000	13.0	16.3	.13*, .13*	Do.

Bronze from Watertown Arsenal foundry—Continued.

Marks.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Lb.	*Per cent.*	*Per cent.*	*In. In.*	
10511	64 600	15.5	16.3	.16*, .14*	Light yellow.
10539	55 700	12.0	11.1	.14*, .10*	Do.
10551	60 800	12.0	14.0	.10, .14*	Do.
10566	65 400	23.5	23.0	.23, .24*	Do.
10578	61 400	16.5	16.3	.14, .19*	Do.
10596	54 200	17.0	18.6	.18*, .16	Do.
10601	58 800	15.0	14.0	.17*, .13	Do.
10605	60 600	12.5	11.6	.15*, .10	Do.
10610	59 800	15.5	14.0	.17*, .14	Do.
10614	58 600	14.5	16.3	.16* .13*	Do.
10619	59 400	12.0	16.3	.10, .14*	Do.

EXPERIMENTAL TESTS.

Marks.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Lb.	*Per ct.*	*Per ct.*	*In. In.*	
1896-1	27 500	19.5	27.4	0.22*, 0.17	Light yellow and chocolate.
1896-2	22 000	15.5	20.5	.26*, .05	Do.
1896-3	24 000	18.5	30.7	.24*, .13	Do.
1543-1	63 000	16.0	20.5	.14, .18*	Light yellow.
1543-2	65 500	20.0	27.4	.18, .22*	Do.
1543-3	60 500	12.5	20.5	.10, .15*	Do.
Tobin-1	62 500	32.5	49.1	.32*, .33*	Do.
Tobin-2	62 500	32.5	49.1	.41*, .24	Do.
Tobin-3	64 000	34.0	49.1	.42*, .26	Do.
Copper-1	44 500	14.5	37.1	.06, .23*	Salmon color.
Copper-2	45 000	15.5	40.3	.21*, .10	Do.
Copper-3	44 500	15.0	40.3	.08, .22*	Do.
AB1	90 500	2.0	1.8	.00, .04*	Light yellow; with hole at center.
AB2	86 000	2.0	1.8	.02, .02	Lavender.

TENSILE TEST OF TOBIN BRONZE FOR WATERTOWN ARSENAL.

Marks.	Tensile strength per sq. in.	Elongation in 2 in.		Contraction of area.	Appearance of fracture.
	Lb.	*In.*	*Per ct.*	*Per ct.*	
1	57 800	0.95	47.5	45.3	Light yellow; oblique.
1-3 2-2	24 400	.....	.....	.....	Light yellow, 30 per cent; lemon, 70 per cent.
2-4 3-1	40 800	.....	.....	.....	Light yellow, 30 per cent; lemon, 70 per cent.
4-3-6	35 800	.....	.....	.....	Lavender and lemon yellow.

White Metal from Watertown Arsenal Foundry.

Marks.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Lb.	*Per ct.*	*Per ct.*	*In.* *In.*	
M1	17 500	1.0	1.8	0.00, 0.02*	Light silvery; amorphous.
M2	23 000	1.0	1.8	.02*, .00	Do.
M3	14 300	1.5	1.8	.03*, .00	Silvery gray; amorphous.
M4	12 750	1.5	1.8	.00, .03*	Do.
M5	12 500	1.5	1.8	.03*, .00	Do.
M6	11 625	1.0	1.8	.00, .02*	Do.
W5	9 750	2.0	1.8	.04*, .00	Do.
W6	10 200	3.0	1.8	.04*, .02	Do.
W7	14 280	1.0	1.8	.00, .02*	Silvery gray.
W8	14 790	1.0	1.8	.02*, .00	Do.
W9	14 790	3.0	1.8	.02, .04*	Do.
W10	15 300	3.5	1.8	.02, .05*	Do.
WM	73 500	10.0	13.2	.09*, .11*	Silvery gray; amorphous; dark spot at circumference.
1	20 400	2.5	5.7	.03*, .02	Silvery gray; amorphous.
2	34 700	.5	1.8	.01*, .00	Do.
1F	13 770	1.0	1.8	.00, .02*	Do.

CAST IRON FOR ORDNANCE WORK.

CAST IRON FROM WATERTOWN ARSENAL FOUNDRY.

Marks.	Tensile strength per sq. in.	Remarks.
	Lb.	
2787	29 800	
2787–2	30 500	
2788	29 100	Defective.
2789	34 000	
2789–2	34 000	
2799	29 300	
2799–1	34 700	
2799–2	34 600	
2799–3	34 400	
2800–1	29 600	
2800–2	24 100	
2800–3	24 700	
2800–4	29 600	
2801–1	34 600	
2801–2	31 300	
2802–1	31 600	
2802–2	30 500	
2807	29 800	
2808–1	29 400	
2808–2	29 400	
2825	30 900	
2826–1	36 000	
2826–2	34 500	
2827–1	31 100	
2827–2	31 200	
2832	32 500	
2833–1	28 900	
2833–2	30 500	
2834–1	31 000	
2834–2	30 500	
2835–1	30 200	
2835–2	30 500	
2836–1	34 900	
2836–2	31 100	
2838	32 500	
2839–1	29 900	
2839–2	29 500	
2840–1	35 200	
2840–2	32 500	
2841–1	25 900	
2841–2	27 500	
2841–3	26 400	
2841–4	29 300	
2842	26 000	Do.
2844–1	34 700	
2844–2	38 300	
2845–1	23 500	
2845–2	21 500	
2845–3	21 400	
2848	30 200	
2849–1	27 700	
2849–2	27 700	
2849–3	28 100	
2849–4	27 100	
2851	19 900	
2852–1	22 700	
2852–2	23 100	
2853–1	25 500	
2853–2	26 600	
2853–3	24 800	
2854	30 600	
2855–1	25 500	
2855–2	25 800	
2855–3	24 200	Spot in metal.
2855–4	28 600	Blowhole.
2855–5	28 500	
2856–1	30 300	
2856–2	31 000	
2863	31 900	
2864–1	31 600	
2864–2	29 600	
2865–1	29 600	
2865–2	29 600	
2866–1	30 500	
2866–2	29 500	
2866½	31 000	
2892	31 600	
2893–1	34 100	

Cast iron from Watertown Arsenal foundry—Continued.

Marks.	Tensile strength per sq. in.	Remarks.
	Lb.	
2893-2	32 400	
2894-1	28 600	
2894-2	27 500	
2894-3	28 600	
2894-4	27 500	
2895	32 200	
2896-1	27 700	
2896-2	30 200	
2896-3	30 200	
2897-1	31 600	
2897-2	29 100	
2898-1	34 700	
2898-2	34 400	
2899	36 500	
2910	30 700	
2911-1	29 600	
2911-2	30 100	
2912	35 700	
2913-1	30 000	
2913-2	30 500	
2914-1	31 500	
2914-2	34 600	
2915	30 500	
2917	29 800	
2918-1	29 600	
2918-2	29 800	
2919-1	28 200	
2919-2	29 200	
2920-1	26 500	
2920-2	28 600	
2920-3	25 500	
2920-4	26 300	
2921-1	32 600	
2922-1	32 000	
2923	32 100	
2924-1	26 000	
2924-2	26 500	
2924-3	27 600	
2924-4	28 500	
2925-1	34 300	
2925-2	30 500	
2927	28 500	
2928-1	32 100	
2929-1	32 100	
2930	30 200	
2931-1	28 700	
2931-2	28 600	
2932	30 600	
2933-1	30 200	
2933-2	28 600	
2934-1	28 800	
2934-2	31 500	
2935	30 400	
2936-1	30 600	
2936-2	29 500	
2937	29 000	
2938-1	28 200	
2938-2	27 400	
2938-3	29 300	
2939-1	31 200	
2939-2	31 100	
2940	28 400	
2941-1	24 300	
2941-2	25 900	
2941-3	26 900	
2941-4	27 600	
2941-5	28 500	
2942	27 200	
2943-1	25 700	
2943-2	28 300	
2943-3	25 800	
2943-4	26 500	
2943-5	22 400	
2943-6	29 400	
2944	21 500	
2946	27 400	
2947-1	24 100	
2947-2	27 000	
2947-3	28 000	

Cast iron from Watertown Arsenal foundry—Continued.

Marks.	Tensile strength per sq. in.	Remarks.
	Lb.	
2947–4	27 600	
2948	26 700	
2949–1	25 000	
2949–2	25 300	
2949–3	25 200	
2949–4	25 400	
2951	29 500	
2952–1	28 500	
2952–2	27 400	
2952–3	27 300	
2952–4	26 800	
2952–5	29 500	
2961	30 500	
2962–1	29 800	
2962–2	31 600	
2963–1	27 500	
2963–2	27 500	

TENSILE TESTS OF CAST-IRON SPECIMENS, FOR THE AUGUSTA ARSENAL, AUGUSTA, GA.

Marks.	Diameter.	Sectional area.	Tensile strength.	Appearance.
	In.	*Sq. in.*	*Lb.*	
H–39–S–46.....	1.129	1	26 100	Fine granular, gray.
H–40–S–45.....	1.129	1	24 200	Do.

MISCELLANEOUS STEEL FOR ORDNANCE WORK.

TENSILE TESTS OF STEEL SPECIMENS FROM WATERVLIET ARSENAL.

Marks.	Dimensions.	Sectional area.	Elastic limit.		Tensile strength.		Elongation in 2 in.		Dimensions at fracture.	Contraction of area.	Elongation of inch sections.
			Total.	Per sq. in.	Total.	Per sq. in.					
	In. *In.*	*Sq. in.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*In.*	*Per ct.*	*In.* *In.*	*Per ct.*	*In.* *In.*
1	0.533 x 0.298	0.158	12 500	79 100	23 800	150 600	0.19	9.5	0.50 x 0.28	11.3	[1] 0.08, 0.11*
2	.535 x .300	.160	12 600	78 800	23 300	145 600	.21	10.5	.50 x .27	15.6	[1] .07, .14*
3	1.333 x .374	.498	29 100	58 400	63 000	126 500	.28	14.0	1.23 x .34	16.1	[2] .14*, .14*
4	.505 diam.	.20	10 700	53 500	25 500	127 500	.20	10.0	.47 diam.	13.2	[2] .10*, .10*

Appearance of fracture: [1] Fine granular; silky spot near circumference. [2] Fine granular.

Flat Steel Bars for Ordnance Department

Nos. 1, 2, and 3, tested as soon as planed.
No. 4, rested 24 hours.
No. 5, rested 20 hours.
No. 6, rested 5 hours.

Mark on specimen.	Dimensions.		Sectional area.	Elastic limit.		Tensile strength.		Elongation in 10 in.		Area at fracture.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
	Width diameter.	Thickness.		Total.	Per sq. in.	Total.	Per sq. in.						
	In.	*In.*	*Sq. in.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*In.*	*Per ct.*		*Per ct.*		
1	1.50	0.370	0.555	24 100	43 400	33 900	61 100	2.56	25.6	1.06 x 0.23=0.243	56.2	.17,.17,.18,.19,.20,.20,.22,.25,.31, .67*	Silky.
2	1.50	.374	.561	24 100	43 000	34 200	61 000	2.56	25.6	1.08 x .23= .248	55.6	.17,.17,.17,.18,.20,.21,.22,.26,.69*,.29	Do.
3	1.50	.372	.558	24 100	43 200	33 900	60 800	2.67	26.7	1.08 x .23= .248	55.5	.17,.19,.20,.19,.21,.21,.24,.26,.41, .59*	Do.
4	1.50	.372	.558	24 100	43 200	34 000	60 900	2.50	25.0	1.07 x .24= .256	54.1	.17,.17,.17,.18,.19,.20,.21,.24,.27, .70*	Do.
5	1.50	.375	.562	24 100	42 900	34 100	60 700	2.53	25.3	1.07 x .23= .246	56.2	.17,.17,.18,.18,.19,.20,.20,.25,.39, .60*	Do.
6	1.50	.375	.562	24 100	42 900	34 000	60 500	2.54	25.4	1.08 x .23= .248	55.8	.17,.17,.18,.18,.20,.20,.21,.25,.32, .66*	Do.

TENSION TESTS OF FLANGE STEEL FOR WATERTOWN ARSENAL.

Marks.	Dimensions.		Sectional area.	Elastic limit.		Tensile strength.		Dimensions at fracture.		Area.	Contraction of area.	Elongation in 8 in.		Appearance of fracture.
	Thickness.	Width.		Total.	Per sq. in.	Total.	Per sq. in.	Thickness.	Width.					
	In.	*In.*	*Sq. in.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*In.*	*In.*	*Sq. in.*	*Per ct.*	*In.*	*Per ct.*	
1	0.061	1	0.061	2 750	45 200	3 880	63 600	0.035	0.915	0.032	47.5	1.38	17.3	Silky.
2	.106	1	.106	3 980	37 600	6 020	56 800	.042	.890	.0374	64.7	1.34	16.8	Do.
3	.150	1	.150	5 810	38 800	9 280	61 900	.100	.74	.074	50.6	1.87	23.4	Do.
4	.172	1	.172	7 140	41 500	9 380	54 500	.105	.71	.075	56.4	2.13	26.6	Do.
5	.195	1	.195	.....	.....	11 000	56 500	.125	.73	.091	53.4	2.08	26.0	Do.
6	.254	1	.254	9 490	37 400	16 000	63 000	.162	.72	.116	54.4	2.09	26.2	Do.
7	.306	1	.306	11 000	36 000	20 400	66 700	.195	.73	.142	53.6	2.75	34.4	Do.

TENSILE TESTS OF MANGANESE STEEL BARS FOR THE QUARTERMASTER AND DISBURSING OFFICER, WEST POINT, N. Y.

Bars were 48 in. long and 1.5 in. square, with a reduced section 8 in. long at the middle.
Bars were not straight, and were rather rough at reduced section.

Marks.	Diameter.	Sectional area.	Elastic limit, approximate.		Tensile strength.		Elongation in in 8 in.		Diameter at fracture.	Contraction of area.	Elongation in inch sections.	Appearance of fracture.
			Total.	Per sq. in.	Total.	Per sq. in.						
	In.	*Sq. in.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*In.*	*Per ct.*	*In.*	*Per ct.*	*In. In. In. In. In. In. In. In.*	
1	1 18	1 0936	58 700	53 700	133 800	122 300	3.20	40.0	0.97	32.4	.38, .38, .38, .37, .58*, .37, .37, .37	Silky.
2	1.12	.9852	48 800	49 500	110 900	112 500	3.42	42.7	.94	29.6	.40, .39, .42, .41, .62*, .39, .41, .38	Silky, in part seamy.
3	1.14	1.0207	51 600	50 500	110 100	107 800	3.14	39.2	.90	37.7	.34, .54*, .50*, .36, .40, .39, .36, .25	Do.
4	1.10	.9503	48 400	50 900	109 700	115 400	3.12	39.2	.94	27.0	.32, .34, .36, .36, .43, .63*, .35, .33	Do.
5	1.13	1.0028	52 500	52 300	118 600	118 300	3.30	41.2	.93	32.3	.28, .36, .41, .41, .51*, .53*, .40, .40	Do.

No. 9008.

Marks, A.
Cast-steel bar, not welded.
Diameter, 1.129 in.
Sectional area, 1 in.
Gaged length, 10 in.

Applied loads per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0012	0.	
10 000	.0029	.....	
20 000	.0065	.....	
25 000	.0082	.....	
30 000	.0100	0.	
31 000	.0102	.....	
32 000	.0107	.....	
33 000	.0110	.....	
34 000	.0113	.....	
35 000	.0117	0.	
36 000	.0119	.....	
37 000	.0122	.....	
38 000	.0126	.....	
39 000	.0130	.....	
40 000	.0140	.0009	
41 000	.0170	.....	
42 000	.0197	.....	
43 000	.0217	.....	
44 000	.0280	.....	
	.0680	.....	
45 000	.0750	.0587	
45 900	.....	.....	Tensile strength.

Elongation after fracture, 0.10 in. in 10 in. = 1 per cent.
Elongation of inch sections, .01, .01, .00, .01, .01, .02*, .00, .01, .01.
Diameter at fracture, 1.12 in. Area, 0.985.
Contraction of area, 1.5 per cent.
Position of fracture, 3.20 in. from neck.
Appearance of fracture, fine granular, amorphous center.

No. 9009.

Marks, B.

Cast-steel bar cut in two and then burned with molten steel to form weld.

Diameter, 1.129 in.

Sectional area, 1 in.

Gaged length, 10 in.

Applied loads per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0010	0.	
10 000	.0030	.....	
20 000	.0063	.....	
25 000	.0081	.....	
30 000	.0100	0.	
35 000	.0117	0.	
36 000	.0122	.....	
37 000	.0127	.....	
38 000	.0132	.....	
	.0380	.....	
39 000	.0430	.....	
40 000	.0475	.0342	
41 000	.0510	.....	
42 000	.0580	.....	
43 000	.08	.....	
43 500	.....	.....	Tensile strength.

Elongation after fracture, 0.10 in. in 10 in. = 1 per cent.

Elongation of inch sections, .00, .01, .01, .01, .02, .02, .01, .02*, .00, .00.

Diameter at fracture, 1.12 in. Area, 0.985 sq. in.

Contraction of area, 1.5 per cent.

Position of fracture, 2.90 in. from the neck.

Appearance of fracture, fine granular 70 per cent, amorphous 30 per cent.

TENSILE TESTS OF WELDED STEEL TIRES. SCARFWELD.

The specimens as received were about 5 in. wide by 17 to 18.25 in. long. Each was cut longitudinally to form two specimens about 2.25 in. wide, as the original specimens could not be tested readily.

Marks.	Dimensions at weld.		Sectional area.	Tensile strength.		Remarks.
	Width.	Thickness.		Total.	Per sq. in.	
	In.	*In.*	*Sq. in.*	*Lb.*	*Lb.*	
A.....	2.25	0.62	1.40	59 500	42 500	Parted along the scarf.
A.....	2.35	.63	1.48	74 000	50 000	Do.
B.....	2.25	.60	1.35	69 400	51 400	Do.
B.....	2.35	.61	1.43	78 800	55 100	Do.
C.....	2.27	.60	1.36	64 300	47 300	Do.
C.....	2.33	.61	1.42	79 200	55 800	Do.

COMPRESSION TEST OF A PIECE OF I BEAM FOR WATERTOWN ARSENAL.

Length of beam, 5.57 in.
Depth of beam, 15.12 in.
Thickness of web, 0.66 in.
Width of flange, 5.53 in.
Thickness of flange at web, 1.40 in.
Thickness of flange at edge, 0.55 in.

Applied loads, total.	In gaged length.		Remarks.
	Compression.	Set.	
Lb.	*In.*	*In.*	
500	0.	.....	
7 560	.02	.....	
15 120	.03	.....	
20 000	.03	.....	
25 000	.03	.....	
30 000	.03	0.01	
35 000	.03	.....	
40 000	.03	.....	
45 000	.04	.....	
50 000	.04	.01	
55 000	.04	.....	
60 000	.04	.....	
65 000	.04	.....	
70 000	.05	.01	
75 000	.05	.....	
80 000	.05	.....	
85 000	.05	.....	
90 000	.05	.....	
95 000	.05	.....	
100 000	.05	.01	
105 000	.06	.....	
110 000	.06	.....	Elastic limit.
115 000	.08	.....	
117 000	.16	.....	Ultimate strength.

Web deflected sidewise, to east.

TENSILE TESTS OF BOLTS.

Marks.	Diameter at root of thread.	Sectional area.	Tensile strength.		Appearance of fracture.
			Total.	Per sq. in.	
	In.	*Sq. in.*	*Lb.*	*Lb.*	
1	0.625	0.306	22 100	72 200	Silky.
2	.625	.306	23 200	75 800	Fine granular, 90 per cent; silky, 10 per cent.
3	.625	.306	22 600	73 900	Silky; with trace of granulation.
4	.625	.306	22 000	71 900	Silky, 95 per cent; granular, 5 per cent.
5	.625	.306	21 500	70 300	Silky; with trace of granulation.
6	.625	.306	22 600	73 900	Do.

Three of these bolts were $4\frac{5}{16}$ in. long and three were $4\frac{13}{16}$ in. long. Length measured from underside of head to the end of bolt.

The nominal diameter was $\frac{3}{4}$ in.

The specimens were tested by means of a special fixture to take the bolthead and the other end was screwed into a threaded socket about the length of the thread.

All specimens fractured at root of thread.

STANDARD TENSION SPECIMENS TURNED FROM HUB BOLTS.

Marks.	Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation in 2 in.	Contraction of area.	Appearance of fracture.
	Lb.	*Lb.*	*Per ct.*	*Per ct.*	
1	46 000	64 500	33.5	64.6	Silky; cup shaped.
2	54 000	65 000	35.0	66.9	Silky.
3	49 000	64 000	34.0	66.9	Do.
4	50 000	67 000	33.5	62.2	Do.
5	46 000	62 000	35.5	66.9	Do.
6	50 500	64 500	34.0	66.9	Do.
7	45 500	64 000	34.5	62.2	Silky; cup shaped.
8	42 000	63 000	32.5	64.6	Silky.
9	45 500	63 000	31.5	64.6	Silky; cup shaped.
10	44 000	63 000	33.0	64.6	Silky.
11	44 000	62 000	34.5	64.6	Do.
12	42 500	61 000	35.5	66.9	Silky; cup shaped.

STEEL WIRE.

TENSILE TESTS OF CRUCIBLE STEEL WIRE FOR THE UNITED STATES NAVY YARD, BOSTON, MASS.

Mark on specimen.	Diameter.	Sectional area.	Elastic limit, approximate.		Tensile strength.		Elongation in 10 in.		Diameter at fracture.	Contraction of area.	Appearance of fracture.	Location of fracture.
			Total.	Per sq. in.	Total.	Per sq. in.						
	In.	*Sq. in.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*In.*	*P. ct.*	*In.*	*P. ct.*		
1	0.091	0.0065	449	69 100	1 836	282 500	0.11	1.1	0.08	23.0	Silky	0.35 in. outside gaged length.
2	.091	.0065	440	67 700	1 700	261 500	.14	1.4	.07	41.5	...do	Inside gaged length.
3	.091	.0065	700	107 700	1 836	282 500	.16	1.6	.07	41.5	...do	Do.
4	.091	.0065	612	94 200	1 815	279 200	.10	1.0	.07	41.5	...do	1.60 in. outside gaged length.
5	.091	.0065	439	67 500	1 836	282 500	.20	2.0	.07	41.5	...do	1.10 in. outside gaged length.
6	.091	.0065	867	133 400	1 836	282 500	.21	2.1	.07	41.5	...do	Inside gaged length.
7	.091	.0065	739	113 700	1 754	269 800	.15	1.5	.06	56.9	...do	Do.
8	.091	.0065	714	109 800	1 734	266 800	.10	1.0	.09	3.0	...do	At gage mark.
9	.091	.0065	816	125 500	2 019	310 600	.10	1.0	.07	41.5	...do	0.65 in. outside gaged length.
10	.091	.0065	653	100 500	1 938	298 200	.13	1.3	.07	41.5	...do	Inside gaged length.
11	.091	.0065	816	125 500	1 836	282 500	.01	.1	.09	3.0	...do	3.30 in. outside gaged length.
12	.091	.0065	857	131 800	1 968	302 800	.07	.7	.09	3.0	...do	At gage mark.
13	.091	.0065	765	117 700	1 836	282 500	.11	1.1	.07	41.5	...do	2.10 in. outside gaged length.
14	.091	.0065	663	102 000	1 826	280 900	.20	2.0	.07	41.5	...do	Inside gaged length.
15	.091	.0065	612	94 200	1 876	288 600	.14	1.4	.07	41.5	...do	Do.
16	.091	.0065	653	100 500	1 938	298 200	.12	1.2	.07	41.5	...do	Do.
17	.091	.0065	612	94 200	1 836	282 500	.14	1.4	.07	41.5	...do	Do.
18	.091	.0065	755	116 200	1 866	287 100	.31	3.1	.07	41.5	...do	Do.
19	.091	.0065	683	105 100	1 876	288 600	.11	1.1	.07	41.5	...do	Do.
20	.091	.0065	842	129 500	2 040	313 800	.14	1.4	.07	41.5	...do	Do.
21	.091	.0065	765	117 700	1 938	298 200	.31	3.1	.07	41.5	...do	Do.
22	.091	.0065	714	109 800	1 836	282 500	.14	1.4	.07	41.5	...do	Do.
23	.091	.0065	816	125 500	1 877	288 800	.29	2.9	.07	41.5	...do	At gage mark.
24	.091	.0065	714	109 800	1 836	282 500	.13	1.3	.07	41.5	...do	Inside gaged length.
25	.091	.0065	714	109 800	1 836	282 500	.11	1.1	.08	23.0	...do	At gage mark.

The elastic limits were vague and indefinite.

The total elongation was measured on the wire after testing and shows the permanent set which the metal received.

TENSILE TESTS OF SQUARE STEEL WIRE.

Marks.	Dimensions.		Sectional area.	Tensile strength.		Elongation in 10 in.		Dimensions at fracture.	Contraction of area.
	Width.	Thickness.		Total.	Per sq. in.				
	In.	*In.*	*Sq. in.*	*Lb.*	*Lb.*	*In.*	*Per cent.*	*In.* *In.*	*Per cent.*
460–I	0.125	0.125	0.0156	3 400	217 900	0.32	3.2	0.09 x 0.09	48.0
475–I	.125	.125	.0156	3 300	211 500	.34	3.4	.09 x .09	48.0
482–I	.125	.125	.0156	3 500	224 400	.29	2.9	.09 x .09	48.0
575–I	.125	.125	.0156	3 200	205 100	.23	2.3	.09 x .09	48.0

Appearance of fracture silky in all cases.

Applied loads.	Elongation in gaged lengths of 10 in.							
	460–I.		475–I.		482–I.		575–I.	
	Elongation.	Set.	Elongation.	Set.	Elongation.	Set.	Elongation.	Set.
Lb.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
100	0.	0.	0.	0.	0.	0.	0.	0.
200	.0029	0.	.0029	0.	.0028	0.	.0023	0.
300	.0052	.....	.0056	.....	.0040	.....	.0047	.....
400	.0075	.....	.0074	.....	.0065	.....	.0077	.....
500	.0103	0.	.0094	0.	.0088	.0015	.0100	0.
600	.0126	.....	.0123	.....	.0117	.....	.0125	.....
700	.0147	.....	.0145	.....	.0139	.....	.0152	.....
800	.0166	.....	.0158	.....	.0163	.....	.0176	.....
900	.0188	.....	.0194	.....	.0191	.....	.0198	.....
1 000	.0215	.0006	.0222	.0006	.0219	.0022	.0226	.0004
1 100	.0241	.....	.0238	.....	.0239	.....	.0258	.....
1 200	.0262	.....	.0288	.....	.0266	.....	.0276	.....
1 300	.0287	.....	.0304	.....	.0287	.....	.0310	.....
1 400	.0317	.....	.0337	.....	.0321	.....	.0340	.....
1 500	.0345	.0026	.0356	.0022	.0348	.0030	.0380	.0029
1 600	.0372	.....	.0395	.....	.0387	.....	.0410	.....
1 700	.0402	.....	.0419	.....	.0414	.....	.0445	.....
1 800	.0437	.....	.0457	.....	.0445	.....	.0483	.....
1 900	.0479	.....	.0515	.....	.0477	.....	.0541	.....
2 000	.0515	.0072	.0547	.0078	.0521	.0063	.0565	.0108
2 100	.0563	.....	.0577	.....	.0560	.....	.0640	.....
2 200	.0622	.....	.0643	.....	.0597	.....	.0690	.....
2 300	.0674	.....	.0690	.....	.0649	.....	.0770	.....
2 400	.0740	.....	.0795	.....	.0695	.....	.0870	.....
2 500	.0886	.0244	.0865	.0265	.0750	.0173	.0967	.0347
2 600	.0947	.....	.0970	.....	.0830	.....	.1108	.....
2 700	.1051	.....	.1053	.....	.0890	.....	.1222	.....
2 800	.1198	.....	.1250	.....	.1007	.....	.1540	.....
2 900	.1415	.....	.1500	.....	.1135	.....	.1820	.....
3 000	.1705	.0916	.1910	.1075	.1305	.0536	.2330	.1485
3 100	.2156	.....	.2330	.....	.1540	.....	.....	.....

TENSILE TESTS OF GALVANIZED ARMOR WIRE FOR TORPEDO STATION, FORT TOTTEN, N. Y.

Sample No. 1, 8 pieces.

Diameter.	Sectional area.	Tensile strength.	
		Total.	Per sq. in.
In.	*Sq. in.*	*Lb.*	*Lb.*
0.138	0.0150	1 730	115 000
.141	.0156	1 840	118 000
.138	.0150	1 840	123 000
.141	.0156	1 940	124 000
.138	.0150	1 630	109 000
.138	.0150	2 040	136 000
.138	.0150	1 730	115 000
.141	.0156	1 840	118 000
Average...	.....	.....	120 000

Sample No. 2, 8 pieces.

Diameter.	Sectional area.	Tensile strength.	
		Total.	Per sq. in.
In.	*Sq. in.*	*Lb.*	*Lb.*
0.135	0.0143	1 020	71 400
.130	.0133	820	61 600
.135	.0143	1 210	84 600
.134	.0141	912	64 700
.133	.0139	1 080	77 800
.134	.0141	840	59 600
.134	.0141	850	60 300
.130	.0133	1 010	76 000
Average...	.....	.....	69 500

TENSILE TESTS OF WIRE CABLES FOR CORPS OF ENGINEERS, UNITED STATES ARMY, FOR ISTHMIAN CANAL COMMISSION.

No.	Nominal diameter.	Actual diameter.	Length between jaws of machine.	Number of strands.	Total tensile strength.	Parted.
	In.	*In.*	*Ft. In.*		*Lb.*	
1	1	1	3 6	6	28 900	2 strands 12 in. from jaws of testing machine.
2	1	1	10 6	6	28 200	4 strands at jaws of machine.
3	1.5	1.55	4 11	6	89 900	Fractured the bail of socket. Rope not fractured.
4	1.5	1.55	11 11	6	75 100	Do.
5	.....	1.56	2 8	6	179 900	1 strand at middle.
6	1	1.03	4 8	6	90 100	2 strands 16 in. from end of sockets.
7	1	1.03	3 5	6	86 400	3 strands 5 in. from socket.

Samples prepared for testing with closed sockets at the ends.

STEEL CHAIN.

TENSILE TEST OF CHAIN FOR WATERTOWN ARSENAL.

No. of links.	Length of links.	Width of links.	Thickness of wire.	Tensile strength.	Parted.	Appearance of fracture.
7	*In.* 1.69	*In.* 1.18	*In.* 0.37	*Lb.* 9 600	3 links from end.....	Silky.

THREE LINKS OF WROUGHT-IRON CHAIN FOR ENGINEER CORPS, WILMINGTON, N. C.

Diameter of iron, 1 65 in.

Sample prepared for testing with end links welded in. On first test the maximum load reached was 166 200 pounds tension. An end link fractured, the three links of chain remaining unbroken.

The fractured end link was replaced and test resumed. At the second test the end link again fractured under a reduced load.

The triplet was returned to the testing machine, using special loops to secure the same in the machine. At the third test one of the outside links of the triplet fractured in the quarter on the opposite end from the weld under a tensile stress of 161 000 pounds. Appearance of fracture, fibrous.

STEEL FOR COMPARISON OF TESTING MACHINES.

TENSILE TESTS OF STEEL SPECIMENS FOR COMPARISON OF TESTING MACHINE OF NEW YORK CAR WHEEL CO., BUFFALO, N. Y.

Marks.	Diameter.	Sectional area.	Elastic limit.		Tensile strength.		Diameter at fracture.	Contraction of area.	Elongation in 2 in.		Appearance of fracture.
			Total.	Per sq. in.	Total.	Per sq. in.					
	In.	*Sq. in.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*In.*	*Per ct.*	*In.*	*Per ct.*	
1.....	0.500	0.196	15 100	77 000	16 600	84 600	0.34	54.0	0.36	18.0	Silky, cup shaped.
2.....	.500	.196	15 300	78 100	16 600	84 600	.35	51.0	.36	18.0	Do.
3.....	.501	.197	15 100	76 600	16 600	84 300	.35	51.3	.34	17.0	Do.

TENSION TESTS OF SPECIMENS FOR COMPARISON OF TESTING MACHINE AT WORKS OF THE A. & J. M. ANDERSON CO., SOUTH BOSTON.

No. 9203.

Marks, 2.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads, per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0002	0.	
10 000	.0005	0.	
15 000	.0009	0.	
20 000	.0013	0.	
25 000	.0016	0.	
30 000	.0020	0.	
35 000	.0024	0.	
40 000	.0026	0.	
41 000	.0027	0.	
42 000	.0028	0.	
43 000	.0029	0.	
44 000	.0661	.....	
45 000	.0680	.0644	
46 000	.0734	.....	
47 000	.0798	.....	
48 000	.0877	.....	
49 000	.0922	.....	
50 000	.0978	.0957	
63 000	.....	.....	Tensile strength.

Elongation after fracture, 0.73 in. in 2 in. = 36.5 per cent.
Elongation of inch sections, .36*, .37*.
Diameter at fracture, 0.32 in. Area, 0.0804 sq. in.
Contraction of area, 59.8 per cent.
Position of fracture, in the middle.
Appearance of fracture, silky.

No. 9204.

Marks, 4.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads, per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0002	0.	
10 000	.0005	0.	
15 000	.0008	0.	
20 000	.0012	0.	
25 000	.0015	0.	
30 000	.0018	0.	
35 000	.0022	0.	
40 000	.0026	0.	
41 000	.0517	.....	
42 000	.0547	.....	
43 000	.0579	.....	
44 000	.0618	.....	
45 000	.0647	.0623	
46 000	.0702	.....	
47 000	.0786	.....	
48 000	.0821	.....	
49 000	.0876	.....	
50 000	.0973	.0941	
64 000	.....	.....	Tensile strength.

Elongation after fracture, 0.74 in. in 2 in.=37 per cent.
Elongation of inch sections, .37*, .37*.
Diameter at fracture, 0.32 in. Area, 0.0804 sq. in.
Contraction of area, 59.8 per cent.
Position of fracture, in the middle.
Appearance of fracture, silky.

No. 9205.

Marks, 6.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads, per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0002	0.	
10 000	.0005	0.	
15 000	.0008	0.	
20 000	.0011	0.	
25 000	.0013	0.	
30 000	.0017	0.	
35 000	.0020	0.	
40 000	.0023	0.	
41 000	.0538	.....	
42 000	.0543	.....	
43 000	.0574	.....	
44 000	.0604	.....	
45 000	.0655	.0621	
46 000	.0705	.....	
47 000	.0766	.....	
48 000	.0827	.....	
49 000	.0875	.....	
50 000	.0955	.0927	
63 000	.....	.....	Tensile strength.

Elongation after fracture, 0.72 in. in 2 in. = 36 per cent.
Elongation of inch sections, .37, .35*.
Diameter at fracture, 0.32 in. Area, 0.0804 sq. in.
Contraction of area, 59.8 per cent.
Position of fracture, in the middle.
Appearance of fracture, silky.

TESTS OF TENSION SPECIMENS FOR COMPARISON OF TESTING MACHINE AT THE WORKS OF THE HALCOMB STEEL CO.

No. 9206.

Marks, 1–2.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads, per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0003	0.	
10 000	.0004	0.	
20 000	.0008	0.	
30 000	.0015	.0003	
35 000	.0020	.0005	
40 000	.0023	.....	
45 000	.0027	.....	
50 000	.0032	.0005	
60 000	.0039	.0005	
70 000	.0045	.0005	
80 000	.0053	.....	
85 000	.0056	.0005	
90 000	.0058	.....	
95 000	.0062	.....	
96 000	.0063	.....	
97 000	.0064	.....	
98 000	.0065	.....	
99 000	.0067	.....	Elastic limit.
100 000	.0105 .0375	.....	
101 000	.0950	.....	
102 000	.1015	.....	
103 000	.1045	.....	
104 000	.1075	.....	
105 000	.1230	.....	
108 000	.....	.....	Tensile strength.

Elongation after fracture, 0.52 in. in 2 in. = 26 per cent.
Elongation of inch sections, .37*, .15.
Diameter at fracture, 0.27 in. Area, 0.0573 sq. in.
Contraction of area, 71.3 per cent.
Position of fracture, 1.20 in. from the neck.
Appearance of fracture, fine silky; serrated.

No. 9207.

Marks, 1–4.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads, per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0003	0.	
10 000	.0005	.....	
20 000	.0010	.....	
30 000	.0015	.0005	
35 000	.0020	.....	
40 000	.0024	.....	
45 000	.0028	.....	
50 000	.0032	.0006	
60 000	.0036	.0006	
70 000	.0043	.0007	
80 000	.0050	.0007	
85 000	.0052	.0007	
90 000	.0057	.....	
92 000	.0058	.....	
94 000	.0060	.....	
95 000	.0060	.....	
96 000	.0062	.....	Elastic limit.
97 000	.0690	.....	
98 000	.0730	.....	
99 000	.0755	.....	
100 000	.0850	.....	
101 000	.0890	.....	
106 500	.....	.....	Tensile strength.

Elongation after fracture, 0.53 in. in 2 in. = 26.5 per cent.
Elongation of inch sections, .13, .40*.
Diameter at fracture, 0.27 in. Area, 0.0573 sq. in.
Contraction of area, 71.3 per cent.
Position of fracture, 1.20 in. from the neck.
Appearance of fracture, fine silky; serrated.

No. 9208.

Marks, 1–6.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads, per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0001	0.	
10 000	.0003	0.	
20 000	.0007	.....	
30 000	.0012	0.	
35 000	.0015	.....	
40 000	.0023	.....	
45 000	.0024	.....	
50 000	.0026	0.	
60 000	.0033	0.	
70 000	.0040	0.	
80 000	.0046	0.	
85 000	.0050	0.	
90 000	.0054	.....	
92 000	.0056	.....	
94 000	.0058	.....	
95 000	.0059	.....	
96 000	.0060	.....	Elastic limit.
97 000	.0250 .0645	.....	
98 000	.0755	.....	
99 000	.0800	.....	
100 000	.0890	.....	
101 000	.0930	.....	
106 500	.....	.....	Tensile strength.

Elongation after fracture, 0.54 in. in 2 in. = 27 per cent.
Elongation of inch sections, .15, .39*.
Diameter at fracture, 0.27 in. Area, 0.0573 sq. in.
Contraction of area, 71.3 per cent.
Position of fracture, 1.20 in. from the neck.
Appearance of fracture, fine silky; serrated.

No. 9209.

Marks, 2–2.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0001	0.	
10 000	.0003	0.	
20 000	.0008	.....	
30 000	.0013	.0005	
35 000	.0018	.0008	
40 000	.0021	.....	
41 000	.0022	.....	
43 000	.0022	.....	
44 000	.0023	.....	
45 000	.0023	.....	
46 000	.0024	.....	
47 000	.0024	.....	Elastic limit.
48 000	.0635	.....	
49 000	.0645	.....	
50 000	.0675	.....	
51 000	.0720	.....	
52 000	.0770	.....	
65 500	.....	.....	Tensile strength.

Elongation after fracture, 0.75 in. in 2 in. = 37.5 per cent.
Elongation of inch sections, .44*, .31.
Diameter at fracture, 0.26 in. Area, 0.0531 sq. in.
Contraction of area, 73.4 per cent.
Position of fracture, at middle of stem.
Appearance of fracture, fine silky; cup shaped.

No. 9210.

Marks, 2–4.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0002	0.	
10 000	.0005	0.	
20 000	.0007	----------	
30 000	.0011	0.	
35 000	.0015	----------	
40 000	.0017	0.	
45 000	.0020	----------	
46 000	.0021	----------	
47 000	.0022	----------	
48 000	.0023	----------	
49 000	.0024	----------	Elastic limit.
50 000	.0665	----------	
51 000	.0690	----------	
52 000	.0770	----------	
53 000	.0810	----------	
54 000	.0880	----------	
55 000	.0930	----------	
65 500	----------	----------	Tensile strength.

Elongation after fracture, 0.76 in. in 2 in. = 38 per cent.
Elongation of inch sections, .48*, .28.
Diameter at fracture, 0.27 in. Area, 0.0573 sq. in.
Contraction of area, 71.3 per cent.
Position of fracture, 1.40 in. from the neck.
Appearance of fracture, fine silky.

No. 9211.

Marks, 2–6.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0003	0.	
10 000	.0005	0.	
20 000	.0010	.....	
30 000	.0017	0.	
35 000	.0020	.....	
40 000	.0023	0.	
41 000	.0025	.....	
42 000	.0025	.....	
43 000	.0025	.....	
44 000	.0025	.....	Elastic limit.
45 000	.0130	.....	
46 000	.0545	.....	
47 000	.0555	.....	
48 000	.0585	.....	
49 000	.0622	.....	
50 000	.0680	.....	
65 000	.....	.....	Tensile strength.

Elongation after fracture, 0.75 in. in 2 in. = 37.5 per cent.
Elongation of inch sections, .44*, .31.
Diameter at fracture, 0.26 in. Area, 0.0531 sq. in.
Contraction of area, 73.4 per cent.
Position of fracture, at middle of stem.
Appearance of fracture, fine silky.

TENSION SPECIMENS OF COLD ROLLED-STEEL FOR COMPARISON OF TESTING MACHINE AT THE WORKS OF THE HEPPENSTALL FORGE & KNIFE CO., PITTSBURG, PA.

No. 9216.

Marks, 2.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0003	0.	
10 000	.0005	.....	
20 000	.0010	.....	
30 000	.0019	0.	
40 000	.0026	0.	
50 000	.0036	0.	
51 000	.0037	.....	
52 000	.0039	.....	
53 000	.0040	.....	
54 000	.0045	.....	
55 000	.0045	.....	
56 000	.0047	.....	
57 000	.0050	.....	
58 000	.0052	.....	
59 000	.0055	.....	
60 000	.0057	.0015	
61 000	.0060	.....	
62 000	.0063	.....	
63 000	.0064	.....	
64 000	.0067	.....	
65 000	.0075	.....	
66 000	.0085	.....	
67 000	.0085	.....	
68 000	.0091	.....	
69 000	.0095	.....	
70 000	.0100	.....	
71 000	.0110	.....	
72 000	.0125	.....	
73 000	.0130	.....	
74 000	.0144	.....	
75 000	.0150	.....	
76 000	.0162	.....	
77 000	.0180	.....	
78 000	.0210	.....	
79 000	.0244	.....	
80 000	.0330	.....	
81 000	.0400	.....	
82 000	.....	.....	Tensile strength.

Elongation after fracture, 0.30 in. in 2 in. = 15 per cent.
Elongation of inch sections, .06, .24*.
Diameter at fracture, 0.38 in. Area, 0.1184 sq. in.
Contraction of area, 43.3 per cent.
Position of fracture, 0.95 in. from the neck.
Appearance of fracture, silky.

No. 9217.

Marks, 4.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads, per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0003	0.	
10 000	.0006	.....	
20 000	.0012	.....	
30 000	.0020	0.	
40 000	.0027	.0003	
50 000	.0040	.0006	
51 000	.0040	.....	
52 000	.0042	.....	
53 000	.0045	.....	
54 000	.0045	.....	
55 000	.0048	.....	
56 000	.0048	.....	
57 000	.0052	.....	
58 000	.0055	.....	
59 000	.0058	.....	
60 000	.0060	.0018	
61 000	.0063	.....	
62 000	.0065	.....	
63 000	.0070	.....	
64 000	.0075	.....	
65 000	.0078	.....	
66 000	.0083	.....	
67 000	.0090	.....	
68 000	.0095	.....	
69 000	.0100	.....	
70 000	.0106	.....	
71 000	.0116	.....	
72 000	.0124	.....	
73 000	.0135	.....	
74 000	.0144	.....	
75 000	.0156	.....	
76 000	.0175	.....	
77 000	.0197	.....	
78 000	.0225	.....	
79 000	.0260	.....	
80 000	.0325	.....	
81 000	.0365	.....	
81 500	.....	.....	Tensile strength.

Elongation after fracture, 0.34 in. in 2 in. = 17 per cent.
Elongation of inch sections, .15, .19*.
Diameter at fracture, 0.38 in. Area, 0.1184 sq. in.
Contraction of area, 43.3 per cent.
Position of fracture, 1.20 in. from the neck.
Appearance of fracture, silky.

No. 9218.

Marks, 6.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads, per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0003	0.	
10 000	.0005	.....	
20 000	.0015	.....	
30 000	.0023	0.	
40 000	.0030	.0003	
50 000	.0040	.0007	
51 000	.0044	.....	
52 000	.0045	.....	
53 000	.0047	.....	
54 000	.0048	.....	
55 000	.0050	.0012	
56 000	.0055	.....	
57 000	.0055	.....	
58 000	.0057	.....	
59 000	.0059	.....	
60 000	.0063	.0020	
61 000	.0067	.....	
62 000	.0070	.....	
63 000	.0072	.....	
64 000	.0075	.....	
65 000	.0080	.....	
66 000	.0085	.....	
67 000	.0090	.....	
68 000	.0095	.....	
69 000	.0102	.....	
70 000	.0110	.....	
71 000	.0115	.....	
72 000	.0125	.....	
73 000	.0135	.....	
74 000	.0144	.....	
75 000	.0158	.....	
76 000	.0175	.....	
77 000	.0192	.....	
78 000	.0218	.....	
79 000	.0248	.....	
80 000	.0290	.....	
81 000	.0370	.....	
81 500	.....	.....	Tensile strength.

Elongation after fracture, 0.33 in. in 2 in. = 16.5 per cent.
Elongation of inch sections, .22*, .11.
Diameter of fracture, 0.38 in. Area, 0.1184 sq. in.
Contraction of area, 43.3 per cent.
Position of fracture, 1.20 in. from the neck
Appearance of fracture, silky.

No. 9219.

Marks, 8.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lbs.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0003	0.	
10 000	.0005	.....	
20 000	.0011	.....	
30 000	.0018	0.	
40 000	.0025	0.	
50 000	.0035	.0003	
51 000	.0037	.....	
52 000	.0038	.....	
53 000	.0039	.....	
54 000	.0041	.....	
55 000	.0043	.0008	
56 000	.0046	.....	
57 000	.0048	.....	
58 000	.0050	.....	
59 000	.0053	.....	
60 000	.0059	.0015	
61 000	.0062	.....	
62 000	.0064	.....	
63 000	.0066	.....	
64 000	.0070	.....	
65 000	.0076	.....	
66 000	.0080	.....	
67 000	.0085	.....	
68 000	.0090	.....	
69 000	.0095	.....	
70 000	.0106	.....	
71 000	.0115	.....	
72 000	.0123	.....	
73 000	.0133	.....	
74 000	.0140	.....	
75 000	.0160	.....	
76 000	.0178	.....	
77 000	.0195	.....	
78 000	.0215	.....	
79 000	.0275	.....	
80 000	.0315	.....	
81 000	.....	.....	Tensile strength.

Elongation after fracture, 0.34 in. in 2 in. = 17 per cent.
Elongation of inch sections, .23*, .11.
Diameter at fracture, 0.38 in. Area, 0.1184 sq. in.
Contraction of area, 43.3 per cent.
Position of fracture, 1.10 in. from the neck.
Appearance of fracture, silky; cup shaped.

TENSION TESTS OF STEEL BARS FOR COMPARISON OF TESTING MACHINE AT THE WORKS OF THE BETHLEHEM STEEL CO.

No. 9220.

Marks, AW1, ⚓ L.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0003	0.	
10 000	.0005	.....	
20 000	.0014	.....	
30 000	.0023	0.	
35 000	.0028	.....	
40 000	.0030	0.	
41 000	.0031	.....	
42 000	.0032	.....	
43 000	.0034	.....	
44 000	.0035	.....	
45 000	.0037 .0180	.....	Elastic limit.
46 000	.0405	.....	
47 000	.0430	.....	
48 000	.0460	.....	
49 000	.0495	.....	
50 000	.0530	.....	
51 000	.0578	.....	
52 000	.0612	.....	
53 000	.0657	.....	
54 000	.0705	.....	
55 000	.0750	.....	
56 000	.0800	.....	
57 000	.0863	.....	
58 000	.0925	.....	
59 000	.1000	.....	
60 000	.1060	.....	
61 000	.1140	.....	
62 000	.1270	.....	
63 000	.1335	.....	
64 000	.1400	.....	
65 000	.1550	.....	
66 000	.18	.....	
67 000	.20	.....	
68 000	.22	.....	
69 000	.26	.....	
70 000	.30	.....	
70 500	.....	.....	Tensile strength.

Elongation after fracture, 0.69 in. in 2 in. = 34.5 per cent.
Elongation of inch sections, .28, .41*.
Diameter at fracture, 0.31 in. Area, 0.0755 sq. in.
Contraction of area, 62.2 per cent.
Position of fracture, 1.25 in. from the neck.
Appearance of fracture, silky; with small hole at center.

No. 9221.

Marks, AW2, ⚓, L.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0003	0.	
10 000	.0005	.....	
20 000	.0012	.....	
30 000	.0020	0.	
35 000	.0023	.....	
40 000	.0027	0.	
41 000	.0028	.....	
42 000	.0029	.....	
43 000	.0029	.....	
44 000	.0030 / .0070	.....	Elastic limit.
45 000	.0260	.....	
46 000	.0410	.....	
47 000	.0445	.....	
48 000	.0460	.....	
49 000	.0485	.....	
50 000	.0515	.....	
51 000	.0545	.....	
52 000	.0600	.....	
53 000	.0650	.....	
54 000	.0690	.....	
55 000	.0720	.....	
56 000	.0790	.....	
57 000	.0860	.....	
58 000	.0910	.....	
59 000	.0980	.....	
60 000	.1050	.....	
61 000	.1100	.....	
62 000	.1190	.....	
63 000	.1250	.....	
64 000	.1380	.....	
65 000	.1480	.....	
66 000	.1600	.....	
67 000	.1750	.....	
68 000	.2000	.....	
69 000	.22	.....	
70 000	.29	.....	
70 500	.....	.....	Tensile strength.

Elongation after fracture, 0.69 in. in 2 in. = 34.5 per cent.
Elongation of inch sections, .22, .47*.
Diameter at fracture, 0.31 in. Area, 0.0755 sq. in.
Contraction of area, 62.2 per cent.
Position of fracture, 1 in. from the neck.
Appearance of fracture, silky.

No. 9222.

Marks, BW1, ⚓, L.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gaged length, 2 in.

Applied loads per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0004	0.	
10 000	.0008	.....	
20 000	.0015	.....	
30 000	.0020	0.	
35 000	.0027	.0002	
37 000	.0028	.0002	
40 000	.0029	.0002	
41 000	.0030	.....	
42 000	.0030	.....	
43 000	.0030	.....	
44 000	.0030	.....	
45 000	.0031	.....	
46 000	.0033	.....	
47 000	.0033	.....	
48 000	{ .0035 / .0500 }	.....	Elastic limit.
49 000	.0525	.....	
50 000	.0550	.....	
51 000	.0572	.....	
52 000	.0625	.....	
53 000	.0685	.....	
54 000	.0710	.....	
55 000	.0790	.....	
56 000	.0860	.....	
57 000	.0895	.....	
58 000	.0940	.....	
59 000	.0995	.....	
60 000	.1130	.....	
61 000	.1200	.....	
62 000	.1340	.....	
63 000	.1420	.....	
64 000	.1515	.....	
65 000	.1615	.....	
66 000	.1800	.....	
67 000	.20	.....	
68 000	.24	.....	
69 000	.28	.....	
70 000	.35	.....	Tensile strength.

Elongation after fracture, 0.74 in. in 2 in. = 37 per cent.
Elongation of inch sections, .28, .46*.
Diameter at fracture, 0.30 in. Area, 0.0707 sq. in.
Contraction of area, 64.6 per cent.
Position of fracture, 1.20 in. from the neck.
Appearance of fracture, silky.

STEEL COLUMN PROGRAM.

BUILT I COLUMNS.

General.

The sectional area was computed from the total weight and length of the column after deducting the estimated weight of all rivet heads.

Columns with flat ends were tested by compression blocks having plane surfaces. One of these was provided with a ball and socket bearing which was adjusted to secure uniform loading over the milled ends of the column.

Columns with pin ends were tested by special fixtures shown in figures 9 and 10, two being used for each specimen. The one shown in figure 9, however, was not used for any of the tests contained in this report. The pins, 3 inches in diameter, were placed with their axes vertically in the plane of the web.

Columns marked 60 000 or 70 000-lb. steel were made of material having approximately that ultimate strength.

The longer columns were counterweighted at the middle to neutralize the weight of the column which would produce an initial deflection, due to the horizontal position of the column during the test.

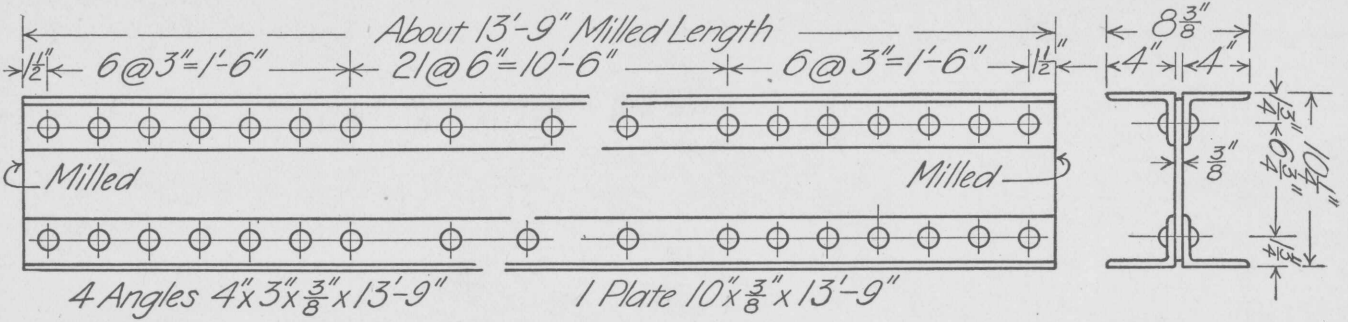


FIG. 1

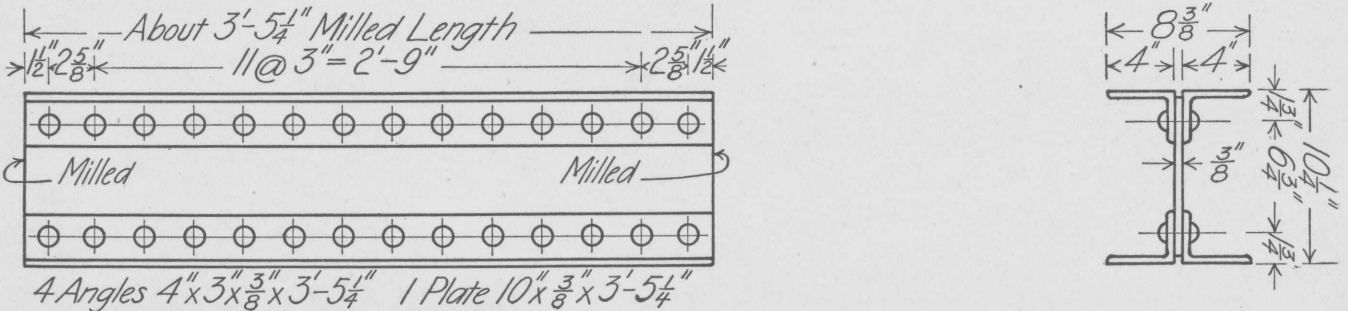
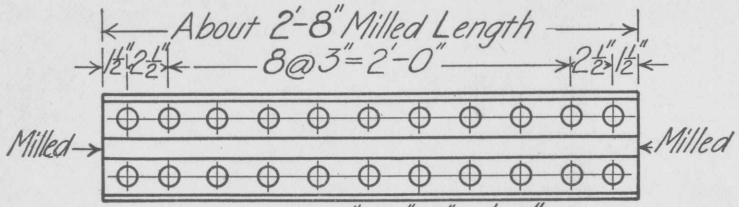


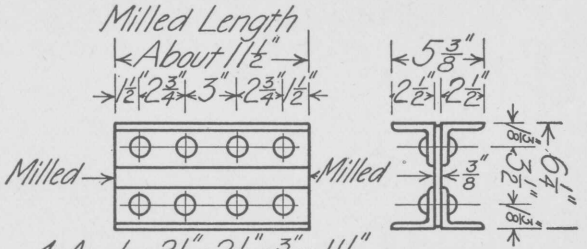
FIG. 2.

All rivets 3/4" diameter



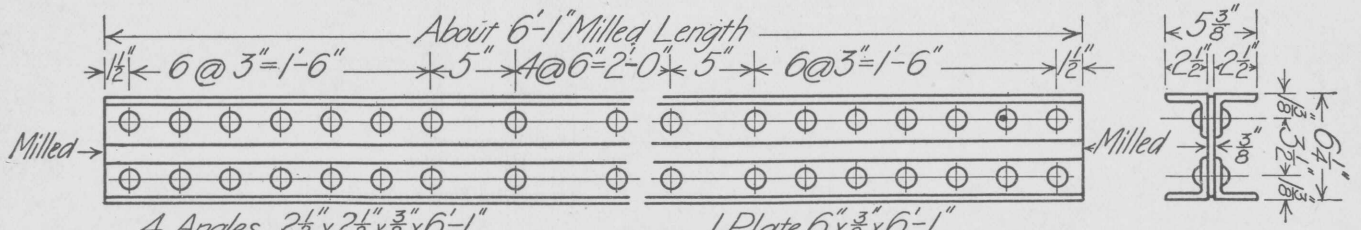
4 Angles 2½"x2½"x⅜"x2'-8"
1 Plate 6"x⅜"x2'-8"

FIG. 4.



4 Angles 2½"x2½"x⅜"x11½"
1 Plate 6"x⅜"x11½"

FIG. 3.



4 Angles 2½"x2½"x⅜"x6'-1"
1 Plate 6"x⅜"x6'-1"

FIG. 5

All rivets ¾" diameter.

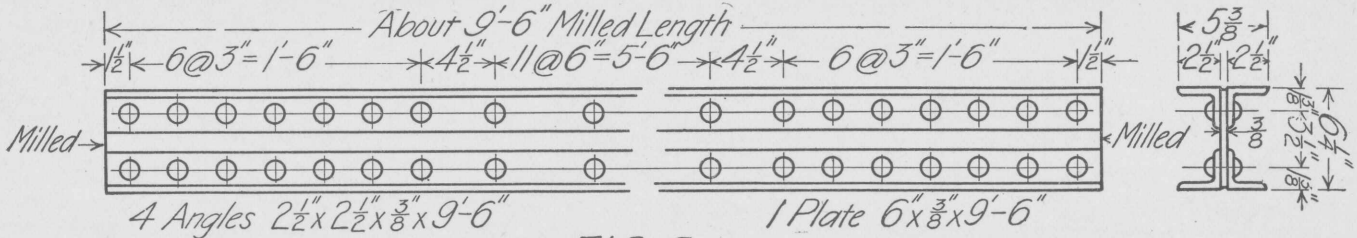


FIG. 6.

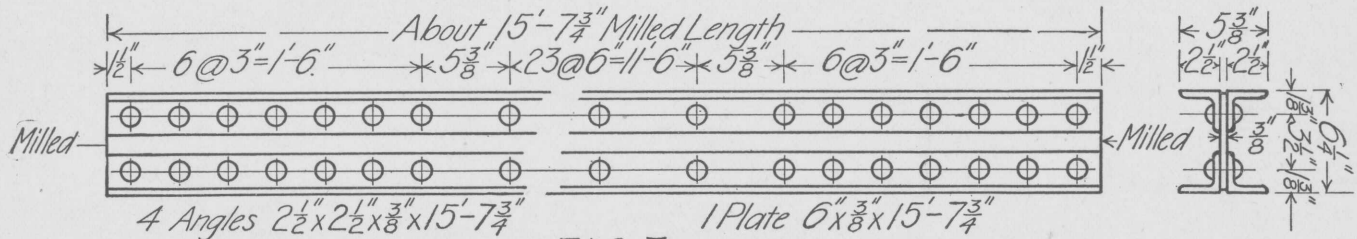


FIG. 7.

All rivets ¾" diameter.

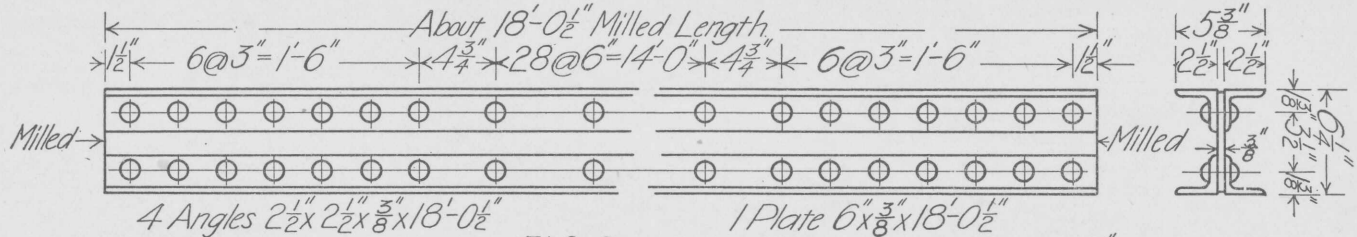


FIG. 8.

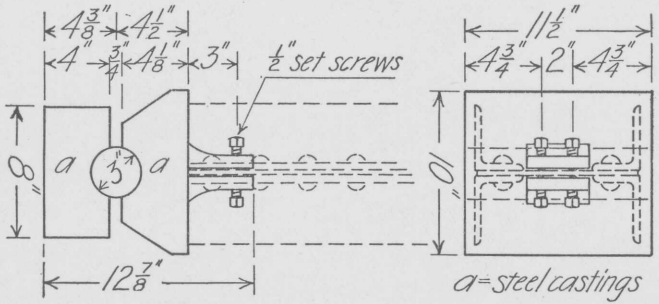


FIG. 9.

Axis of pins in the plane of the web.

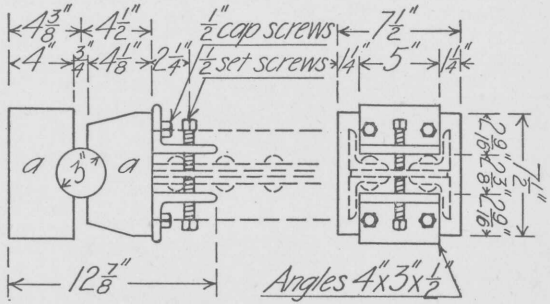


FIG. 10.

No. 2089.

Built I column.
Figure 2. Nickel steel.
Length of column, 3 ft. 5.10 in.
Weight, 160.5 lb.
Sectional area, 13.13 sq. in.
Gaged length, taken on edge of web plate, 20 in.
Flat ends.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
13 130	1 000	0.	0.	
65 650	5 000	.0010	0.	
131 300	10 000	.0038	.0002	
196 950	15 000	.0078	.0007	
262 600	20 000	.0112	.0005	
328 250	25 000	.0167	.0012	Rested under initial load over night.
341 380	26 000	.0178	.....	
354 510	27 000	.0185	.....	
367 640	28 000	.0193	.....	
380 770	29 000	.0196	.....	
393 900	30 000	.0207	.0028	
407 030	31 000	.0224	.....	
420 160	32 000	.0231	.....	
433 290	33 000	.0240	.0030	
446 420	34 000	.0248	.....	
459 550	35 000	.0250	.0031	
472 680	36 000	.0257	.....	
485 810	37 000	.0264	.....	
498 940	38 000	.0269	.0031	
512 070	39 000	.0275	.....	
525 200	40 000	.0283	.0029	
538 330	41 000	.0289	.....	
551 460	42 000	.0300	.....	
564 590	43 000	.0312	.0032	
577 720	44 000	.0321	.....	
590 850	45 000	.0335	.0036	
603 980	46 000	.0345	.....	
617 110	47 000	.0358	.....	
630 240	48 000	.0371	.0046	
643 370	49 000	.0398	.....	
656 500	50 000	.0415	.0057	Elastic limit; approximate.
669 630	51 000	.0460	.....	
682 760	52 000	.0535	.....	
695 890	53 000	.0640	.0263	
709 020	54 000	.0840	.....	
718 500	54 722	.....	.....	Ultimate strength.

The column failed by buckling the flanges and web plate.

No. 2090.

Built I column.
Figure 2. Nickel steel.
Length of column, 3 ft. 5.05 in.
Weight, 162.5 lb.
Sectional area, 13.32 sq. in.
Gaged length, taken on edge of web plate, 20 in.
Flat ends.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
13 320	1 000	0.	0.	
66 600	5 000	.0021	0.	
133 200	10 000	.0055	.0002	
199 800	15 000	.0090	.0003	
266 400	20 000	.0126	.0002	
333 000	25 000	.0163	.0003	
399 600	30 000	.0200	.0003	
466 200	35 000	.0236	.0007	
532 800	40 000	.0277	.0013	
546 120	41 000	.0287	.....	
559 440	42 000	.0295	.....	
572 760	43 000	.0305	.0016	
586 080	44 000	.0315	.....	
599 400	45 000	.0325	.0023	
612 720	46 000	.0337	.....	
626 040	47 000	.0347	.....	
639 360	48 000	.0361	.0033	
652 680	49 000	.0374	.....	
666 000	50 000	.0388	.0045	Elastic limit; approximate.
679 320	51 000	.0409	.....	
692 640	52 000	.0450	.....	
705 960	53 000	.0540	.0174	
719 280	54 000	.0730	.....	
725 800	54 420	.....	.....	Ultimate strength.

The column failed by buckling the flanges and web plates.

No. 2091.

Built I column.
Figure 2. Nickel steel.
Length of column, 3 ft. 5.10 in.
Weight, 161 lb.
Sectional area, 13.17 sq. in.
Gaged length, taken on edge of web plate, 20 in.
Flat ends.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
13 170	1 000	0.	0.	
65 850	5 000	.0022	0.	
131 700	10 000	.0057	0.	
197 550	15 000	.0093	.0002	
263 400	20 000	.0129	.0002	
329 250	25 000	.0165	.0002	
395 100	30 000	.0201	.0002	
460 950	35 000	.0238	.0004	
526 800	40 000	.0280	.0008	
539 970	41 000	.0287	.....	
553 140	42 000	.0297	.....	
566 310	43 000	.0304	.0010	
579 480	44 000	.0315	.....	
592 650	45 000	.0323	.0015	
605 820	46 000	.0335	.....	
618 990	47 000	.0347	.....	
632 160	48 000	.0358	.0028	
645 330	49 000	.0375	.....	Elastic limit; approximate.
658 500	50 000	.0391	.0044	
671 670	51 000	.0424	.....	
684 840	52 000	.0485	.....	
698 010	53 000	.0570	.0201	
711 180	54 000	.0730	.....	
716 300	54 380	.....	.....	Ultimate strength.

The column failed by buckling the flanges and web 14 in. from end.

No. 2092.

Built I column.
Figure 4. Nickel steel.
Length of column, 2 ft. 7.95 in.
Weight, 88 lb.
Sectional area, 9.06 sq. in.
Gaged length, taken on edge of web plate, 20 in.
Pin ends: Figure 10.
Length from center to center of pins, 3 ft. 4.95 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
9 060	1 000	0.	0.	
45 300	5 000	.0027	.0003	
90 600	10 000	.0064	.0005	
135 900	15 000	.0099	.0005	
181 200	20 000	.0135	.0005	
226 500	25 000	.0168	.0003	
271 800	30 000	.0205	.0005	
317 100	35 000	.0245	.0010	
362 400	40 000	.0288	.0016	
371 460	41 000	.0301	.....	
380 520	42 000	.0312	.....	
389 580	43 000	.0322	.0030	
398 640	44 000	.0328	.....	
407 700	45 000	.0350	.0042	
416 760	46 000	.0367	.....	
425 820	47 000	.0388	.....	Elastic limit; approximate.
434 880	48 000	.0430	.0102	
443 940	49 000	.0483	.....	
453 000	50 000	.0555	.0209	
462 060	51 000	.0657	.....	
471 120	52 000	.0870	.....	
474 700	52 400	.....	.....	Ultimate strength.

Pins vertical. The column deflected sidewise (to west) at middle of length.

No. 2093.

Built I column.
Figure 4. Nickel steel.
Length of column, 2 ft. 7.97 in.
Weight, 88 lb.
Sectional area, 9.05 sq. in.
Gaged length, taken on edge of web plate, 20 in.
Pin ends: Figure 10.
Length from center to center of pins, 3 ft. 4.97 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
9 055	1 000	0.	0.	
45 275	5 000	.0028	.0004	
90 550	10 000	.0063	.0004	
135 825	15 000	.0100	.0005	
181 100	20 000	.0135	.0004	
226 375	25 000	.0174	.0006	
271 650	30 000	.0210	.0007	
316 925	35 000	.0250	.0011	
344 090	38 000	.0277	.....	
362 200	40 000	.0297	.0025	
371 255	41 000	.0310	.....	
380 310	42 000	.0322	.....	
389 365	43 000	.0334	.0042	
398 420	44 000	.0352	.....	
407 475	45 000	.0367	.0060	Elastic limit; approximate.
416 530	46 000	.0395	.....	
425 585	47 000	.0420	.....	
434 640	48 000	.0470	.0150	
443 695	49 000	.0565	.....	
452 300	49 950	.....	.....	Ultimate strength.

Pins vertical. The column deflected sidewise (to west) at middle of length.

No. 2094.

Built I column.
Figure 4. Nickel steel.
Length of column, 2 ft. 7.92 in.
Weight, 88 lb.
Sectional area, 9.07 sq. in.
Gaged length, taken on edge of web plate, 20 in.
Pin ends: Figure 10.
Length from center to center of pins, 3 ft. 4.92 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
9 070	1 000	0.	0.	
45 350	5 000	.0008	.0003	
90 700	10 000	.0037	.0007	
136 050	15 000	.0070	.0005	
181 400	20 000	.0107	.0007	
226 750	25 000	.0146	.0009	
272 100	30 000	.0188	.0010	
317 450	35 000	.0235	.0015	
344 660	38 000	.0268	.0023	
362 800	40 000	.0297	.0030	
371 870	41 000	.0312	.....	
380 940	42 000	.0325	.....	
390 010	43 000	.0338	.0047	
399 080	44 000	.0355	.....	
408 150	45 000	.0370	.0059	
417 220	46 000	.0389	.....	Elastic limit; approximate.
426 290	47 000	.0413	.....	
435 360	48 000	.0451	.0125	
444 430	49 000	.0515	.....	
453 500	50 000	.0595	.0250	
462 570	51 000	.0735	.....	
471 640	52 000	.0890	.0533	
471 900	52 030	.....	.....	Ultimate strength.

Pins vertical. The column deflected sidewise (to west) at middle of length.

No. 2095–1.

Built I column.
Figure 3. Nickel steel.
Length of column, 11.40 in.
Weight, 32 lb.
Sectional area, 9.24 sq. in.
Pin ends: Figure 10.
Length from center to center of pins, 20.40 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb. 705 900	*Lb.* 76 396	*In.*	*In.*	Ultimate strength.

The column failed by buckling the flanges and web plate.

No. 2095–2

Built I column.
Figure 3. Nickel steel.
Length of column, 11.48 in.
Weight, 32 lb.
Sectional area, 9.17 sq. in.
Pin ends: Figure 10.
Length from center to center of pins, 20.48 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb. 722 200	*Lb.* 78 756	*In.*	*In.*	Ultimate strength.

The column failed by buckling the flanges and web plate.

No. 2095–3.

Built I column.
Figure 3. Nickel steel.
Length of column, 11.40 in.
Weight, 32 lb.
Sectional area, 9.24 sq. in.
Pin ends: Figure 10.
Length from center to center of pins, 20.40 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb. 710 100	*Lb.* 76 396	*In.*	*In.*	Ultimate strength.

The column failed by buckling the flanges and web plate.

No. 2096–1.

Built I column.
Figure 3. 60 000-lb. carbon steel.
Length of column, 11.40 in.
Weight, 31 lb.
Sectional area, 8.93 sq. in.
Pin ends: Figure 10.
Length from center to center of pins, 20.40 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb. 495 300	*Lb.* 55 464	*In.*	*In.*	Ultimate strength.

The column failed by buckling the flanges and web plate.

No. 2096–2.

Built I column.
Figure 3. 60 000-lb. carbon steel.
Length of column, 11.40 in.
Weight, 31 lb.
Sectional area, 8.93 sq. in.
Pin ends: Figure 10.
Length from center to center of pins, 20.40 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in	Compression.	Set.	
Lb. 496 700	*Lb.* 55 621	*In.*	*In.*	Ultimate strength.

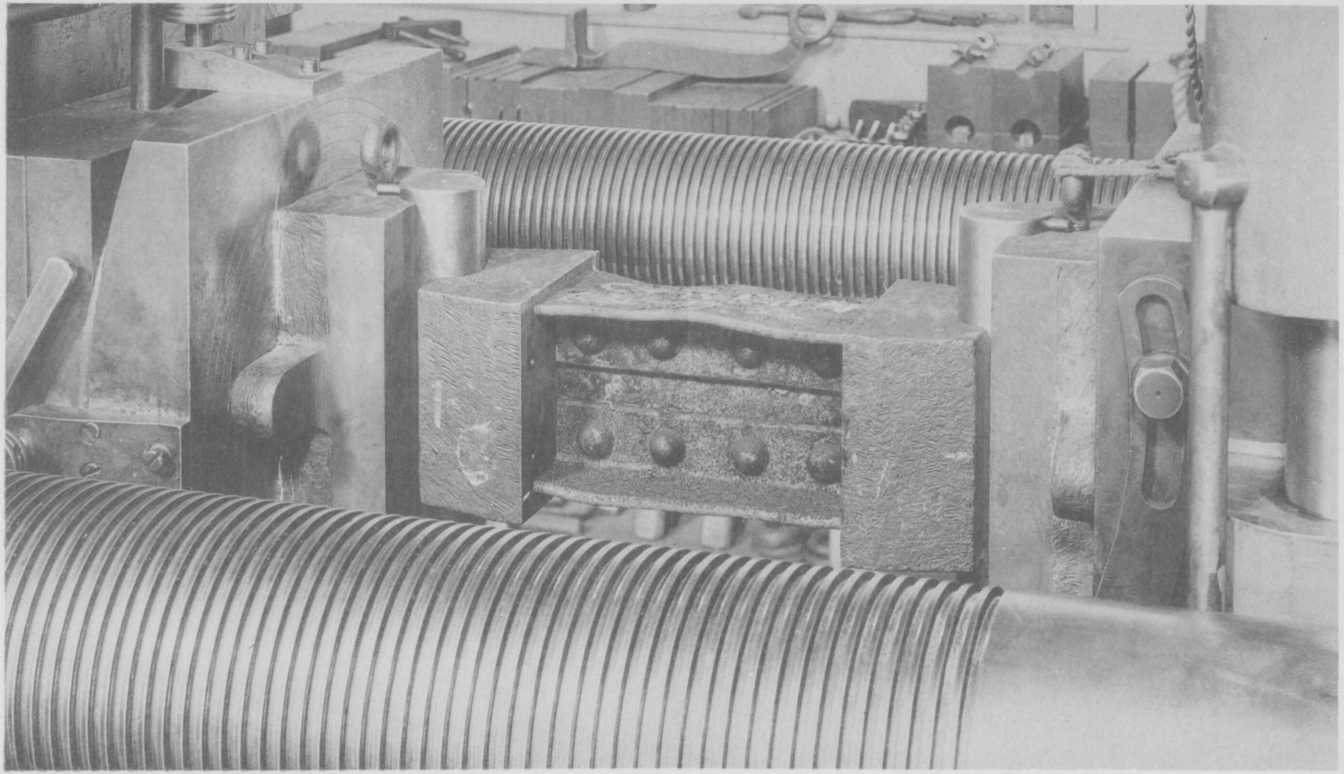
The column failed by buckling the flanges and web plate.

No. 2096–3.

Built I column.
Figure 3. 60 000-lb. carbon steel.
Length of column, 11.42 in.
Weight, 31.5 lb.
Sectional area, 9.06 sq. in.
Pin ends: Figure 10.
Length from center to center of pins, 20.42 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb. 490 400	*Lb.* 54 128	*In.*	*In.*	Ultimate strength.

The column failed by buckling the flanges and web plate.



MANNER OF FAILURE FOR STEEL COLUMN 11.4 INCHES LONG.

TESTS No. 2096–1
2096–2
2096–3

No. 2097–1.

Built I column.
Figure 3. 70 000-lb. carbon steel.
Length of column, 11.42 in.
Weight, 32 lb.
Sectional area, 9.22 sq. in.
Pin ends: Figure 10.
Length from center to center of pins, 20.42 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb. 477 200	*Lb.* 51 636	*In.*	*In.*	Ultimate strength.

Pins vertical. The column failed by buckling the flanges on one side of plate and deflecting sidewise at middle of length.

No. 2097–2.

Built I column.
Figure 3. 70 000-lb. carbon steel.
Length of column, 11.40 in.
Weight, 32 lb.
Sectional area, 9.23 sq. in.
Pin ends: Figure 10.
Length from center to center of pins, 20.40 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb. 598 500	*Lb.* 64 842	*In.*	*In.*	Ultimate strength.

The column failed by buckling the flanges and web plate.

No. 2097–3.

Built I column.
Figure 3. 70 000-lb. carbon steel.
Length of column, 11.42 in.
Weight, 32 lb.
Sectional area, 9.22 sq. in.
Pin ends: Figure 10.
Length from center to center of pins, 20.42 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb. 601 700	*Lb.* 65 260	*In.*	*In.*	Ultimate strength.

The column failed by buckling the flanges and web plate.

No. 2098.

Built I column.
Figure 2. 70 000-lb. carbon steel.
Length of column, 3 ft. 5 in.
Weight, 161 lb.
Sectional area, 13.20 sq. in.
Gaged length, taken on edge of web plate, 20 in.
Flat ends.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
13 200	1 000	0.	0.	Initial load.
66 000	5 000	.0026	.0003	
132 000	10 000	.0061	.0003	
198 000	15 000	.0100	.0005	
264 000	20 000	.0133	.0005	
330 000	25 000	.0171	.0007	
369 600	28 000	.0197	.....	
396 000	30 000	.0215	.0015	
409 200	31 000	.0225	.....	
422 400	32 000	.0239	.....	
435 600	33 000	.0250	.0028	Scaling begins.
448 800	34 000	.0265	.....	Elastic limit.
462 000	35 000	.0287	.0052	
475 200	36 000	.0313	.....	
488 400	37 000	.0367	.....	
501 600	38 000	.0540	.0285	
514 800	39 000	.0830	.....	
523 600	39 666	.....	.....	Ultimate strength.

The column failed by buckling the flanges.

No. 2099.

Built I column.
Figure 2. 70 000-lb. carbon steel.
Length of column, 3 ft. 5.05 in.
Weight, 162 lb.
Sectional area, 13.27 sq. in.
Gaged length, taken on edge of web plate, 20 in.
Flat ends.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
13 270	1 000	0.	0.	Initial load.
66 350	5 000	.0020	.0002	
132 700	10 000	.0050	.0005	
199 050	15 000	.0090	.0005	
265 400	20 000	.0127	.0007	
331 750	25 000	.0165	.0008	
371 560	28 000	.0192	.0010	
398 100	30 000	.0210	.0014	
411 370	31 000	.0220	.....	
424 640	32 000	.0232	.....	
437 910	33 000	.0243	.0022	
451 180	34 000	.0260	.....	
464 450	35 000	.0276	.0040	Elastic limit.
477 720	36 000	.0300	.....	
490 990	37 000	.0353	.....	
504 260	38 000	.0455	.0203	
517 530	39 000	.0625	.....	
536 800	40 452	.....	.....	Ultimate strength.

The column failed by buckling the flanges and web plate.

No. 2100.

Built I column.
Figure 2. 70 000-lb. carbon steel.
Length of column, 3 ft. 5 in.
Weight, 162 lb.
Sectional area, 13.29 sq. in.
Gaged length, taken on edge of web plate, 20 in.
Flat ends.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
13 290	1 000	0.	0.	
66 450	5 000	.0020	0.	
132 900	10 000	.0052	0.	
199 350	15 000	.0086	.0001	
265 800	20 000	.0121	.0002	
332 250	25 000	.0161	.0003	
372 120	28 000	.0188	.0007	
398 700	30 000	.0207	.0010	
411 990	31 000	.0215	.....	
425 280	32 000	.0227	.....	
438 570	33 000	.0240	.0017	
451 860	34 000	.0252	.....	Elastic limit
465 150	35 000	.0272	.0030	
478 440	36 000	.0298	.....	
491 730	37 000	.0345	.....	
505 020	38 000	.0438	.0188	
518 310	39 000	.0660	.....	
554 700	41 738	.....	.....	Ultimate strength

The column failed by buckling the flanges and web plate.

No. 2101.

Built I column.
Figure 4. 60 000-lb. carbon steel.
Length of column, 2 ft. 7.91 in.
Weight, 87 lb.
Sectional area, 8.96 sq. in.
Gaged length, taken on edge of web plate, 20 in.
Pin ends: Figure 10.
Length from center to center of pins, 3 ft. 4.91 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
8 960	1 000	0.	0.	
44 800	5 000	.0025	0.	
89 600	10 000	.0057	0.	
134 400	15 000	.0092	.0002	
179 200	20 000	.0132	.0007	
224 000	25 000	.0185	.0020	
232 960	26 000	.0197	.....	
241 920	27 000	.0211	.....	
250 880	28 000	.0227	.0040	
259 840	29 000	.0245	.....	Elastic limi
268 800	30 000	.0270	.0067	
277 760	31 000	.0306	.....	
286 720	32 000	.0355	.....	
295 680	33 000	.0425	.0202	
304 640	34 000	.0584	.....	
313 600	35 000	.0850	.0680	
345 600	38 570	.....	.....	Ultimate strength.

Pins vertical. The column deflected sidewise (to east) at about middle of length.

No. 2102.

Built I column.
Figure 4. 60 000-lb. carbon steel.
Length of column, 2 ft. 7.94 in.
Weight, 87.5 lb.
Sectional area, 9.01 sq. in.
Gaged length, taken on edge of web plate, 20 in.
Pin ends: Figure 10.
Length from center to center of pins, 3 ft. 4.94 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
9 010	1 000	0.	0.	
45 050	5 000	.0012	.0002	
90 100	10 000	.0041	.0005	
135 150	15 000	.0080	.0006	
180 200	20 000	.0123	.0012	
207 230	23 000	.0155	.0018	Rested about 41 hours.
9 010	1 000	.0017	.....	
207, 230	23 000	.0155	.0017	
216 240	24 000	.0164	.....	
225 250	25 000	.0173	.0020	
234 260	26 000	.0190	.....	
243 270	27 000	.0205	.....	
252 280	28 000	.0219	.0035	
261 290	29 000	.0238	.....	
270 300	30 000	.0255	.0055	Elastic limit.
279 310	31 000	.0288	.....	
288 320	32 000	.0318	.....	
297 330	33 000	.0355	.0140	
306 340	34 000	.0440	.....	
315 350	35 000	.0760	.0545	
324 360	36 000	.1250	.1015	
366 800	40 710	.....	.....	Ultimate strength.

Pins vertical. The column buckled the flange and deflected sidewise (to west) at middle of length.

No. 2103.

Built I column.
Figure 4. 60 000-lb. carbon steel.
Length of column, 2 ft. 7.92 in.
Weight, 87 lb.
Sectional area, 8.96 sq. in.
Gaged length, taken on edge of web plate, 20 in.
Pin ends: Figure 10.
Length from center to center of pins, 3 ft. 4.92 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
8 960	1 000	0.	0.	
44 800	5 000	.0020	.0002	
89 600	10 000	.0067	.0003	
134 400	15 000	.0105	.0005	
179 200	20 000	.0145	.0010	
206 080	23 000	.0172	.0015	
224 000	25 000	.0190	.0020	
232 960	26 000	.0198	.....	
241 920	27 000	.0210	.....	
250 880	28 000	.0222	.0035	
259 840	29,000	.0240	.....	
268 800	30 000	.0261	.0057	
277 760	31 000	.0287	.....	Elastic limit.
286 720	32 000	.0330	.....	
295 680	33 000	.0408	.0178	
304 640	34 000	.0495	.....	
313 600	35 000	.0730	.0525	
322 560	36 000	.1390	.1155	
338 800	37 810	.....	.....	Ultimate strength.

Pins vertical. The column deflected sidewise (to east) at middle of length.

No. 2104.

Built I column.
Figure 4. 70 000-lb. carbon steel.
Length of column, 2 ft. 7.90 in.
Weight, 89 lb.
Sectional area, 9.19 sq. in.
Gaged length, taken on edge of web plate, 20 in.
Pin ends: Figure 10.
Length from center to center of pins, 3 ft. 4.90 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
9 190	1 000	0.	0.	
45 950	5 000	.0020	.0002	
91 900	10 000	.0050	0.	
137 850	15 000	.0086	.0003	
183 800	20 000	.0124	.0005	
229 750	25 000	.0168	.0011	
257 320	28 000	.0202	.0018	
275 700	30 000	.0225	.0027	
284 890	31 000	.0239	.....	
294 080	32 000	.0255	.....	
303 270	33 000	.0266	.0045	Elastic limit, approximate.
312 460	34 000	.0287	.....	
321 650	35 000	.0311	.0070	
330 840	36 000	.0340	.....	
340 030	37 000	.0375	.....	
349 220	38 000	.0425	.0160	
358 410	39 000	.0490	.....	
367 600	40 000	.0595	.0317	
376 790	41 000	.0785	.....	
385 980	42 000	.1150	.0875	
452 800	49 270	.....	.....	Ultimate strength.

Pins vertical. The column deflected sidewise (to west) at middle of length.

No. 2105.

Built I column.
Figure 4. 70 000-lb. carbon steel.
Length of column, 2 ft. 7.90 in.
Weight, 88.5 lb.
Sectional area, 9.13 sq. in.
Gaged length, taken on edge of web plate, 20 in.
Pin ends: Figure 10.
Length from center to center of pins, 3 ft. 4.90 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
9 130	1 000	0.	0.	
45 650	5 000	.0019	.0005	
91 300	10 000	.0054	.0006	
136 950	15 000	.0090	.0007	
182 600	20 000	.0132	.0010	
228 250	25 000	.0180	.0014	
255 640	28 000	.0204	.0020	
273 900	30 000	.0220	.0025	
283,030	31 000	.0235	.....	
292 160	32 000	.0246	.....	
301 290	33 000	.0257	.0035	
310 420	34 000	.0270	.....	
319 550	35 000	.0288	.0051	Rested 1.5 hours.
328 680	36 000	.0307	.....	Elastic limit.
337 810	37 000	.0345	.....	
346 940	38 000	.0415	.0162	Scaling begins.
356 070	39 000	.0499	.....	
365 200	40 000	.0600	.0343	
374 330	41 000	.0755	.....	
383 460	42 000	.1340	.1045	
445 100	48 740	.....	.....	Ultimate strength.

Pins vertical. Column deflected sidewise (to east) at middle of length.

68604°—H. Doc. 1089, 61-3——12

No. 2106.

Built I column.
Figure 4. 70 000-lb. carbon steel.
Length of column, 2 ft. 7.91 in.
Weight, 89 lb.
Sectional area, 9.18 sq. in.
Gaged length, taken on edge of web plate, 20 in.
Pin ends: Figure 10.
Length, from center to center of pins, 3 ft. 4.91 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
9 180	1 000	0.	0.	
45 900	5 000	.0011	0.	
91 800	10 000	.0040	.0002	
137 700	15 000	.0075	.0002	
183 600	20 000	.0114	.0003	
229 500	25 000	.0155	.0003	
257 040	28 000	.0180	.0007	
275 400	30 000	.0203	.0011	
284 580	31 000	.0215	.....	
293 760	32 000	.0225	.....	
302 940	33 000	.0240	.0023	
312 120	34 000	.0260	.....	
321 300	35 000	.0275	.0040	Elastic limit; approximate.
330 480	36 000	.0297	.....	
339 660	37 000	.0335	.....	Scaling begins.
348 840	38 000	.0395	.0138	
358 020	39 000	.0452	.....	
367 200	40 000	.0575	.0315	
376 380	41 000	.0850	.....	
385 560	42 000	.1341	.1060	
448 800	48 880	.....	.....	Ultimate strength.

Pins vertical. Column deflected sidewise (to east) at middle of length.

No. 2107.

Built I column.
Figure 5. 70 000-lb. carbon steel.
Length of column, 6 ft. 0.90 in.
Weight, 200.5 lb.
Sectional area, 9.21 sq. in.
Gaged length, taken on edge of web plate, 50 in.
Pin ends: Figure 10.
Length from center to center of pins, 6 ft. 9.90 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
9 210	1 000	0.	0.	
46 050	5 000	.0050	.0009	
92 100	10 000	.0130	.0010	
138 150	15 000	.0210	.0012	
9 210	1 000	.0005	.....	Rested under initial load 1 hour. Micrometer reset at .1988 in.
138 150	15 000	.0225	.0025	
184 200	20 000	.0325	.0027	
230 250	25 000	.0411	.0040	
257 880	28 000	.0470	.0050	
276 300	30 000	.0525	.0062	
285 510	31 000	.0550	.....	
294 720	32 000	.0576	.....	
303 930	33 000	.0610	.0095	
313 140	34 000	.0655	.....	
322 350	35 000	.0715	.0170	
331 560	36 000	.0825	.....	Scaling begins.
340 770	37 000	.0960	.....	
348 800	37 870	.....	.....	Ultimate strength.

Pins vertical. Sudden springing of the column sidewise (to west) occurred when maximum load was reached.

No. 2108.

Built I column.
Figure 5. 70 000-lb. carbon steel.
Length of column, 6 ft. 0.90 in.
Weight, 200.5 lb.
Sectional area, 9.21 sq. in.
Gaged length, taken on edge of web plate, 50 in.
Pin ends: Figure 10.
Length from center to center of pins, 6 ft. 9.90 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
9 210	1 000	0.	0.	
46 050	5 000	.0120	0.	
92 100	10 000	.0220	.0002	
138 150	15 000	.0310	.0004	
184 200	20 000	.0401	.0013	
230 250	25 000	.0494	.0030	
257 880	28 000	.0554	.0050	
276 300	30 000	.0597	.0065	
285 510	31 000	.0624	.....	
294 720	32 000	.0650	.....	
303 930	33 000	.0678	.0105	
313 140	34 000	.0712	.....	
322 350	35 000	.0755	.0151	
331 560	36 000	.0810	.....	
340 770	37 000	.0925	.....	Scaling begins.
349 500	37 940	.....	.....	Ultimate strength.

Pins vertical. Sudden springing of the column sidewise (to west) occurred when maximum load was reached.

No. 2109.

Built I column.
Figure 5. 70 000-lb. carbon steel.
Length of column, 6 ft. 0.91 in.
Weight, 201.5 lb.
Sectional area, 9.25 sq. in.
Gaged length, taken on edge of web plate, 50 in.
Pin ends: Figure 10.
Length from center to center of pins, 6 ft. 9.90 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
9 250	1 000	0.	0.	
46 250	5 000	.0038	0.	
92 500	10 000	.0120	0.	
138 750	15 000	.0208	0.	
185 000	20 000	.0300	.0002	
231 250	25 000	.0400	.0007	
259 000	28 000	.0464	.0015	
.....	1 000	.0025	.....	Rested under initial load over night.
259 000	28 000	.0480	.0028	
277 500	30 000	.0528	.0037	
286 750	31 000	.0555	.....	
296 000	32 000	.0585	.....	
305 250	33 000	.0620	.0065	
314 500	34 000	.0661	.....	
323 750	35 000	.0704	.0108	
333 000	36 000	.0745	.....	
342 250	37 000	.0810	.....	
351 500	38 000	.0915	.0262	
358 700	38 770	.....	.....	Ultimate strength.

Pins vertical. Sudden springing of the column sidewise (to east) occurred when maximum load was reached.

No. 2110.

Built I column.
Figure 5. Supposed to be 60 000-lb. carbon steel.
Length of column, 6 ft. 0.96 in.
Weight, 197 lb.
Sectional area, 9.03 sq. in.
Gaged length, taken on edge of web plate, 50 in.
Pin ends: Figure 10.
Length, from center to center of pins, 6 ft. 9.96 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
9 030	1 000	0.	0.	
45 150	5 000	.0050	0.	
90 300	10 000	.0135	0.	
135 450	15 000	.0230	.0005	
180 600	20 000	.0330	.0015	
225 750	25 000	.0453	.0045	
234 780	26 000	.0480	.....	
243 810	27 000	.0510	.....	
252 840	28 000	.0541	.0075	
261 870	29 000	.0580	.....	
270 900	30 000	.0620	.0115	
279 930	31 000	.0675	.....	
288 960	32 000	.0770	.....	
297 990	33 000	.0940	.0135	
302 500	33 490	.....	.....	Ultimate strength.

Pins vertical. Column deflected sidewise (to east) at middle of length.

No. 2111.

Built I column.
Figure 5. Supposed to be 60 000-lb. carbon steel.
Length of column, 6 ft. 0.96 in.
Weight, 196 lb.
Sectional area, 8.98 sq. in.
Gaged length, taken on edge of web plate, 50 in.
Pin ends: Figure 10.
Length, from center to center of pins, 6 ft. 9.96 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
8 980	1 000	0.	0.	
44 900	5 000	.0055	0.	
89 800	10 000	.0141	0.	
134 700	15 000	.0235	.0005	
179 600	20 000	.0340	.0020	
206 540	23 000	.0410	.0035	
215 520	24 000	.0438	.....	
224 500	25 000	.0460	.0050	
233 480	26 000	.0490	.....	
242 460	27 000	.0520	.....	
251 440	28 000	.0550	.0085	
260 420	29 000	.0590	.....	
269 400	30 000	.0630	.0125	
278 380	31 000	.0680	.....	
287 360	32 000	.0740	.....	
296 340	33 000	.0860	.0300	
307 500	34 240	.....	.....	Ultimate strength.

Pins vertical. Column deflected sidewise (to west) at middle of length.

No. 2112.

Built I column.
Figure 5. Supposed to be 60 000-lb. carbon steel.
Length of column, 6 ft. 0.93 in.
Weight, 196 lb.
Sectional area, 8.99 sq. in.
Gaged length, taken on edge of web plate, 50 in.
Pin ends: Figure 10.
Length, from center to center of pins, 6 ft. 9.93 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
8 990	1 000	0.	0.	
44 950	5 000	.0054	0.	
89 900	10 000	.0138	0.	
134 850	15 000	.0230	.0005	
179 800	20 000	.0325	.0015	
206 770	23 000	.0395	.0025	
215 760	24 000	.0420	.....	
224 750	25 000	.0445	.0038	
233 740	26 000	.0473	.....	
242 730	27 000	.0500	.....	
251 720	28 000	.0530	.0068	
260 700	29 000	.0565	.....	
269 700	30 000	.0600	.0101	
278 690	31 000	.0645	.....	
287 680	32 000	.0710	.....	
296 670	33 000	.0830	.0280	
303 600	33 770	.....	.....	Ultimate strength.

Pins vertical. Column deflected sidewise (to west) at middle of length.

No. 2113.

Built I column.
Figure 5. Nickel steel.
Length of column, 6 ft. 0.90 in.
Weight, 198 lb.
Sectional area, 9.09 sq. in.
Gaged length, taken on edge of web plate, 50 in.
Pin ends: Figure 10.
Length from center to center of pins, 6 ft. 9.90 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
9 090	1 000	0.	0.	
45 450	5 000	.0065	0.	
90 900	10 000	.0150	−.0002	
136 350	15 000	.0240	−.0001	
181 800	20 000	.0325	0.	
209 070	23 000	.0380	0.	
227 250	25 000	.0415	.0001	
254 520	28 000	.0472	.0004	
272 700	30 000	.0510	.0006	
299 970	33 000	.0567	.0011	
318 150	35 000	.0610	.0015	
327 240	36 000	.0630	.....	
336 330	37 000	.0652	.....	
345 420	38 000	.0675	.0038	
354 510	39 000	.0690	.....	
363 600	40 000	.0720	.0040	
372 690	41 000	.0745	.....	
381 780	42 000	.0770	.....	
390 870	43 000	.0797	.0065	Elastic limit; approximate.
399 960	44 000	.0832	.....	
409 050	45 000	.0868	.0100	
418 140	46 000	.0910	.....	
427 230	47 000	.0975	.....	
436 320	48 000	.1085	.0260	
439 900	48 390	.....	.....	Ultimate strength.

Pins vertical. Sudden springing of the column (to west) occurred when maximum load was reached.

No. 2114.

Built I column.
Figure 5. Nickel steel.
Length of column, 6 ft. 0.98 in.
Weight, 198 lb.
Sectional area, 9.08 sq. in.
Gaged length, taken on edge of web plate, 50 in.
Pin ends: Figure 10.
Length, from center to center of pins, 6 ft. 9.98 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
9 080	1 000	0.	0.	
45 400	5 000	.0060	0.	
90 800	10 000	.0142	0.	
136 200	15 000	.0230	0.	
181 600	20 000	.0320	0.	
227 000	25 000	.0408	.0004	
272 400	30 000	.0505	.0010	
299 640	33 000	.0570	.0019	
317 800	35 000	.0610	.0025	
345 040	38 000	.0685	.0043	
354 120	39 000	.0708	.....	
363 200	40 000	.0738	.0057	
372 280	41 000	.0768	.....	
381 360	42 000	.0795	.....	
390 440	43 000	.0825	.0091	Elastic limit; approximate.
399 520	44 000	.0862	.....	
408 600	45 000	.0900	.0125	
417 680	46 000	.0950	.....	
426 760	47 000	.1020	.0250	
439 800	48 430	.....	.....	Ultimate strength.

Pins vertical. Sudden springing of the column (to west) occurred when maximum load was reached.

No. 2115.

Built I column.
Figure 5. Nickel steel.
Length of column, 6 ft. 0.98 in.
Weight, 198 lb.
Sectional area, 9.08 sq. in.
Gaged length, taken on edge of web plate, 50 in.
Pin ends: Figure 10.
Length, from center to center of pins, 6 ft. 9.98 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
9 080	1 000	0.	0.	
45 400	5 000	.0061	0.	
90 800	10 000	.0150	0.	
136 200	15 000	.0240	0.	
181 600	20 000	.0330	0.	
227 000	25 000	.0420	.0002	
272 400	30 000	.0520	.0011	
299 640	33 000	.0580	.0020	
317 800	35 000	.0626	.0028	
345 040	38 000	.0698	.0045	
354 120	39 000	.0725	.....	
363 200	40 000	.0755	.0061	
372 280	41 000	.0782	.....	
381 360	42 000	.0813	.....	
390 440	43 000	.0841	.0097	Elastic limit; approximate.
399 520	44 000	.0882	.....	
408 600	45 000	.0925	.0145	
417 680	46 000	.0980	.....	
426 760	47 000	.1050	.0255	
439 900	49 450	.....	.....	Ultimate strength.

Pins vertical. Sudden springing of the column (to west) occurred when maximum load was reached.

No. 2116.

Built I column.
Figure 1. 70 000-lb. carbon steel.
Length of column, 13 ft., 8.75 in.
Weight, 654.5 lb.
Sectional area, 13.63 sq. in.
Gaged lengths of 50 in. taken at middle of length of column on the four angles or flanges 0.20 in. from the outer edge.
Compressometer No. 1, on top, east side.
Compressometer No. 2, on top, west side.
Compressometer No. 3, on bottom, west side.
Compressometer No. 4, on bottom, east side.
Initial deflection: Horizontal, 0.10 in. to west on one angle on east side top. Vertical, 0.
Web plate: Horizontal, 0; vertical, 0.02 in. down.
Flat ends.
Counterweighted at middle.

Applied loads.		In gaged length.								Deflections.				Remarks.
		No. 1.		No. 2.		No. 3.		No. 4.						
Total.	Per sq. in.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Horizontal.	Set.	Vertical.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	
13 630	1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
68 150	5 000	.0067	.0002	.0072	.0003	.0065	.0008	.0067	0.	0.	0.	0.	0.	
136 300	10 000	.0156	.0003	.0156	.0004	.0158	.0012	.0151	.0001	0.	0.	0.	0.	
204 450	15 000	.0245	.0005	.0241	.0006	.0245	.0014	.0240	.0002	0.	0.	0.	0.	
272 600	20 000	.0335	.0013	.0329	.0009	.0331	.0017	.0325	.0004	0.	0.	0.	0.	
340 750	25 000	.0438	.0029	.0420	.0018	.0425	.0030	.0375	.0014	0	0.	0.	0.	
381 640	28 000	.0505	.0044	.0482	.0030	.0487	.0042	.0477	.0025	0.	0.	0.	0.	
395 270	29 000	.0530	.....	.0504	.....	.0510	.....	.0498	.....	0.	0.	0.	0.	
408 900	30 000	.0554	.0056	.0525	.0040	.0534	.0053	.0521	.0035	0.	0.	0.	0.	
422 530	31 000	.0582	.....	.0548	.....	.0557	.....	.0549	.....	0.	0.	0.	0.	
436 160	32 000	.0611	.....	.0568	.....	.0575	.....	.0585	.....	0.	0.	0.	0.	
449 790	33 000	.0648	.0095	.0583	.0052	.0583	.0053	.0656	.0112	[1].02	.02	0.	0.	
463 420	34 000	.0730	.0265	.0560	+.0018	.0510	+.0037	.0983	.0362	[1].17	.14	0.	0.	
473 100	34 710	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Ultimate strength.

[1] West.

Column deflected sidewise (to west) at middle of length.

No. 2117.

Built **I** column.
Figure 1. 70 000-lb. carbon steel.
Length of column, 13 ft., 8.84 in.
Weight, 652 lb.
Sectional area, 13.56 sq. in.
Gaged lengths of 50 in. taken at middle of length of column on the four angles or flanges 0.20 in. from the outer edge.
Compressometer No. 1, on top, east side.
Compressometer No. 2, on top, west side.
Compressometer No. 3, on bottom, west side.
Compressometer No. 4, on bottom, east side.
Initial deflection: Horizontal, 0.05 in. to east on one angle on west side top. Vertical, 0.
On web plate: Horizontal, 0; vertical, 0.
Flat ends.
Counterweighted at middle.

Applied loads.		In gaged length.								Deflections.				Remarks.
		No. 1.		No. 2.		No. 3.		No. 4.						
Total.	Per sq. in.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Horizontal.	Set.	Vertical.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	
13 560	1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
67 800	5 000	.0072	.0005	.0072	.0005	.0071	.0018	.0074	.0010	0.	0.	0.	0.	
135 600	10 000	.0162	.0007	.0156	.0009	.0175	.0027	.0157	.0010	0.	0.	0.	0.	
203 400	15 000	.0251	.0010	.0241	.0010	.0268	.0032	.0240	.0008	0.	0.	0.	0.	
271 200	20 000	.0340	.0011	.0332	.0014	.0360	.0036	.0328	.0007	.01	.01	0.	0.	
339 000	25 000	.0430	.0019	.0421	.0021	.0454	.0043	.0425	.0010	.01	.01	0.	0.	
379 680	28 000	.0496	.0031	.0480	.0031	.0515	.0055	.0477	.0020	.01	.01	0.	0.	
393 240	29 000	.0518	.....	.0499	.....	.0538	.....	.0501	.....	.01	.....	0.	.....	
406 800	30 000	.0540	.0040	.0524	.0041	.0560	.0065	.0527	.0030	.01	.01	0.	0.	
420 360	31 000	.0565	.....	.0555	.....	.0585	.....	.0554	.....	.01	.....	0.	.....	
433 920	32 000	.0592	.....	.0585	.....	.0610	.....	.0595	.....	.01	.....	0.	.....	
447 480	33 000	.0620	.0079	.0602	.0069	.0616	.0073	.0660	.0101	0.	0.	0.	0.	
461 040	34 000	.0684	.0155	.0600	.0040	.0593	.0038	.0810	.0200	.08	.08	0.	0.	
463 800	34 200	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Ultimate strength.
447 480	33 000	.0865	.....	.0500	.....	.0490	.....	.0986	.....	.21	.....	0.	0.	
447 480	33 000	.1210	.1000	.0294	−.0300	.0265	+.0285	.1850	.1080	.61	.57	.02	0.	Observations taken at reduced load while column was yielding. Second observation taken 7 minutes after first.
13 560	1 000	.0965	.....	.0325	.....	−.0322	.....	.1049	.....	.59	.....	0.	0.	Rested under initial load over Sunday.
406 800	30 000	.1742	.0973	.0350	−.0322	−.0338	−.0321	.1833	.1055	.85	.59	0.	0.	

Deflected sidewise (to west) at middle of length. Test discontinued.

No. 2119.

Built I column.
Figure 1. Nickel steel.
Length of column, 13 ft., 8.72 in.
Weight, 636 lb.
Sectional area, 13.23 sq. in.
Gaged lengths of 50 in. taken at middle of length of column on the four angles or flanges 0.20 in. from the outer edge.
Compressometer No. 1, on top, east side.
Compressometer No. 2, on top, west side.
Compressometer No. 3, on bottom, west side.
Compressometer No. 4, on bottom, east side.
Initial deflection: Horizontal, 0.10 in. to west, top and bottom east side, vertical, 0.08 in. to 0.12 in. down.
On web plate: Horizontal, 0.03 in. to west; vertical 0.05 in. down.
Flat ends.
Counterweighted at middle.

Applied loads.		In gaged length.								Deflections.				Remarks.
		No. 1.		No. 2.		No. 3.		No. 4.						
Total.	Per sq. in.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Horizontal.	Set.	Vertical.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	
13 230	1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
66 150	5 000	.0100	.0020	.0075	.0003	.0085	.0005	.0075	.0007	0.	0.	0.	0.	
132 300	10 000	.0197	.0025	.0167	.0003	.0175	.0007	.0172	.0006	0.	0.	0.	0.	
198 450	15 000	.0285	.0035	.0260	.0005	.0268	.0012	.0260	.0007	0.	0.	0.	0.	
264 600	20 000	.0380	.0045	.0350	.0008	.0355	.0015	.0355	.0012	0.	0.	0.	0.	Rested under initial load over noon.
330 750	25 000	.0435	.0038	.0435	.0005	.0436	.0013	.0442	.0020	0.	0.	[2].03	.02	
370 440	28 000	.0500	.0040	.0490	.0005	.0490	.0015	.0485	.0030	0.	0.	.02	.02	
383 670	29 000	.0530	.....	.0505	.....	.0505	.....	.0500	.....	0.	.....	.02	.....	
396 900	30 000	.0535	.0040	.0520	.0006	.0524	.0015	.0514	.0030	0.	0.	.02	.02	
410 130	31 000	.0560	.....	.0540	.....	.0540	.....	.0538	.....	0.	.....	.02	.....	
423 360	32 000	.0570	.....	.0560	.....	.0560	.....	.0552	.....	0.	.....	.02	.....	
436 590	33 000	.0583	.0040	.0580	.0012	.0578	.0022	.0575	.0020	0.	0.	.02	.02	
449 820	34 000	.0585	.....	.0610	.....	.0597	.....	.0590	.....	0.	.....	.02	.....	
463 050	35 000	.0600	.0050	.0620	.0017	.0612	.0022	.0605	.0040	0.	0.	.02	.02	
502 740	38 000	.0635	.0050	.0685	.0025	.0668	.0030	.0670	.0028	0.	0.	.02	.02	
529 200	40 000	.0662	.0050	.0725	.0032	.0702	.0034	.0705	.0035	0.	0.	.02	.02	
542 430	41 000	.0672	.....	.0748	.....	.0725	.....	.0720	.....	0.	.....	.02	.....	
555 660	42 000	.0688	.....	.0765	.....	.0740	.....	.0744	.....	0.	.....	.02	.....	
568 890	43 000	.0702	.0060	.0795	.0048	.0760	.0050	.0762	.0050	0.	0.	.02	.02	
582 120	44 000	.0715	.....	.0815	.....	.0788	.....	.0785	.....	0.	.....	.02	.02	
595 350	45 000	.0732	.0055	.0845	.0066	.0805	.0054	.0808	.0065	0.	0.	.02	.02	
608 580	46 000	.0755	.....	.0865	.....	.0825	.....	.0834	.....	0.	.....	.02	.....	
621 810	47 000	.0784	.0040	.0890	.0075	.0839	.0059	.0865	.0053	[1].01	0.	.02	.02	
13 230	1 000	—.0018	.....	.0066	.....	.0050	.....	.0042	.....	0.	.....	.02	.....	
635 040	48 000	.0820	0.	.0885	.0077	.0812	.0047	.0880	.0041	.05	.01	.02	.02	Rested under initial load over Sunday. Nearest load that observations could be obtained on account of the range of micrometer being exhausted.
647 200	48 910	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Ultimate strength.
555 660	42 000	.2150	.0085	—.0015	—.0295	—.0052	—.0300	.1854	.0765	.74	.52	[3].02	0.	
582 120	44 000	.....	.....	.....	.....	.....	.....	.....	.....	3.92	3.12	.04	.04	Yielding rapidly.

[1] West. [2] Up. [3] Down.

Column failed by lateral deflection. Deflecting perpendicular to the width of the web plate at middle of length.

No. 2118.

Built I column.
Figure 1. 70 000-lb. carbon steel.
Length of column, 13 ft., 8.75 in.
Weight, 649.5 lb.
Sectional area, 13.52 sq. in.
Gaged lengths of 50 in. taken at middle of length of column on the four angles or flanges 0.20 in. from the outer edge.
Compressometer No. 1, on top, east side.
Compressometer No. 2, on top, west side.
Compressometer No. 3, on bottom, west side.
Compressometer No. 4, on bottom, east side.
Initial deflection: Horizontal 0.03 in. to west on one angle, east side bottom; vertical, 0.
On web plate: Horizontal, 0; vertical, 0.
Flat ends.
Counterweighted at middle.

Applied loads.		In gaged lengths.								Deflections.				Remarks.
		No. 1.		No. 2.		No. 3.		No. 4.						
Total.	Per sq. in.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Horizontal.	Set.	Vertical.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	
13 520	1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
67 600	5 000	.0065	0.	.0065	0.	.0075	.0005	.0065	.0001	.01	0.	0.	0.	
135 200	10 000	.0150	.0001	.0160	.0005	.0160	.0009	.0148	.0001	.01	0.	0.	0.	
202 800	15 000	.0235	.0006	.0245	.0006	.0245	.0009	.0237	.0004	.02	.01	0.	0.	
270 400	20 000	.0322	.0007	.0334	.0008	.0337	.0012	.0325	.0005	.02	.02	0.	0.	
338 000	25 000	.0410	.0018	.0427	.0013	.0427	.0015	.0417	.0013	.02	.02	0.	0.	
378 560	28 000	.0470	.0030	.0490	.0026	.0487	.0030	.0485	.0025	.02	0.	0.	0.	
392 080	29 000	.0492	0.	.0510	.....	.0513	.....	.0505	.....	.03	.....	0.	.....	
405 600	30 000	.0510	.0040	.0535	.0034	.0540	.0045	.0525	.0030	.03	.03	0.	0.	
419 120	31 000	.0539	.....	.0558	.....	.0565	.....	.0548	.....	.03	.....	0.	.....	
432 640	32 000	.0566	.....	.0585	.....	.0625	.....	.0575	.....	.03	.....	0.	.....	
446 160	33 000	.0610	.0095	.0605	.0055	.0636	.0097	.0628	.0068	.0	0.	0.	0.	
459 680	34 000	.0710	.0225	.0580	.0002	.0590	.0042	.0810	.0187	.13	.10	.01	.01	
464 100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Ultimate strength.
446 200	33 000	.1310	.....	.0224	.....	.0245	.....	.1321	.....	.52	.....	.01	.....	Observations taken at reduced load while column was yielding. Second observation taken 7 minutes after first.
446 200	33 000	.1350	.0630	.0205	—.0180	.0228	—.0128	.1362	.0610	.54	.35	.03	.03	
452 600	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Column yielding rapidly.
338 000	25 000	.2100	.1310	—.0360	—.0450	—.0303	—.0382	.1956	.1155	1.11	.78	.08	.03	Nearest load that observations could be obtained on account of the range of micrometer being exhausted.

The column failed by lateral deflection, deflecting perpendicular to the width of web plate.

No. 2120.

Built I column.
Figure 1. Nickel steel.
Length of column, 13 ft., 8.73 in.
Weight, 637 lb.
Sectional area, 13.25 sq. in.
Gaged lengths of 50 in. taken at middle of length of column on the four angles or flanges 0.20 in. from the outer edge.
Compressometer No. 1, on top, east side.
Compressometer No. 2, on top, west side.
Compressometer No. 3, on bottom, west side.
Compressometer No. 4, on bottom, east side.
Initial deflection: Horizontal, 0.13 in. to east, at top, 3 ft. 11.5 in. from the north end; horizontal, 0.15 in. to west, at top 3 ft. 4 in. from the south end; vertical, 0.
On web plate: Horizontal, 0.03 in. to west; vertical, 0.02 in. down.
Flat ends.
Counterweighted at middle.

Applied loads.		In gaged lengths.								Deflections.				Remarks.
		No. 1.		No. 2.		No. 3.		No. 4.						
Total.	Per sq. in.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Horizontal.	Set.	Vertical.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	
13 250	1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
66 250	5 000	.0100	.0005	.0070	0.	.0095	.0020	.0080	.0002	0.	0.	0.	0.	
132 500	10 000	.0200	0.	.0150	0.	.0185	.0020	.0171	0.	[1] .01	0.	0.	0.	
198 750	15 000	.0300	.0005	.0238	.0005	.0272	.0025	.0268	0.	.01	0.	0.	0.	
265 000	20 000	.0385	.0010	.0325	.0008	.0362	.0025	.0362	.0002	.01	0.	0.	0.	
331 250	25 000	.0490	.0028	.0413	.0013	.0448	.0035	.0458	.0005	.02	0.	0.	0.	
397 500	30 000	.0580	.0050	.0500	.0015	.0540	.0038	.0553	.0009	.02	0.	0.	0.	
463 750	35 000	.0665	.0065	.0598	.0030	.0630	.0040	.0650	.0015	.03	.01	0.	0.	
503 500	38 000	.0710	.0075	.0655	.0040	.0680	.0060	.0722	.0027	.03	0.	0.	0.	
530 000	40 000	.0715	.0060	.0693	.0048	.0722	.0060	.0775	.0038	.05	[1] .02	0.	0.	
543 250	41 000	.0737	.....	.0720	.....	.0737	.....	.0805	.....	.06	.....	0.	.....	
556 500	42 000	.0755	.....	.0738	.....	.0760	.....	.0835	.....	.07	.....	.02	.....	
569 750	43 000	.0770	.0060	.0762	.0062	.0770	.0070	.0872	.0062	.07	.03	.02	0.	
538 000	44 000	.0785	.....	.0765	.....	.0778	.....	.0915	.....	.10	.....	.02	.....	
596 250	45 000	.0805	.0070	.0770	.0058	.0782	.0065	.0970	.0093	.12	.06	.02	0.	
609 500	46 000	.0835	.0100	.0770	.0033	.0705	—.0010	.1245	.0298	.24	.15	.02	.02	
615 300	46 437	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Ultimate strength.

[1] West.

At this load the column deflected rather suddenly to the west, throwing compressometers 1 and 4 from their gaged lengths and extending compressometers 2 and 3 beyond the range of micrometers.

No. 2121.

Built I column.
Figure 1. Nickel steel.
Length of column, 13 ft., 8.73 in.
Weight, 633.5 lb.
Sectional area, 13.18 sq. in.
Gaged lengths of 50 in. taken at middle of length of column on the four angles or flanges 0.20 in. from the outer edge.
Compressometer No. 1, on top, east side.
Compressometer No. 2, on top, west side.
Compressometer No. 3, on bottom, west side.
Compressometer No. 4, on bottom, east side.
Initial deflections: Horizontal, 0.10 in. to east bottom angle; vertical, 0.
On web plate: Horizontal, 0; vertical, 0.
Flat ends. Ends of column not perfectly square.
Counterweighted at middle.

Applied loads.		In gaged lengths.								Deflections.				Remarks.
		No. 1.		No. 2.		No. 3.		No. 4						
Total.	Per sq. in.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Horizontal.	Set.	Vertical.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	
13 180	1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
65 900	5 000	.0150	.0010	.0070	0.	.0080	0.	.0082	0.	0.	0.	0.	0.	
131 800	10 000	.0200	−.0020	.0154	−.0005	.0172	0.	.0170	−.0004	0.	0.	0.	0.	
197 700	15 000	.0290	−.0020	.0230	−.0011	.0257	−.0003	.0255	−.0005	0.	0.	0.	0.	
263 600	20 000	.0320	−.0026	.0320	−.0010	.0353	0.	.0344	−.0005	0.	0.	0.	0.	
329 500	25 000	.0400	−.0025	.0397	−.0010	.0440	.0002	.0435	−.0006	.01	.01	.01	.01	
395 400	30 000	.0485	−.0032	.0482	−.0008	.0528	.0005	.0523	−.0005	.01	.01	.01	0.	
461 300	35 000	.0623	−.0035	.0574	−.0006	.0610	0.	.0615	0.	.02	.01	.01	0.	
As the sets shown above did not appear to be correct, the compressometers were readjusted at the initial load and measurements were repeated.														
13 180	1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
65 900	5 000	.0084	0.	.0064	0.	.0085	.0010	.0085	0.	0.	0.	0.	0.	
131 800	10 000	.0175	0.	.0150	0.	.0185	.0015	.0175	.0002	0.	0.	0.	0.	
197 700	15 000	.0250	0.	.0235	.0002	.0275	.0006	.0265	.0002	0.	0.	0.	0.	
263 600	20 000	.0335	−.0003	.0315	−.0003	.0350	−.0003	.0350	−.0003	0.	0.	0.	0.	
329 500	25 000	.0420	−.0004	.0398	−.0004	.0435	0.	.0435	−.0003	.01	0.	.01	0.	
395 400	30 000	.0505	−.0005	.0480	−.0005	.0525	−.0005	.0520	−.0005	0.	0.	.01	.01	
461 300	35 000	.0596	0.	.0570	0.	.0612	0.	.0613	0.	0.	0.	.01	0.	
500 840	38 000	.0655	.0005	.0628	.0001	.0670	.0005	.0670	.0005	.01	0.	.02	0.	
527 200	40 000	.0693	.0011	.0659	.0006	.0705	.0011	.0710	.0012	.01	0.	.02	0.	
540 380	41 000	.0720	.....	.0685	.....	.0735	.....	.0738	.....	.01	.....	.02	.....	
553 560	42 000	.0744	.....	.0705	.....	.0755	.....	.0762	.....	.01	.....	.02	.....	
566 740	43 000	.0766	.0028	.0725	.0022	.0775	.0030	.0788	.0030	.02	0.	.02	0.	
579 920	44 000	.0800	.....	.0765	.....	.0810	.....	.0828	.....	.01	.....	.02	.....	
593 100	45 000	.0825	.0050	.0784	.0039	.0830	.0057	.0860	.0060	.03	0.	.02	0.	
606 280	46 000	.0870	.....	.0840	.....	.0845	.....	.0945	.....	.07	.....	.02	.....	
619 460	47 000	.0920	.0088	.0865	.0115	.0850	.0092	.1050	.0162	.12	.05	.02	.02	
624 400	47 374	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Ultimate strength.
606 280	46 000	.1370	.0438	.0555	−.0045	.0560	−.0065	.1545	.0500	.47	.27	.02	.02	
593 100	45 000	.0174	.0760	.0265	−.0150	.0215	−.0465	.2025	.0855	.82	.47	.02	.02	

At 573 300, or 43 500 lb. per sq. in., the column deflected 4.25 in. to the west at middle of length, also buckled the flanges at the ends of column.

No. 2122.

Built I column.
Figure 6. Nickel steel.
Length of column, 9 ft. 5.89 in.
Weight, 305.5 lb.
Sectional area, 9.03 sq. in.
Gaged lengths of 38 in. taken at middle of length of column on the four angles or flanges 0.20 in. from the outer edge.
Compressometer No. 1, on top, east side.
Compressometer No. 2, on top, west side.
Compressometer No. 3, on bottom, west side.
Compressometer No. 4, on bottom, east side.
Initial deflection: Horizontal, 0.04 in. to east; vertical, 0.
On web plate: Horizontal, 0; vertical, 0.
Pin ends: Figure 10.
Length from center to center of pins, 10 ft. 2.89 in.
Counterweighted at middle.

Applied loads.		In gaged lengths.								Deflections.				Remarks.
		No. 1.		No. 2.		No. 3.		No. 4.						
Total.	Per sq. in.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Horizontal.	Set.	Vertical.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	
9 030	1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
45 150	5 000	.0055	.0005	.0102	.0005	.0072	.0005	.0065	.0005	0.	0.	0.	0.	
90 300	10 000	.0120	.0005	.0175	.0020	.0140	.0004	.0135	.0006	0.	0.	0.	0.	
135 450	15 000	.0180	.0004	.0240	.0035	.0215	.0005	.0200	.0010	0.	0.	0.	0.	
180 600	20 000	.0250	.0004	.0315	.0050	.0285	.0007	.0274	.0010	0.	0.	up .03	.01	
225 750	25 000	.0315	.0008	.0395	.0065	.0368	.0020	.0340	.0020	0.	0.	.03	.01	
270 900	30 000	.0382	.0010	.0473	.0080	.0454	.0035	.0404	.0025	.01	0.	.03	.01	
316 050	35 000	.0438	.0009	.0580	.0107	.0560	.0067	.0465	.0028	east .05	.04	.03	.01	
343 140	38 000	.0455	.0006	.0680	.0145	.0660	.0098	.0473	.0028	.09	.05	.03	.01	
352 170	39 000	.0448	.....	.0745	.....	.0720	.....	.0455	.....	.15	.....	.03	.....	
361 200	40 000	.0435	—.0006	.0815	.0220	.0788	.0160	.0430	.0010	.20	.10	.04	.01	
370 230	41 000	.0310	—.0105	.1100	.0450	.1132	.0355	.0125	—.0085	.50	.25	.04	.01	
At this load the column was gradually yielding. Load reduced to the initial load to obtain set.														
370 230	41 000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Ultimate strength.
Pins vertical. At 358 700, 39 723 lb. per sq. in., the column sprung suddenly to the eastward at middle of length.														
Load fell to 81 100, 8 970 lb. per sq. in., at which horizontal deflection was taken										3.28	2.12	.....	.....	

No. 2123.

Built I column.
Figure 6. Nickel steel.
Length of column, 9 ft. 5.85 in.
Weight, 308.5 lb.
Sectional area, 9.13 sq. in.
Gaged lengths of 38 in. taken at middle of length of column on the four angles or flanges 0.20 in. from the outer edge.
Compressometer No. 1, on top, east side.
Compressometer No. 2, on top, west side.
Compressometer No. 3, on bottom, west side.
Compressometer No. 4, on bottom, east side.
Initial deflection: Horizontal, 0.03 in. to 0.08 in. to west; vertical, 0.
On web plate: Horizontal, 0.05 in. to west; vertical, 0.
Pin ends: Figure 10.
Length from center to center of pins, 10 ft. 2.85 in.
Counterweighted at middle.

Applied loads.		In gaged lengths.								Deflections.				Remarks.
		No. 1.		No. 2.		No. 3.		No 4.						
Total.	Per sq. in.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Horizontal.	Set.	Vertical.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	
9 130	1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
45 650	5 000	.0060	0.	.0045	0.	.0055	0.	.0090	.0015	0.	0.	0.	0.	
91 300	10 000	.0135	0.	.0105	.0004	.0120	.0005	.0168	.0020	0.	0.	0.	0.	
136 950	15 000	.0210	0.	.0170	.0005	.0180	.0006	.0245	.0020	.01	0.	0.	0.	
182 600	20 000	.0280	0.	.0235	.0010	.0245	.0010	.0324	.0020	west .03	0.	0.	0.	
228 250	25 000	.0360	.0002	.0300	.0013	.0306	.0013	.0398	.0027	.03	0.	0.	0.	
273 900	30 000	.0435	.0005	.0367	.0020	.0370	.0020	.0480	.0035	.04	0.	0.	0.	
283 030	31 000	.0450	.....	.0396	.....	.0390	.....	.0490	.....	.04	.....	0.	.....	
292 160	32 000	.0465	.....	.0400	.....	.0405	.....	.0510	.....	.04	.....	0.	.....	
301 290	33 000	.0485	.0012	.0410	.0030	.0415	.0030	.0530	.0045	.04	0.	.01	.01	
310 420	34 000	.0500	.....	.0434	.....	.0434	.....	.0540	.....	.04	.....	.01	.....	
319 550	35 000	.0525	.0015	.0450	.0038	.0442	.0035	.0567	.0050	.05	0.	.01	0.	
328 680	36 000	.0535	.....	.0472	.....	.0465	.....	.0582	.....	.05	.....	.01	.....	
337 810	37 000	.0555	.....	.0480	.....	.0472	.....	.0598	.....	.05	.....	.01	.....	
346 940	38 000	.0580	.0030	.0494	.0050	.0478	.0045	.0620	.0060	.06	0.	.02	.01	
356 070	39 000	.0593	.....	.0515	.....	.0495	.....	.0600	.....	.06	.....	.02	.....	
365 200	40 000	.0620	.0045	.0520	.0056	.0498	.0045	.0645	.0066	.07	0.	.02	0.	
374 330	41 000	.0650	.....	.0540	.....	.0530	.....	.0688	.....	.08	.....	.01	.....	
383 460	42 000	.0770	.0155	.0482	.0030	.0420	.0005	.0770	.0135	.21	.06	—.02	—.02	
385 200	42 190	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Ultimate strength. Load was reduced, as column was yielding.
The load was again advanced to obtain another reading if possible at a lower load.														
Pins vertical. At 368 000 lb. the column suddenly sprung to the west, throwing off all the compressometers.														
Load fell to 69 500 lb., at which horizontal deflection was taken										3.08	2.02	.....	.....	
Measurements taken on gaged lengths 1, 2, 3, 4, at the following loads:														
69 500	7 612	37.703	.....	38.197	.....	38.202	.....	37.709	.....	.....	.....	.....	.....	
9 130	1 000	37.782	.....	38.169	.....	38.175	.....	37.787	.....	.....	.....	.....	.....	

No. 2124.

Built I column.
Figure 6. Nickel steel.
Length of column, 9 ft. 5.88 in.
Weight, 305.5 lb.
Sectional area, 9.03 sq. in.
Gaged lengths of 38 in. taken at middle of length of column on the four angles or flanges 0.20 in. from the outer edge.
Compressometer No. 1, on top, east side.
Compressometer No. 2, on top, west side.
Compressometer No. 3, on bottom, west side.
Compressometer No. 4, on bottom, east side.
Initial deflection: Horizontal, 0.03 to 0.06 in. to west; vertical, 0.02 in. down.
On web plate: Horizontal, 0.02 in. to west; vertical, 0.02 in. down.
Pin ends: Figure 10.
Length from center to center of pins, 10 ft. 2.88 in.
Counterweighted at middle.

Applied loads.		In gaged lengths.								Deflections.				Remarks.
		No. 1.		No. 2.		No. 3.		No. 4.						
Total.	Per sq. in.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Horizontal.	Set.	Vertical.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	
9 030	1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
45 150	5 000	.0057	.0001	.0050	.0005	.0060	.0005	.0065	.0002	0.	0.	0.	0.	
90 300	10 000	.0130	.0003	.0120	.0005	.0130	.0015	.0140	.0003	.01	0.	0.	0.	
135 450	15 000	.0200	.0005	.0185	.0013	.0205	.0022	.0210	.0003	.02	0.	0.	0.	
180 600	20 000	.0272	.0005	.0250	.0015	.0275	.0025	.0285	.0005	.02	0.	0.	0.	
225 750	25 000	.0348	.0013	.0320	.0017	.0345	.0029	.0360	.0010	.03	0.	0.	0.	
270 900	30 000	.0425	.0020	.0390	.0025	.0410	.0035	.0445	.0020	.03	0.	0.	0.	
297 990	33 000	.0480	.0032	.0430	.0032	.0450	.0040	.0495	.0032	.05	0.	0.	0.	
307 020	34 000	.0494	.....	.0435	.....	.0460	.....	.0510	.....	.05	.....	0.	.....	
316 050	35 000	.0512	.0035	.0455	.0040	.0480	.0040	.0535	.0035	.06	0.	0.	0.	
325 080	36 000	.0540	.....	.0475	.....	.0495	.....	.0560	.....	.07	.....	0.	.....	
334 110	37 000	.0560	.....	.0488	.....	.0510	.....	.0580	.....	.08	.....	0.	.....	
343 140	38 000	.0585	.0060	.0500	.0052	.0515	.0052	.0605	.0055	.08	.03	0.	0.	
352 170	39 000	.0620	.....	.0515	.....	.0525	.....	.0640	.....	.09	.....	0.	.....	
361 200	40 000	.0650	.0080	.0520	.0055	.0530	.0054	.0680	.0078	.10	.03	0.	0.	
370 230	41 000	.0700	.0095	.0518	.0055	.0518	.0052	.0765	.0093	.13	.04	0.	0.	Compressometers removed from column.
381 200	42 214	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Ultimate strength. Load reduced as column was yielding.
Measurements taken on lengths 1, 2, 3, 4, and horizontal deflection.														
352 170	39 000	37.885	.....	37.990	.....	37.990	.....	37.882	.....	.54	.....	0.	.....	
363 100	40 210	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Pins vertical. Column sprung suddenly to the west at middle of length.
Load fell to 64 000 lb., at which measurements on lengths 1, 2, 3, 4, and horizontal deflection were again taken.														
64 600	7 153	37.692	.....	38.226	.....	38.226	.....	37.688	.....	3.04	.....	.....	.....	
9 030	1 000	37.790	.....	38.169	.....	38.170	.....	37.788	.....	2.99	.....	.....	.....	

No. 2125.

Built I column.
Figure 7. Nickel steel.
Length of column, 15 ft. 7.64 in.
Weight, 503.5 lb.
Sectional area, 9.08 sq. in.
Gaged lengths of 50 in. taken at middle of length of column on the four angles or flanges 0.20 in. from the outer edge.
Compressometer No. 1, on top, east side.
Compressometer No. 2, on top, west side.
Compressometer No. 3, on bottom, west side.
Compressometer No. 4, on bottom, east side.
Initial deflection: Horizontal, 0.08 in. to west; vertical, 0.04 to 0.08 in. up.
On web plate: Horizontal, 0.03 in. to west; vertical, 0.15 in. up.
Pin ends: Figure 10.
Length, from center to center of pins, 16 ft. 4.64 in.
Counterweighted at middle.

Applied loads.		In gaged lengths.								Deflections.				Remarks.
		No. 1.		No. 2.		No. 3.		No. 4.						
Total.	Per sq. in.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Horizontal.	Set.	Vertical.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	
9 080	1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
45 400	5 000	.0090	.0009	.0100	.0028	.0080	0.	.0150	.0015	west .04	.02	.02	0.	
90 600	10 000	.0190	.0010	.0175	.0035	.0167	0.	.0287	.0037	.07	.04	.05	.02	
136 200	15 000	.0295	.0015	.0255	.0035	.0250	.0005	.0395	.0045	.09	.04	.05	.02	
181 600	20 000	.0410	.0015	.0315	.0044	.0320	.0013	.0530	.0060	.16	.05	.05	.03	
190 680	21 000	.0435	.....	.0330	.....	.0335	.....	.0555	.....	.17	.....	.05	.....	
199 760	22 000	.0465	.....	.0335	.....	.0345	.....	.0590	.....	.19	.....	.05	.....	
208 840	23 000	.0495	.0015	.0345	.0048	.0352	.0013	.0600	.0046	.24	.06	.05	.02	
217 920	24 000	.0530	.....	.0330	.....	.0350	.....	.0590	.....	.26	.....	.05	.....	
227 000	25 000	.0577	.0015	.0332	.0040	.0340	.0005	.0628	.0035	.31	.06	.05	.02	
Repeated														
227 000	25 000	.0580	.....	.0325	.....	.0335	.....	.0635	.....	.32	.....	.05	.....	
236 080	26 000	.0638	.0020	.0304	.0040	.0320	0.	.0680	.0035	.40	.07	.05	.03	
Compressometers removed as horizontal deflection was 0.40 in. and compressometers 2 and 3 had changed from a + to a—reading.														
245 160	27 000	.....	.....	.....	.....	.....	.....	.....	.....	.54	.....	.05	.....	
246 600	27 158	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Ultimate strength.
Pins vertical. Sudden springing of the column sidewise, to west, occurred when maximum load was reached, deflecting in a direction perpendicular to the width of the web plate. Load fell to 48,400 lb., at which measurements on lengths 1, 2, 3, 4, and horizontal deflection were taken.														
48 400	5 330	49.843	.....	50.128	.....	50.128	.....	49.838	.....	3.62	.....	.....	.....	
9 080	1 000	49.930	.....	50.055	.....	50.045	.....	49.938	.....	1.27	.....	.....	.....	

No. 2126.

Built I column.
Figure 7. Nickel steel.
Length of column, 15 ft. 7.60 in.
Weight, 500.5 lb.
Sectional area, 9.03 sq. in.
Gaged lengths of 50 in. taken at middle of length of column on the four angles or flanges 0.20 in. from the outer edge.
Compressometer No. 1, on top, east side.
Compressometer No. 2, on top, west side.
Compressometer No. 3, on bottom, west side.
Compressometer No. 4, on bottom, east side.
Initial deflection: Horizontal, 0.08 to 0.10 in. to west; vertical, 0.05 in. up.
On web plate: Horizontal, 0.03 in. to west; vertical, 0.10 in. down.
Pin ends: Figure 10.
Length, from center to center of pins, 16 ft. 4.60 in.
Counterweighted at middle.

Applied loads.		In gaged lengths.								Deflections.				Remarks.
		No. 1.		No. 2.		No. 3.		No. 4.						
Total.	Per sq. in.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Horizontal.	Set.	Vertical.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	
9 030	1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
45 150	5 000	.0120	0.	.0125	.0010	.0075	0.	.0105	.0004	west .04	.....	.02	.....	
90 300	10 000	.0224	0.	.0195	.....	.0155	0.	.0225	.0005	.09	.03	.02	.....	
135 450	15 000	.0345	.0010	.0255	.....	.0220	0.	.0330	.0010	.13	.03	.02	.....	
180 600	20 000	.0480	.0015	.0298	.0010	.0260	0.	.0485	.0028	.23	.03	.02	.....	
189 630	21 000	.0520	.....	.0295	.....	.0268	.....	.0528	.....	.28	.....	0.	.....	
198 660	22 000	.0555	.....	.0295	.....	.0265	.....	.0562	.....	.33	.....	0.	.....	
207 690	23 000	.0602	.0035	.0288	.0025	.0260	.0005	.0600	.0045	.39	.04	0.	.....	
216 720	24 000	.0665	.....	.0250	.....	.0220	.....	.0675	.....	.49	.....	0.	.....	
221 400	24 518	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Ultimate strength.
Pins vertical. Sudden springing of the column sidewise, to west, occurred when maximum load was reached. Deflecting in a direction perpendicular to the width of the web plate.														
Sudden springing threw off all the compressometers.														
Load fell to 54 000 lb., at which measurements on lengths 1, 2, 3, 4, and horizontal deflection were taken.														
54 000	5 980	49.869	.....	50.108	.....	50.109	.....	49.861	.....	3.06	.....	.....	.....	
9 030	1 000	49.963	.....	50.048	.....	50.044	.....	49.954	.....	.83	.....	.....	.....	

No. 2127.

Built I column.
Figure 7. Nickel steel.
Length of column, 15 ft. 7.62 in.
Weight, 502.5 lb.
Sectional area, 9.07 sq. in.
Gaged lengths of 50 in. taken at middle of length of column on the four angles or flanges 0.20 in. from the outer edge.
Compressometer No. 1, on top, east side.
Compressometer No. 2, on top, west side.
Compressometer No. 3, on bottom, west side.
Compressometer No. 4, on bottom, east side.
Initial deflection: Horizontal, 0.03 to 0.04 in. to east; vertical, 0.
On web plate: Horizontal, 0.02 in. to east; vertical, 0.04 in. up.
Pin ends: Figure 10.
Length, from center to center of pins, 16 ft. 4.32 in.
Counterweighted at middle.

Applied loads.		In gaged lengths.								Deflections.				Remarks.
		No. 1.		No. 2.		No. 3.		No. 4.						
Total.	Per sq. in.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Horizontal.	Set.	Vertical.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	
9 070	1 000	0.	0.	0.	0.	0.	0.	0.	0	0.	0.	0.	0.	
45 350	5 000	.0085	.0013	.0070	0.	.0086	.0009	.0095	.0013	west .01	0.	0.	0.	
90 700	10 000	.0186	.0016	.0152	.0004	.0171	.0019	.0198	.0018	.03	.01	0.	0.	
136 050	15 000	.0290	.0021	.0230	.0015	.0260	.0031	.0308	.0027	.09	.02	0.	0.	
163 260	18 000	.0357	.0020	.0278	.0010	.0310	.0033	.0377	.0024	.11	.02	0.	0.	
172 330	19 000	.0378	.....	.0285	.....	.0318	.....	.0400	.....	.11	.....	.....	.....	
181,400	20 000	.0401	.0018	.0296	.0007	.0328	.0031	.0424	.0025	.12	.03	0.	0.	Rested under initial load overnight.
9 070	1 000	− .0002	.....	− .0015	.....	− .0110	.....	− .0005	.....	.03	.....	.....	.....	
.....	1 000	.0018	.....	.0007	.....	.0031	.....	.0025	.....	.....	.....	.....	.....	Micrometers reset to correspond with the sets of the previous day.
181 400	20 000	.0422	.0035	.0305	.0012	.0415	.0077	.0438	.0038	.13	.04	.02	0.	
190 470	21 000	.0455	.....	.0315	.....	.0425	.....	.0470	.....	.17	.....	.04	.....	
199 540	22 000	.0470	.....	.0325	.....	.0435	.....	.0498	.....	.18	.....	.04	.....	
208 610	23 000	.0505	.0045	.0326	.0017	.0440	.0090	.0530	.0045	.21	.04	.04	.01	
217 680	24 000	.0555	.....	.0330	.....	.0440	.....	.0578	.....	.25	.....	.04	.....	
226 750	25 000	.0615	.0055	.0323	.0040	.0435	.0105	.0630	.0055	.31	.06	.04	.02	
Compressometers removed as horizontal deflection was 0.31 in. and compressometers 2 and 3 had changed from a + to a − reading.														
235 820	26 000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
243 500	26 846	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Ultimate strength. Load reduced as column was yielding.
Measurements taken on lengths 1, 2, 3, 4, and deflections.														
217 680	24 000	49.933	.....	49.982	.....	49.978	.....	49.928	.....	.47	.....	.04	.....	
226 750	25 000	49.925	.....	49.984	.....	49.980	.....	49.924	.....	.55	.....	.04	.....	
235 820	26 000	49.921	.....	49.988	.....	49.985	.....	49.919	.....	.66	.....	.....	.....	
239 400	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Pins vertical. Column suddenly sprung sidewise, to the west, at middle of length. Deflecting in a direction perpendicular to the width of the web plate.														
Measurements on lengths 1, 2, 3, 4, and deflections were again taken.														
54 300	5 986	49.841	.....	50.124	.....	50.129	.....	49.842	.....	3.62	.....	.....	.....	
9 070	1 000	49.946	.....	50.050	.....	50.064	.....	49.947	.....	1.15	.....	.....	.....	

No. 2128.

Built I column.
Figure 8: Nickel steel.
Length of column, 18 ft., 0.35 in.
Weight, 583.5 lb.
Sectional area, 9.14 sq. in.
Gaged lengths of 50 in. taken at middle of length of column on the four angles or flanges 0.20 in. from the outer edge.
Compressometer No. 1, on top, east side.
Compressometer No. 2, on top, west side.
Compressometer No. 3, on bottom, west side.
Compressometer No. 4, on bottom, east side.
Initial deflections: Horizontal, 0.05 to 0.06 in. to west, south end, 2 ft. from center of column; horizontal, 0.07 to 0.10 in. to east, north end, 3 ft. from center of column; vertical, 0.11 in. down.
On web plate, 0.03 to 0.05 in. same directions, as above; vertical, 0.08 in. down.
Pin ends: Figure 10.
Length, from center to center of pins, 18 ft. 9.05 in.
Counter weighted at middle.

Applied loads.		In gaged lengths.								Deflections.				Remarks.
		No. 1.		No. 2.		No. 3.		No. 4.						
Total.	Per sq. in.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Horizontal.	Set.	Vertical.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	
9 140	1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
45 700	5 000	.0100	.0020	.0068	0.	.0130	.0055	.0103	.0020	[1].06	.05	.01	.01	
91 400	10 000	.0230	.0070	.0157	.0010	.0310	.0160	.0228	.0060	.12	.06	.01	0.	
109 680	12 000	.0300	.0070	.0180	.0002	.0335	.0150	.0291	.0050	.14	.07	.03	0.	
118 820	13 000	.0332	.....	.0187	.....	.0346	.....	.0320	.....	.16	.....	.01	.....	
127 960	14 000	.0360	.....	.0200	.....	.0358	.....	.0346	.....	.18	.....	.01	.....	
137 100	15 000	.0384	.0077	.0210	.0007	.0368	.0165	.0375	.0062	.21	.07	.01	.01	Compressometer removed for safety.
Measurements taken with a micrometer mounted in a sliding frame.														
155 380	17 000	49.9690	.....	49.9915	.....	49.9905	.....	49.9662	.....	.31	.....	.02	.....	
164 520	18 000	49.9655	.....	49.9950	.....	49.9920	.....	49.9628	.....	.36	.....	.03	.....	
173 660	19 000	49.9585	.....	49.9930	.....	49.9950	.....	49.9555	.....	.47	.....	.03	.....	
180 400	19 737	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Ultimate strength.
180 400	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Pins vertical. Column sprung suddenly sidewise, to west, at middle of length. Deflecting in a direction perpendicular to the width of the web plate. Measurements on lengths 1, 2, 3, 4 and deflections were again taken:														
49 400	5 404	49.9030	.....	50.0875	.....	50.0915	.....	49.9060	.....	3.57	.....	.....	.....	
9 140	1 000	49.9900	.....	50.0270	.....	50.0275	.....	49.9920	.....	.70	.....	.....	.....	

[1] West

No. 2129.

Built I column.
Figure 8: Nickel steel.
Length of column, 18 ft., 0.39 in.
Weight, 581 lb.
Sectional area, 9.10 sq. in.
Gaged lengths of 50 in. taken at middle of length of column on the four angles or flanges 0.20 in. from the outer edge.
Compressometer No. 1, on top, east side.
Compressometer No, 2, on top, west side.
Compressometer No. 3, on bottom, west side.
Compressometer No. 4, on bottom, east side.
Initial deflection: Horizontal, 0.15 in. to east, at middle top flange; vertical, 0.05 to 0.08 in. up; horizontal, 0.12 in. to west 4 ft. from south end bottom flange.
On web plate: Horizontal, 0.10 in. to east, at middle; vertical, 0.15 in. up.
Pin ends: Figure 10.
Length, from center to center of pins, 18 ft., 9.09 in.
Counterweighted at middle.

Applied loads		In gaged lengths.								Deflections.				Remarks.
		No. 1.		No. 2.		No. 3.		No. 4.						
Total.	Per sq. in.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Compression.	Set.	Horizontal.	Set.	Vertical.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	
9 100	1 000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
45 500	5 000	.0125	.0060	.0095	.0008	.0110	.0020	.0070	.0010	.05	[1] 0.	[2] .03	.01	
91 000	10 000	.0195	.0070	.0215	.0010	.0232	.0025	.0150	.0008	.10	0.	.03	.02	
100 100	11 000	.0210	.....	.0240	.....	.0260	.....	.0160	.....	.12	.....	.03	.....	
109 200	12 000	.0225	.....	.0265	.....	.0288	.....	.0168	.....	.15	.....	.04	.....	
118 300	13 000	.0230	.0080	.0295	.0012	.0315	.0030	.0180	.0009	.17	.03	.06	.02	
127 400	14 000	.0240	.....	.0325	.....	.0348	.....	.0185	.....	.20	.....	.....	.....	
136 500	15 000	.0248	.0085	.0355	.0015	.0378	.0034	.0190	.0006	.23	.03	.07	.03	
145 600	16 000	.0240	.....	.0391	.....	.0415	.....	.0190	.....	.28	.....	.....	.....	
154 700	17 000	.0240	.0085	.0435	.0013	.0455	.0035	.0190	.0010	.33	.04	.07	.02	Compressometers removed for safety.
163 800	18 000	.....	.....	.....	.....	.....	.....	.....	.....	.41	.....	.07	.....	
172 900	19 000	.....	.....	.....	.....	.....	.....	.....	.....	.51	.05	.07	.02	
177 200	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Ultimate strength.
Pins vertical. Sudden springing sidewise to east occurred when maximum load was reached. Deflecting in a direction perpendicular to the width of the web plate.														
Load dropped to 49,200 lb., at which measurements on lengths 1, 2, 3, 4 and horizontal deflection were taken:														
49 200	.....	50.0805	.....	49.8960	.....	49.8930	.....	50.0802	.....	3.32	.....	.....	.....	
9 100	1 000	50.0155	.....	49.9830	.....	49.9770	.....	50.0203	.....	.55	.....	.....	.....	

[1] East.

[2] Up.

RAILROAD MATERIAL.

SPECIMENS FROM STEEL RAILS.

TENSION SPECIMENS TAKEN FROM RAILS SUPPLIED BY MR. P. H. DUDLEY.

Specimens A, B, and C, all from one rail, had their axes in a vertical plane through the center of the web. A was taken from the upper portion of the head of the rail. B was taken from the junction of head and web, while C was from the junction of the base and web.

Specimens X, Y, and Z were all from one rail. Specimen X was taken from one side of head of the rail and Y from the other side. Specimen Z was taken from the bottom of the base of the rail in the plane of the web.

No. 9154.

Marks, A. O. H., 490.
Diameter, 0.564 in.
Sectional area, 0.25 sq. in.
Gaged length, 3 in.

Applied loads per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0003	0.	
10 000	.0008	0.	
20 000	.0018	.....	
25 000	.0024	.....	
30 000	.0029	0.	
35 000	.0035	0.	
40 000	.0040	0.	
45 000	.0046	.0001	
46 000	.0048	.....	
47 000	.0049	.....	
48 000	.0052	.....	
49 000	.0053	.....	
50 000	.0055	.0003	
51 000	.0059	.....	
52 000	.0062	.....	
53 000	.0069	.....	
54 000	.0074	.....	
55 000	.0087	.0027	
56 000	.0099	.....	
57 000	.0107	.....	
58 000	.0115	.....	
59 000	.0130	.....	
60 000	.0139	.0070	
61 000	.0155	.....	
62 000	.0166	.....	
63 000	.0176	.....	
64 000	.0194	.....	
65 000	.0205	.0125	
66 000	.0228	.....	
67 000	.0235	.....	
68 000	.0254	.....	
69 000	.0265	.....	
70 000	.0286	.0192	
72 000	.03	.....	
74 000	.04	.....	
76 000	.04	.....	
78 000	.04	.....	
80 000	.05	.....	
82 000	.05	.....	
84 000	.06	.....	
86 000	.06	.....	
88 000	.06	.....	
90 000	.07	.....	
92 000	.07	.....	
94 000	.08	.....	
96 000	.08	.....	
98 000	.09	.....	
100 000	.10	.....	
102 000	.11	.....	
106 000	.12	.....	
108 000	.13	.....	
110 000	.14	.....	
112 000	.16	.....	
114 000	.17	.....	
116 000	.19	.....	
118 000	.23	.....	
119 000	.28	.....	
120 000	.....	.....	Tensile strength.

Elongation after fracture, 0.40 in. in 3 in. = 13.3 per cent.
Elongation of inch sections, .08, .13, .19*.
Diameter at fracture, 0.50 in. Area, 0.1964 sq. in.
Contraction of area, 21.4 per cent.
Position of fracture, 0.95 in. from the neck.
Appearance of fracture, fine granular; silky center.

No. 9155.

Marks, B. O. H., 490.
Diameter, 0.564 in.
Sectional area, 0.25 sq. in.
Gaged length, 3 in.

Applied loads per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0003	0.	
10 000	.0008	0.	
20 000	.0018	.....	
25 000	.0024	.....	
30 000	.0029	0.	
35 000	.0035	0.	
40 000	.0040	0.	
45 000	.0047	0.	
46 000	.0050	.....	
47 000	.0052	.....	
48 000	.0055	.....	
49 000	.0057	.....	
50 000	.0063	.0007	
51 000	.0067	.....	
52 000	.0072	.....	
53 000	.0083	.....	
54 000	.0088	.....	
55 000	.0100	.0038	
56 000	.0112	.....	
57 000	.0121	.....	
58 000	.0133	.....	
59 000	.0148	.....	
60 000	.0160	.0089	
61 000	.0176	.....	
62 000	.0192	.....	
63 000	.0200	.....	
64 000	.0220	.....	
65 000	.0233	.0150	
66 000	.0258	.....	
67 000	.0267	.....	
68 000	.0286	.....	
69 000	.0300	.....	
70 000	.0323	.0227	
72 000	.04	.....	
76 000	.05	.....	
82 000	.06	.....	
86 000	.07	.....	
90 000	.08	.....	
94 000	.09	.....	
98 000	.10	.....	
100 000	.11	.....	
102 000	.12	.....	
106 000	.13	.....	
108 000	.14	.....	
110 000	.16	.....	
112 000	.19	.....	
114 000	.22	.....	
116 000	.30	.....	
117 200	.....	.....	Tensile strength.

Elongation after fracture, 0.40 in. in 3 in. = 13.3 per cent.
Elongation of inch sections, .20*, .12, .08.
Diameter at fracture, 0.50 in. Area, 0.1964 sq. in.
Contraction of area, 21.4 per cent.
Position of fracture, 0.95 in. from the neck.
Appearance of fracture, fine granular; silky center.

No. 9156.

Marks, C. O. H., 490.
Diameter, 0.564 in.
Sectional area, 0.25 sq. in.
Gaged length, 3 in.

Applied loads per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0003	0.	
10 000	.0008	0.	
20 000	.0018	.....	
25 000	.0024	.....	
30 000	.0029	0.	
35 000	.0034	0.	
40 000	.0040	0.	
45 000	.0046	0.	
50 000	.0052	0.	
51 000	.0054	.....	
52 000	.0055	.....	
53 000	.0057	.....	
54 000	.0059	.....	
55 000	.0062	.0003	
56 000	.0070	.....	
57 000	.0072	.....	
58 000	.0073	.....	
59 000	.0077	.....	
60 000	.0082	.0015	
61 000	.0087	.....	
62 000	.0093	.....	
63 000	.0098	.....	
64 000	.0107	.....	
65 000	.0115	.0042	
66 000	.0129	.....	
67 000	.0136	.....	
68 000	.0148	.....	
69 000	.0156	.....	
70 000	.0171	.0088	
72 000	.02	.....	
74 000	.03	.....	
80 000	.04	.....	
84 000	.05	.....	
92 000	.06	.....	
96 000	.07	.....	
100 000	.08	.....	
102 000	.09	.....	
106 000	.10	.....	
110 000	.11	.....	
112 000	.12	.....	
114 000	.13	.....	
116 000	.14	.....	
118 000	.15	.....	
120 000	.18	.....	
121 000	.19	.....	
122 000	.20	.....	
123 000	.24	.....	
124 000	.27	.....	Tensile strength.

Elongation after fracture, 0.29 in. in 3 in. = 9.7 per cent
Elongation of inch sections, .17 *, .07, .05.
Diameter at fracture, 0.50 in. Area, 0.1964. sq. in.
Contraction of area, 21.4 per cent.
Position of fracture, 0.70 in. from the neck.
Appearance of fracture, fine granular; silky center.

No. 9157.

Marks, X. O. H., 503.
Diameter, 0.564 in.
Sectional area, 0.25 sq. in.
Gaged length, 3 in.

Applied loads per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0003	0.	
10 000	.0008	0.	
20 000	.0019	.....	
25 000	.0025	.....	
30 000	.0031	0.	
35 000	.0037	0.	
40 000	.0043	0.	
45 000	.0048	0.	
46 000	.0049	.....	
47 000	.0050	.....	
48 000	.0052	.....	
49 000	.0054	.....	
50 000	.0056	.0002	
51 000	.0058	.....	
52 000	.0060	.....	
53 000	.0064	.....	
54 000	.0068	.....	
55 000	.0075	.0014	
56 000	.0087	.....	
57 000	.0095	.....	
58 000	.0102	.....	
59 000	.0114	.....	
60 000	.0123	.0053	
61 000	.0138	.....	
62 000	.0148	.....	
63 000	.0156	.....	
64 000	.0170	.....	
65 000	.0183	.0101	
66 000	.0207	.....	
67 000	.0213	.....	
68 000	.0229	.....	
69 000	.0240	.....	
70 000	.0255	.0161	
72 000	.03	.....	
76 000	.04	.....	
82 000	.05	.....	
88 000	.06	.....	
92 000	.07	.....	
96 000	.08	.....	
100 000	.09	.....	
104 000	.10	.....	
106 000	.11	.....	
108 000	.12	.....	
110 000	.13	.....	
114 000	.14	.....	
116 000	.16	.....	
118 000	.19	.....	
120 000	.22	.....	
121 000	.24	.....	
122 000	.27	.....	
122 800	.....	.....	Tensile strength.

Elongation after fracture, 0.41 in. = 13.7 per cent.
Elongation of inch sections, .18 *, .15, .08.
Diameter at fracture, 0.50 in. Area, 0.1964 sq. in.
Contraction of area, 21.4 per cent.
Position of fracture, 1 in. from the neck.
Appearance of fracture, fine granular; silky spot near circumference.

No. 9158.

Marks, Y. O. H., 503.
Diameter, 0.564 in.
Sectional area, 0.25 sq. in.
Gaged length, 3 in.
Loads held for about 1 minute each before taking reading.

Applied loads per sq. in.	In gaged length.		Remarks.
	Elongation.	Set. mm	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0003	0.	
10 000	.0008	0.	
20 000	.0019	.....	
25 000	.0024	.....	
30 000	.0030	0.	
35 000	.0035	0.	
40 000	.0040	0.	
45 000	.0047	0.	
50 000	.0053	0.	
51 000	.0054	.....	
52 000	.0056	.....	
53 000	.0058	.....	
54 000	.0060	.....	
55 000	.0064	.0003	
56 000	.0067	.....	
57 000	.0074	.....	
58 000	.0080	.....	
59 000	.0092	.....	
60 000	.0100	.0029	
61 000	.0111	.....	
62 000	.0119	.....	
63 000	.0128	.....	
64 000	.0142	.....	
65 000	.0154	.0074	
66 000	.0172	.....	
67 000	.0176	.....	
68 000	.0191	.....	
69 000	.0201	.....	
70 000	.0215	.0124	
72 000	.03	.....	
78 000	.04	.....	
84 000	.05	.....	
90 000	.06	.....	
94 000	.07	.....	
98 000	.08	.....	
102 000	.09	.....	
106 000	.10	.....	
110 000	.11	.....	
112 000	.12	.....	
114 000	.13	.....	
116 000	.14	.....	
118 000	.15	.....	
120 000	.16	.....	
121 000	.18	.....	
122 000	.20	.....	
123 000	.22	.....	
124 000	.24	.....	
125 000	.27	.....	
126 000	.....	.....	Tensile strength.

Elongation after fracture, 0.38 in. = 12.7 per cent.
Elongation of inch sections, .11, .18 *, .09.
Diameter at fracture, 0.50 in. Area, 0.1964 sq. in.
Contraction of area, 21.4 per cent.
Position of fracture, 1.50 in. from the neck.
Appearance of fracture, fine granular; silky spot near circumference.

No. 9159.

Marks, Z. O. H., 503.
Diameter, 0.564 in.
Sectional area, 0.25 sq. in.
Gaged length, 3 in.

Applied loads per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0004	0.	
10 000	.0008	0.	
20 000	.0019	.....	
25 000	.0024	.....	
30 000	.0030	0.	
35 000	.0036	0.	
40 000	.0041	0.	
45 000	.0047	0.	
46 000	.0048	.....	
47 000	.0049	.....	
48 000	.0051	.....	
49 000	.0052	.....	
50 000	.0054	.0002	
51 000	.0056	.....	
52 000	.0057	.....	
53 000	.0059	.....	
54 000	.0062	.....	
55 000	.0065	.0006	
56 000	.0068	.....	
57 000	.0071	.....	
58 000	.0074	.....	
59 000	.0079	.....	
60 000	.0083	.0019	
61 000	.0091	.....	
62 000	.0095	.....	
63 000	.0099	.....	
64 000	.0109	.....	
65 000	.0114	.0043	
66 000	.0128	.....	
67 000	.0134	.....	
68 000	.0148	.....	
69 000	.0154	.....	
70 000	.0168	.0086	
72 000	.02	.....	
76 000	.03	.....	
82 000	.04	.....	
88 000	.05	.....	
94 000	.06	.....	
98 000	.07	.....	
102 000	.08	.....	
106 000	.09	.....	
110 000	.10	.....	
114 000	.11	.....	
116 000	.12	.....	
118 000	.13	.....	
120 000	.14	.....	
121 000	.15	.....	
122 000	.16	.....	
123 000	.17	.....	
124 000	.18	.....	
125 000	.19	.....	
126 000	.22	.....	Tensile strength.

Elongation after fracture, 0.25 in. in 3 in.=8.3 per cent.
Elongation of inch sections, .15*, .07, .03.
Diameter at fracture, 0.51 in. Area, 0.2043 sq. in.
Contraction of area, 18.3 per cent.
Position of fracture, 0.50 in. from the neck.
Appearance of fracture, fine granular 90 per cent; silky 10 per cent.

No. 9160.

Marks (M. C., Sec. 1 000, Plain, 83–11 Bloom), A.
Diameter, 0.564 in.
Sectional area, 0.25 sq. in.
Gaged length, 3 in.

Applied loads per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0003	0.	
10 000	.0008	0.	
20 000	.0018	.....	
25 000	.0024	.....	
30 000	.0029	0.	
35 000	.0034	0.	
40 000	.0039	0.	
45 000	.0045	0.	
50 000	.0051	0.	
51 000	.0053	.....	
52 000	.0055	.....	
53 000	.0057	.....	
54 000	.0060	.....	Elastic limit.
55 000	.0130	.0075	
56 000	.0144	.....	
57 000	.0156	.....	
58 000	.0173	.....	
59 000	.0192	.....	
60 000	.0216	.0149	
61 000	.0235	.....	
62 000	.0246	.....	
63 000	.0267	.....	
64 000	.0298	.....	
65 000	.0317	.0241	
66 000	.0345	.....	
67 000	.0360	.....	
68 000	.0389	.....	
69 000	.0407	.....	
70 000	.0445	.....	
72 000	.05	.....	
74 000	.06	.....	
78 000	.07	.....	
80 000	.08	.....	
84 000	.09	.....	
86 000	.10	.....	
88 000	.11	.....	
90 000	.12	.....	
92 000	.13	.....	
94 000	.14	.....	
96 000	.15	.....	
98 000	.17	.....	
100 000	.19	.....	
102 000	.22	.....	
104 000	.29	.....	
106 000	.....	.....	Tensile strength.

Elongation after fracture, 0.55 in. in 3 in. = 18.3 per cent.
Elongation of inch sections, .21*, .22, .12.
Diameter at fracture, 0.46 in. Area, 0.1662 sq. in.
Contraction of area, 33.5 per cent.
Position of fracture, 1.30 in. from the neck.
Appearance of fracture, fine granular 70 per cent; silky 30 per cent.

No. 9161.

Marks (M. C., Sec. 1 000, Plain, 83–11 Bloom), B.
Diameter, 0.564 in.
Sectional area, 0.25 sq. in.
Gaged length, 3 in.

Applied loads per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0004	0.	
10 000	.0009	0.	
20 000	.0020	.....	
25 000	.0025	.....	
30 000	.0031	0.	
35 000	.0036	0.	
40 000	.0042	0.	
45 000	.0047	0.	
50 000	.0052	0.	
55 000	.0059	.0001	
56 000	.0060	.....	
57 000	.0062	.....	
58 000	.0064	.....	
59 000	.0069	.....	
60 000	.0074	.0011	Elastic limit.
61 000	.0082	.....	
62 000	.0099	.....	
63 000	.0110	.....	
64 000	.0133	.....	
65 000	.0137	.0077	
66 000	.0168	.....	
67 000	.0177	.....	
68 000	.0203	.....	
69 000	.0220	.....	
70 000	.0247	.0165	
72 000	.03	.....	
76 000	.04	.....	
80 000	.05	.....	
84 000	.06	.....	
88 000	.07	.....	
90 000	.08	.....	
94 000	.09	.....	
96 000	.10	.....	
100 000	.11	.....	
102 000	.12	.....	
104 000	.13	.....	
106 000	.14	.....	
108 000	.15	.....	
110 000	.17	.....	
112 000	.18	.....	
114 000	.22	.....	
116 000	.28	.....	
118 000	.....	.....	Tensile strength.

Elongation after fracture, 0.44 in. in 3 in. = 14.7 per cent.
Elongation of inch sections, .11, .22*, .11.
Diameter at fracture, 0.50 in. Area, 0.1964 sq. in.
Contraction of area, 21.4 per cent.
Position of fracture, 1.55 in. from the neck.
Appearance of fracture, fine granular.

No. 9162.

Marks (M. C., Sec. 1000, Plain, 83–11 Bloom), C.
Diameter, 0.564 in.
Sectional area, 0.25 sq. in.
Gaged length, 3 in.

Applied loads per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0003	0.	
10 000	.0008	0.	
20 000	.0019	.....	
25 000	.0024	.....	
30 000	.0030	0.	
35 000	.0036	0.	
40 000	.0041	0.	
45 000	.0046	0.	
50 000	.0053	.0001	
51 000	.0055	.....	
52 000	.0057	.....	
53 000	.0060	.....	
54 000	.0064	.....	
55 000	.0068	.0011	
56 000	.0075	.....	Elastic limit.
57 000	.0127	.....	
58 000	.0135	.....	
59 000	.0151	.....	
60 000	.0164	.0102	
61 000	.0181	.....	
62 000	.0196	.....	
63 000	.0218	.....	
64 000	.0242	.....	
65 000	.0266	.0193	
66 000	.0291	.....	
67 000	.0308	.....	
68 000	.0337	.....	
69 000	.0357	.....	
70 000	.0394	.....	
72 000	.04	.....	
74 000	.05	.....	
78 000	.06	.....	
80 000	.07	.....	
84 000	.08	.....	
86 000	.09	.....	
88 000	.10	.....	
90 000	.11	.....	
92 000	.12	.....	
94 000	.13	.....	
96 000	.14	.....	
98 000	.15	.....	
100 000	.17	.....	
102 000	.20	.....	
104 000	.24	.....	
106 000	.30	.....	
107 600	.....	.....	Tensile strength.

Elongation after fracture, 0.34 in. in 3 in. = 11.3 per cent.
Elongation of inch sections, .12, .13*, .09.
Diameter at fracture, 0.53 in. Area, 0.2206 sq. in.
Contraction of area, 11.8 per cent.
Position of fracture, 1.30 in. from the neck.
Appearance of fracture, fine granular.

No. 9163.

Marks (Spec. F. T., 12211 B), A.
Diameter, 0.564 in.
Sectional area, 0.25 sq. in.
Gaged length, 3 in.

Applied loads per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0003	0.	
10 000	.0009	0.	
20 000	.0020	.....	
25 000	.0026	.....	
30 000	.0031	0.	
35,000	.0037	0.	
40 000	.0042	0.	
45 000	.0047	0.	
50 000	.0052	0.	
55 000	.0057	0.	
60 000	.0065	.0001	Elastic limit.
61 000	.0130	.....	
62 000	.0154	.....	
63 000	.0173	.....	
64 000	.0195	.....	
65 000	.0208	.0135	
66 000	.0239	.....	
67 000	.0252	.....	
68 000	.0269	.....	
69 000	.0290	.....	
70 000	.0306	.0224	
72 000	.04	.....	
76 000	.05	.....	
82 000	.06	.....	
86 000	.07	.....	
88 000	.08	.....	
92 000	.09	.....	
94 000	.10	.....	
98 000	.11	.....	
100 000	.12	.....	
102 000	.13	.....	
104 000	.14	.....	
106 000	.15	.....	
108 000	.17	.....	
110 000	.19	.....	
112 000	.22	.....	
114 000	.25	.....	
116 000	.....	.....	Tensile strength.

Elongation after fracture, 0.39 in. in 3 in. = 13 per cent.
Elongation of inch sections, .15*, .14, .10.
Diameter at fracture, 0.51 in. Area, 0.2043 sq. in.
Contraction of area, 18.3 per cent.
Position of fracture, 0.90 in. from the neck.
Appearance of fracture, fine granular.

No. 9164.

Marks (Spec. F. T., 12211 C), A.
Diameter, 0.564 in.
Sectional area, 0.25 sq. in.
Gaged length, 3 in.

Applied loads per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0003	0.	
10 000	.0008	0.	
20 000	.0018	.....	
25 000	.0023	.....	
30 000	.0029	0.	
35 000	.0034	0.	
40 000	.0039	0.	
45 000	.0044	0.	
50 000	.0049	0.	
55 000	.0055	0.	
60 000	.0067	.0007	Elastic limit.
61 000	.0137	.....	
62 000	.0154	.....	
63 000	.0171	.....	
64 000	.0193	.....	
65 000	.0216	.0142	
66 000	.0241	.....	
67 000	.0250	.....	
68 000	.0276	.....	
69 000	.0290	.....	
70 000	.0315	.....	
72 000	.03	.....	
74 000	.04	.....	
76 000	.05	.....	
80 000	.06	.....	
84 000	.07	.....	
88 000	.08	.....	
90 000	.09	.....	
94 000	.10	.....	
96 000	.11	.....	
98 000	.12	.....	
102 000	.13	.....	
104 000	.14	.....	
106 000	.15	.....	
108 000	.17	.....	
110 000	.19	.....	
112 000	.21	.....	
114 000	.28	.....	
116 000	.....	.....	Tensile strength.

Elongation after fracture, 0.53 in. in 3 in. = 17.7 per cent.
Elongation of inch sections, .13, .23 *, .17.
Diameter at fracture, 0.47 in. Area, 0.1735 sq. in.
Contraction of area, 30.6 per cent.
Position of fracture, 1.40 in. from the neck.
Appearance of fracture, fine granular; silky center.

No. 9165.

Marks (Spec. F. T., 12211 B), B.
Diameter, 0.564 in.
Sectional area, 0.25 sq. in.
Gaged length, 3 in.

Applied loads, per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0003	0.	
10 000	.0008	0.	
20 000	.0019	.....	
25 000	.0025	.....	
30 000	.0031	0.	
35 000	.0036	0.	
40 000	.0042	0.	
45 000	.0047	0.	
46 000	.0052	.....	
47 000	.0053	.....	
48 000	.0054	.....	
49 000	.0055	.....	
50 000	.0056	.0003	
51 000	.0057	.....	
52 000	.0059	.....	
53 000	.0062	.....	
54 000	.0064	.....	Elastic limit.
55 000	.0077	.0023	
56 000	.0122	.....	
57 000	.0153	.....	
58 000	.0171	.....	
59 000	.0201	.....	
60 000	.0215	.0147	
61 000	.0233	.....	
62 000	.0251	.....	
63 000	.0267	.....	
64 000	.0298	.....	
65 000	.0322	.0242	
66 000	.0352	.....	
67 000	.0363	.....	
68 000	.0379	.....	
69 000	.0398	.....	
70 000	.0431	.....	
72 000	.05	.....	
76 000	.06	.....	
80 000	.07	.....	
82 000	.08	.....	
86 000	.09	.....	
88 000	.10	.....	
92 000	.11	.....	
94 000	.12	.....	
96 000	.13	.....	
98 000	.15	.....	
100 000	.17	.....	
102 000	.19	.....	
104 000	.22	.....	
106 000	.27	.....	
108 000	.....	.....	Tensile strength.

Elongation after fracture, 0.56 in. in 3 in. = 18.7 per cent.
Elongation of inch sections, .11, .17, .28.*
Diameter at fracture, 0.44 in. Area, 0.1521 sq. in.
Contraction of area, 39.2 per cent.
Position of fracture, 1.10 in. from the neck.
Appearance of fracture, silky.

No. 9166.

Marks (Spec. F. T., 12211 C), B.
Diameter, 0.564 in.
Sectional area, 0.25 sq. in.
Gaged length, 3 in.

Applied loads per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0003	0.	
10 000	.0008	0.	
20 000	.0018	.....	
25 000	.0024	.....	
30 000	.0029	0.	
35 000	.0035	0.	
40 000	.0040	0.	
45 000	.0045	0.	
50 000	.0050	0.	
55 000	.0059	0.	
56 000	.0066	.....	Elastic limit.
57,000	.0194	.....	
58 000	.0205	.....	
59 000	.0227	.....	
60 000	.0249	.0178	
61 000	.0263	.....	
62 000	.0278	.....	
63 000	.0306	.....	
64 000	.0332	.....	
65 000	.0347	.0271	
66 000	.0381	.....	
67 000	.0393	.....	
68 000	.0415	.....	
69 000	.0442	.....	
70 000	.0473	.....	
72 000	.05	.....	
74 000	.06	.....	
76 000	.07	.....	
80 000	.08	.....	
84 000	.09	.....	
86 000	.10	.....	
88 000	.11	.....	
90 000	.12	.....	
92 000	.13	.....	
94 000	.14	.....	
96 000	.15	.....	
98 000	.17	.....	
100 000	.19	.....	
102 000	.22	.....	
104 000	.28	.....	
106 000	.....	.....	Tensile strength.

Elongation after fracture, 0.65 in. in 3 in.=21.7 per cent.
Elongation of inch sections, .14, .35,* .16.
Diameter at fracture, 0.44 in. Area, 0.1521 sq. in.
Contraction of area, 39.2 per cent.
Position of fracture, 1.60 in. from the neck.
Appearance of fracture, silky.

No. 9167.

Marks (Spec. F. T., 12211 B), C.
Diameter, 0.564 in.
Sectional area, 0.25 sq. in.
Gaged length, 3 in.

Applied loads per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lbs.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0003	0.	
10 000	.0008	0.	
20 000	.0018	.....	
25 000	.0024	.....	
30 000	.0028	0.	
35 000	.0033	0.	
40 000	.0039	0.	
45 000	.0044	0.	
50 000	.0049	0.	
55 000	.0056	0.	
60 000	.0063	0.	
61 000	.0065	.....	
62 000	.0067	.....	
63 000	.0070	.....	Elastic limit.
64 000	.0083	.....	
65 000	.0128	.0061	
66 000	.0155	.....	
67 000	.0167	.....	
68 000	.0192	.....	
69 000	.0204	.....	
70 000	.0239	.0149	
72 000	.03	.....	
76 000	.04	.....	
80 000	.05	.....	
84 000	.06	.....	
88 000	.07	.....	
94 000	.08	.....	
98 000	.09	.....	
100 000	.10	.....	
102 000	.11	.....	
104 000	.12	.....	
106 000	.13	.....	
108 000	.14	.....	
110 000	.15	.....	
112 000	.16	.....	
114 000	.18	.....	
116 000	.20	.....	
118 000	.26	.....	
120 000	.....	.....	Tensile strength.

Elongation after fracture, 0.48 in. in 3 in. = 16 per cent.
Elongation of inch sections, .22,* .16, .10.
Diameter at fracture, 0.47 in. Area, 0.1735 sq. in.
Contraction of area, 30.6 per cent.
Position of fracture, 1.20 in. from the neck.
Appearance of fracture, fine granular, silky center.

No. 9168.

Marks (Spec. F. T., 12211 C), C.
Diameter, 0.564 in.
Sectional area, 0.25 sq. in.
Gaged length, 3 in.

Applied loads per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0003	0.	
10 000	.0008	0.	
20 000	.0019	.....	
25 000	.0024	.....	
30 000	.0029	0.	
35 000	.0034	0.	
40 000	.0039	0.	
45 000	.0044	0.	
50 000	.0049	0.	
55 000	.0055	0.	
56 000	.0057	.....	
57 000	.0059	.....	
58 000	.0060	.....	
59 000	.0061	.....	
60 000	.0063	.0002	
61 000	.0067	.....	Elastic limit.
62 000	.0156	.....	
63 000	.0165	.....	
64 000	.0187	.....	
65 000	.0205	.0134	
66 000	.0233	.....	
67 000	.0241	.....	
68 000	.0266	.....	
69 000	.0281	.....	
70 000	.0300	.0222	
72 000	.03	.....	
74 000	.04	.....	
82 000	.05	.....	
84 000	.06	.....	
86 000	.07	.....	
90 000	.08	.....	
94 000	.09	.....	
96 000	.10	.....	
98 000	.11	.....	
102 000	.12	.....	
104 000	.13	.....	
106 000	.14	.....	
108 000	.16	.....	
110 000	.19	.....	
112 000	.22	.....	
114 000	.26	.....	
116 000	.....	.....	Tensile strength.

Elongation after fracture, 0.53 in. in 3 in. = 17.7 per cent.
Elongation of inch sections, .12, .29*, .12.
Diameter at fracture, 0.46 in. Area, 0.1662 sq. in.
Contraction of area, 33.5 per cent.
Position of fracture, 1.75 in. from the neck.
Appearance of fracture, fine granular; silky center.

No. 9169.

Marks (L. S. Co., M. C. Sec., 1 000 ft., 12190, No. 13 Bloom), A.
Diameter, 0.564 in.
Sectional area, 0.25 sq. in.
Gaged length, 3 in.

Applied loads per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0003	0.	
10 000	.0008	0.	
20 000	.0018	.....	
25 000	.0023	.....	
30 000	.0028	0.	
35 000	.0034	0.	
40 000	.0039	0.	
45 000	.0044	0.	
50 000	.0051	0.	
51 000	.0053	.....	
52 000	.0054	.....	
53 000	.0056	.....	
54 000	.0059	.....	
55 000	.0064	.0005	Elastic limit.
56 000	.0076	.....	
57 000	.0121	.....	
58 000	.0139	.....	
59 000	.0162	.....	
60 000	.0184	.0117	
61 000	.0202	.....	
62 000	.0213	.....	
63 000	.0235	.....	
64 000	.0259	.....	
65 000	.0281	.0204	
66 000	.0306	.....	
67 000	.0326	.....	
68 000	.0353	.....	
69 000	.0370	.....	
70 000	.0396	.....	
72 000	.05	.....	
76 000	.06	.....	
80 000	.07	.....	
84 000	.08	.....	
86 000	.09	.....	
88 000	.10	.....	
92 000	.11	.....	
94 000	.12	.....	
96 000	.13	.....	
98 000	.14	.....	
100 000	.16	.....	
102 000	.18	.....	
104 000	.20	.....	
106 000	.24	.....	
108 000	.31	.....	
109 200	.....	.....	Tensile strength.

Elongation after fracture, 0.53 in. in 3 in. = 17.7 per cent.
Elongation of inch sections, .10, .19, .24.*
Diameter at fracture, 0.47 in. Area, 0.1735 sq. in.
Contraction of area, 30.6 per cent.
Position of fracture, 1.10 in. from the neck.
Appearance of fracture, fine granular, 10 per cent; silky, 90 per cent.

No. 9170.

Marks (L. S. Co., M. C. Sec., 1 000 ft., 12190, No. 13 Bloom), B.
Diameter, 0.564 in.
Sectional area, 0.25 sq. in.
Gaged length, 3 in.

Applied loads per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0003	0.	
10 000	.0008	0.	
20 000	.0019	.....	
25 000	.0025	.....	
30 000	.0030	0.	
35 000	.0035	0.	
40 000	.0040	0.	
45 000	.0045	0.	
50 000	.0052	0.	
51 000	.0054	.....	
52 000	.0056	.....	
53 000	.0059	.....	
54 000	.0061	.....	
55 000	.0064	.0006	
56 000	.0068	.....	
57 000	.0072	.....	Elastic limit.
58 000	.0078	.....	
59 000	.0088	.....	
60 000	.0097	.0038	
61 000	.0112	.....	
62 000	.0126	.....	
63 000	.0137	.....	
64 000	.0155	.....	
65 000	.0177	.0112	
66 000	.0203	.....	
67 000	.0220	.....	
68 000	.0245	.....	
69 000	.0262	.....	
70 000	.0295	.0214	
72 000	.04	.....	
78 000	.05	.....	
82 000	.06	.....	
86 000	.07	.....	
88 000	.08	.....	
90 000	.09	.....	
92 000	.10	.....	
94 000	.11	.....	
98 000	.12	.....	
100 000	.13	.....	
102 000	.15	.....	
104 000	.17	.....	
106 000	.20	.....	
108 000	.23	.....	
110 000	30	.....	
111 200	.....	.....	Tensile strength.

Elongation after fracture, 0.50 in. in 3 in. = 16.7 per cent.
Diameter at fracture, 0.48 in. Area, 0.1810 sq. in.
Contraction of area, 27.6 per cent.
Position of fracture, 1.20 in. from the neck.
Appearance of fracture, fine granular, 90 per cent; silky, 10 per cent.

No. 9171.

Marks (L. S. Co., M. C. Sec., 1000 ft., 12190, No. 13 Bloom), C.
Diameter, 0.564 in.
Sectional area, 0.25 sq. in.
Gaged length, 3 in.

Applied loads, per sq. in.	In gaged length.		Remarks.
	Elongation.	Set.	
Lb.	*In.*	*In.*	
1 000	0.	0.	
5 000	.0003	0.	
10 000	.0008	0.	
20 000	.0018	.....	
25 000	.0023	.....	
30 000	.0028	0.	
35 000	.0034	0.	
40 000	.0039	0.	
45 000	.0045	0.	
50 000	.0052	0.	
51 000	.0053	.....	
52 000	.0055	.....	
53 000	.0056	.....	
54 000	.0058	.....	
55 000	.0061	.0004	
56 000	.0065	.....	
57 000	.0069	.....	
58 000	.0074	.....	Elastic limit
59 000	.0121	.....	
60 000	.0136	.0075	
61 000	.0159	.....	
62 000	.0179	.....	
63 000	.0201	.....	
64 000	.0226	.....	
65 000	.0242	.0168	
66 000	.0265	.....	
67 000	.0281	.....	
68 000	.0313	.....	
69 000	.0328	.....	
70 000	.0354	.0270	
72 000	.04	.....	
76 000	.05	.....	
80 000	.06	.....	
84 000	.07	.....	
86 000	.08	.....	
88 000	.09	.....	
90 000	.10	.....	
94 000	.11	.....	
96 000	.12	.....	
98 000	.13	.....	
100 000	.14	.....	
102 000	.15	.....	
104 000	.17	.....	
106 000	.19	.....	
108 000	.23	.....	
110 000	.27	.....	
111 200	.....	.....	Tensile strength.

Elongation after fracture, 0.55 in. in 3 in. = 18.3 per cent.
Elongation of inch sections, .17, .26*, .12.
Diameter at fracture, 0.45 in. Area, 0.1590 sq. in.
Contraction of area, 36.4 per cent.
Position of fracture, 1.40 in. from the neck.
Appearance of fracture, fine granular 10 per cent; silky, 90 per cent.

LEATHER BELTING.

TENSILE TESTS OF LEATHER BELTING FOR WATERTOWN ARSENAL.

Nominal width.	Dimensions.			Sectional area.	Elongation in 20 in.		Tensile strength.	
	Length.	Width.	Thickness.				Total.	Per sq. in.
In.	*In.*	*In.*	*In.*	*Sq. in.*	*In.*	*Per ct.*	*Lb.*	*Lb.*
2.25	48	2.25	0.36	0.81	1.85	9.25	2 900	3 580
4.00	72	3.99	.21	.84	2.30	11.50	3 050	3 630

Elongations measured on gaged lengths of 20 in.

Applied loads.	Elongation.		Remarks.
	2.25-in. belt.	4-in. belt.	
Lb.	*In.*	*In.*	
100	0.26	0.34	
200	.36	.45	
300	.45	.55	
400	.55	.63	
500	.63	.72	
600	.72	.81	
700	.84	.87	
800	.84	.97	
900	.91	1.02	
1 000	.95	1.11	
1 200	1.12	1.18	
1 400	1.24	1.39	
1 600	1.39	1.44	
1 800	1.56	1.55	
2 000	1.68	1.74	
2 500	1.85	2.05	
3 000	.....	2.30	
.....	2 900 lb.	3 050 lb.	Tensile strength.

2.25-in. belt parted at a joint 6 in. from the jaw of testing machine.
4-in. belt parted at a scarf joint 4 in. from the jaw of the testing machine.

Nominal width.	Dimensions.			Sectional area.	Elongation in 20 in.		Tensile strength.	
	Length.	Width.	Thickness.				Total.	Per sq. in.
In.	*In.*	*In.*	*In.*	*Sq. in.*	*In.*	*Per ct.*	*Lb.*	*Lb.*
1.50	60	1.54	0.32	0.492	2.67	13.3	2 075	4 220
3.00	60	3.00	.35	1.050	3.46	17.3	4 380	4 170

Elongations measured on gaged lengths of 20 in.

Applied loads.	Elongation.		Remarks.
	1.50-in. belt.	3-in. belt.	
Lb.	*In.*	*In.*	
100	0.17	0.16	
200	.32	.30	
300	.52	.45	
400	.64	.50	
500	.76	.65	
600	.84	.73	
700	.99	.81	
800	1.14	.90	
900	1.22	1.02	
1 000	1.32	1.12	
1 200	1.55	1.30	
1 400	1.85	1.49	
1 600	2.10	1.60	
1 800	2.31	1.76	
2 000	2.67	1.90	
2 500	.....	2.25	
3 000	.....	2.70	
3 500	.....	3.03	
4 000	.....	3.46	
.....	2 075 lb.	4 380 lb.	Tensile strength.

1.5-in. belt parted 4.5 in. from jaw of testing machine.
3-in. belt parted 2.25 in. from jaw of testing machine.

Nominal width.	Dimensions.			Sectional area.	Tensile strength.	
	Length.	Width.	Thickness.		Total.	Per sq. in.
In.	*In.*	*In.*	*In.*	*Sq. in.*	*Lb.*	*Lb.*
1.25	60	1.25	0.18	0.225	1 020	4 530
2.25	48	2.25	.33	.742	2 925	3 940
3.50	48	3.50	.33	1.155	5 400	4 675
1.75	48	1.72	.32	.550	2 345	4 265
2.50	48	2.46	.37	.910	3 570	3 920
3.00	48	2.98	.37	1.100	5 920	5 380
2.75	48	2.76	.35	.966	4 285	4 435
[1] 3.50 A	48	1.75	.37	.647	2 960	4 570
[1] 3.50 B	48	1.73	.37	.640	3 570	5 580

[1] Original belt was 3.50 in. wide, but it was split in two to permit testing.

TENSILE TESTS OF LACE LEATHER FOR WATERTOWN ARSENAL.

Samples 15.25 in. long cut from the sides.

Marks.	Width.	Tensile strength.	
		Total.	Per in. wide.
	In.	*Lb.*	*Lb.*
1	1.04	375	360
2	.99	520	525
3	1.02	503	493
4	1.03	522	507

CORDAGE AND FABRIC.

SPECIMENS OF MANILA ROPE, LANYARDS, AND BURLAP.

TENSILE TESTS OF 3-STRAND MANILA ROPE FOR THE WATERTOWN ARSENAL.

No.	Nominal.		Actual diameter.	Tensile strength.		Parted.
	Diameter.	Circumference.		Total.	Per sq. in.	
	In.	*In.*	*In.*	*Lb.*	*Lb.*	
[1] 1	0.375	.....	0.44	1 150	7 550	1 strand at pin.
2	.375	.....	.43	1 730	11 900	1 strand at splice.
3	.375	.....	.43	1 630	11 200	1 strand 4.5 in. from splice.
[1] 4	.50	.....	.54	1 980	8 650	1 strand 18 in. from the pin.
5	.50	.....	.56	2 100	7 300	1 strand 36 in. from splice.
6	.75	.....	.79	6 575	13 400	1 strand at splice.
7	.75	.....	.79	5 800	11 850	1 strand at middle.
8	.....	2.50	.80	4 200	8 350	1 strand 14 in. from splice.
9	.....	2.00	.75	3 400	7 700	1 strand 30 in. from splice.
10	.....	2.00	.75	2 700	6 100	1 strand 16 in. from splice.
11	.....	2.00	.75	3 770	8 500	1 strand 2 in. from splice.
12	.....	2.00	.76	3 980	9 000	Do.
13	.....	2.00	.72	4 200	10 300	1 strand at splice.
14	.....	2.00	.72	4 600	11 300	1 strand 5 in. from splice.
15	.....	2.00	.74	2 400	5 600	1 strand at splice.
16	1.00	.....	1.03	9 500	11 400	Do.
17	1.00	.....	1.03	9 700	11 650	Do.
18	.....	3.00	.94	6 650	9 600	Do.
19	.....	3.00	1.10	9 280	9 750	2 strands at splice.
20	.....	3.00	1.15	7 600	7 300	1 strand at splice.
21	.....	3.00	1.19	11 200	10 700	Do.
22	.....	4.00	1.44	13 700	8 400	Do.
23	.....	6.00	2.19	24 200	6 400	Do.
24	.....	6.00	2.45	19 800	4 200	1 strand at middle.
25	.....	6.00	2.45	33 800	7 200	1 strand at splice.
26	.....	6.00	2.25	17 800	4 500	Do.

[1] Tested with ends wound around pins. All others were tested with eye splices in both ends. Distance between splices from 3 ft. to 6 ft.

TENSILE TESTS OF MANILA ROPE FOR ISTHMIAN CANAL COMMISSION.

FOR UNITED STATES ENGINEER OFFICER, OSWEGO, N. Y.

Diameter.	Length between splices.	Tensile strength.		Parted.
		Total.	Per sq. in.	
In.	*In.*	*Lb.*	*Lb.*	
1.50	12	11 600	6 560	2 strands at the splice.
.71	24	2 320	5 860	1 strand at the splice.

Cables laid double.

FOR UNITED STATES ENGINEER OFFICER, BOSTON, MASS.

Diameter.	Number of strands.	Length between splices.	Tensile strength.		Parted.
			Total.	Per sq. in.	
In.		*In.*	*Lb.*	*Lb.*	
1.18	4	34	9 400	8 600	2 strands at the splice.
1.23	4	43	10 500	8 800	1 strand at the splice.
1.55	4	41	14 500	7 660	2 strands at the splice.

Four-strand rope.

TENSILE TESTS OF ITALIAN HEMP CORD FOR WATERTOWN ARSENAL.

Kind of cord.	Log line.	Lanyard coil.	Braided cord.
Diameter	0.25 in.	0.18 in.	
Lay, 1 turn in	0.73 in.	0.61 in.	
Number of strands	3	3	
Threads in each strand	10	5	
Length of sample	16 ft.	16 ft.	16 ft.
Length between heads	26 in.	26 in.	26 in.
Tensile strength, total	947 lb.	510 lb.	277 lb.
Parted	3 strands in head.	3 strands 8 in. from the head.	In middle.

TENSILE TESTS OF USED LANYARDS OF ITALIAN HEMP LOG LINE.

1 to 10, inclusive. Lanyards used about three years, or approximately 400 times, and have been subjected to both oil and moisture to a considerable extent.

11 and 12. Used two years, or about 300 times. Not subjected to oil or moisture to any extent.

Received from Fort Adams, R. I., February 26, 1910:

13. Used one year and nine months, or about 150 times. Not subjected to moisture but to some extent has come in contact with oil.

14 and 15. Used one year and nine months, or about 200 times. Subjected to oil but not to moisture.

Received from Fort Strong, Boston, February 14, 1910:

16 to 19, inclusive. Used at about 900 drills. Subjected to both oil and moisture.

Received from Fort Revere, Mass., February 9, 1910:

20 to 23, inclusive. Used at 214 drills. Not subjected to oil or moisture.

Received from Fort Revere, Mass., February 9, 1910:

24 to 25, inclusive. Used about 75 times. Subjected to contact with oil and moisture.

26. Used only a few times. Subjected to oil and moisture.

Received from Fort Heath, Boston, February 15, 1910:

27. Used one year, or about 150 times.
28. Used one year, or about 150 times.
29. Used five months, or about 100 times.
30. Used five months, or about 100 times.
31. Used one month, or about 10 times.

27 to 31, inclusive, have not been subjected to moisture but to some extent have come in contact with oil.

Received from Fort Andrews, Mass.:

32 to 35, inclusive. Used about 60 times. Subjected to oil and moisture.

Received from Fort Michie, N. Y.:

36. Used about one week. Not subjected to oil or moisture.

Received from Fort Warren, Boston:

37 and 38. Used about 60 times. Not subjected to oil or moisture.
39 and 40. Used about 80 times. Subjected to oil and moisture.
41 and 42. Used about 60 times. Subjected to oil but not to moisture.
43 and 44. Used about 100 times. Subjected to oil and moisture.
45 and 46. Used about 2 years.

Tensile tests of used lanyards of Italian hemp log line—Continued.

No.	Length over all.	Approximate diameter.	Number of strands.	Number of threads or yarns in each strand.	Tensile strength.	Parted.
	Ft. in.	*In.*			*Lb.*	
1	11 4	.23	3	16 threads.	225	Fractured the wire hook.
1	.....	.23	.....	.....	265	3 strands at the pin.
1	.....	.23	.....	.....	300	Do.
2	11 11	.20	3	20 threads.	152	3 strands 7 in. from end with hook.
2	.....	.20	.....	.....	193	3 strands at the pin.
3	11 8	.28	3	2 yarns....	206	Straightened the wire hook.
3	.....	.28	.....	.....	273	3 strands at the pin.
3	.....	.28	.....	.....	245	Do.
4	11 3	.22 to .28	4	3 yarns....	180	2 strands in the loop at eye of hook.
4	.....	.22 to .28	.....	.....	198	3 strands at the pin.
4	.....	.22 to .28	.....	.....	202	2 strands at the pin.
5	10 2	.22 to .28	3	2 yarns....	258	Straightened the wire hook.
5	.....	.22 to .28	.....	.....	299	3 strands at the pin.
5	.....	.22 to .28	.....	.....	306	Do.
6	11 8	.22 to .28	4	3 yarns....	162	1 strand 16 in. from the pin.
6	.....	.22 to .28	.....	.....	222	1 strand at the pin.
7	9 6	.26	3	2 yarns....	203	Straightened the wire hook.
7	.....	.26	.....	...do.....	290	1 strand 1 in. from the pin.
7	.....	.26	.....	...do.....	246	1 strand at the pin.
8	10 4	.27	3	...do.....	225	Straightened the wire hook.
8	.....	.27	.....	...do.....	275	3 strands at the pin.
8	.....	.27	.....	...do.....	297	1 strand 12 in. from the pin.
9	10 3	.27	3	...do.....	222	Fractured the rope at eye of wire hook.
9	.....	.27	.....	...do.....	295	3 strands at the pin.
9	.....	.27	.....	...do.....	284	Do.
10	10 11	.25	3	...do.....	195	3 strands 6 in. from end of hook.
10	.....	.25	.....	...do.....	366	2 strands 22 in. from pin.
11	33 6	.20	3	5 yarns....	198	1 strand at the pin.
11	.....	.20	.....	...do.....	236	3 strands at the pin.
11	.....	.20	.....	...do.....	256	Do.
12	2 2	.20	3	...do.....	128	Straightened the wire hook.
12	.....	.20	.....	...do.....	226	1 strand 6 in. from the end of snap hook.
13	2 6	.19	3	...do.....	113	1 strand 7 in from end of wire hook.
13	34 7	.20	3	...do.....	165	2 strands in the loop at eye of snap hook.
13	.....	.20	.....	...do.....	279	3 strands at the pin.
13	.....	.20	.....	...do.....	233	Do.
13	.....	.20	.....	...do.....	223	3 strands 30 in. from the pin.
14	2 5.5	.19	3	...do.....	145	In the loop at eye of wire hook.
14	.....	.19	.....	...do.....	186	In the loop at eye of snap hook.
14	34 7	.19	3	...do.....	189	2 strands in the loop at eye of snap hook.
14	.....	.19	.....	...do.....	276	3 strands at the pin.
14	.....	.19	.....	...do.....	264	Do.
14	.....	.19	.....	...do.....	285	Do.
15	2 7	.22	3	2 yarns....	139	Drew out the loop at eye of snap hook.
15	.....	.22	.....	...do.....	135	Drew out the loop at eye of wire hook.
15	34 2	.20	3	5 yarns....	171	3 strands in the loop at eye of snap hook.
15	.....	.20	.....	...do.....	212	3 strands at the pin.
15	.....	.20	.....	...do.....	220	Do.
15	.....	.20	.....	...do.....	240	Do.
16	37 6	.16	3	2 yarns....	134	Do.
16	.....	.16	.....	...do.....	149	Do.
16	.....	.16	.....	...do.....	109	Do.
17	24 10	.14	3	...do.....	126	3 strands 24 in. from the pin.
17	.....	.14	.....	...do.....	105	1 strand 36 in. from the pin.
17	.....	.14	.....	...do.....	87	1 strand at a knot which was in this length.
18	28 10	.23	3	14 threads.	208	2 strands at the pin.
18	.....	.23	.....	...do.....	220	1 strand at the pin.
18	.....	.23	.....	...do.....	219	Do.
19	29 8	.22	3	...do.....	194	2 strands in the loop at eye of wire hook.
19	.....	.22	.....	...do.....	178	1 strand at the pin.
19	.....	.22	.....	...do.....	210	Do.
19	.....	.22	.....	...do.....	237	3 strands at the pin.
20	2 7	.23	3	...do.....	153	Drew out the loop at eye of wire hook.
21	3 6	.22	3	...do.....	170	Opened the eye of wire hook.

Tensile tests of used lanyards of Italian hemp log line—Continued.

No.	Length over all.	Approximate diameter.	Number of strands.	Number of threads or yarns in each strand.	Tensile strength.	Parted.
	Ft. in.	*In.*			*Lb.*	
21	.....	.22	.....	14 threads.	252	1 strand in the loop at eye of snap hook.
22	16 4	.22	3	...do.....	313	1 strand at the pin.
22	.....	.22	.....	...do.....	305	2 strands at the pin.
23	30 2	.21	3	...do.....	227	Opened the eye of wire hook.
23	.....	.21	.....	...do.....	282	3 strands at the pin.
23	.....	.21	.....	...do.....	294	Do.
23	.....	.21	.....	...do.....	316	Do.
24	34 3	.17 to .20	3	5 yarns....	221	3 strands in the loop at eye of snap hook.
24	.....	.17 to .20	.....	...do.....	240	3 strands at the pin.
24	.....	.17 to .20	.....	...do.....	221	Do.
24	.....	.17 to .20	.....	...do.....	194	1 strand at the pin.
[1] 25	30 0	.18 to .20	3	...do.....	186	3 strands at the pin.
[1] 25	.....	.18 to .20	.....	...do.....	205	1 strand at the pin.
[1] 25	.....	.18 to .20	.....	...do.....	36	2 strands 6 in. from the pin.
26	31 8	.18	3	...do.....	250	1 strand 24 in. from end of snap hook.
26	.....	.18	.....	...do.....	217	3 strands at the pin.
26	.....	.18	.....	...do.....	247	Do.
26	.....	.18	.....	...do.....	248	Do.
27	14 5	.14	3	2 yarns....	45	Drew out the loop at eye of snap hook.
27	.....	.14	.....	...do.....	120	1 strand at the pin.
27	.....	.14	.....	...do.....	118	3 strands 8 in. from the pin.
28	13 10	.17	3	...do.....	189	Opened the eye and fractured the wire in hook.
28	.....	.17	.....	...do.....	244	3 strands 27 in. from the pin.
28	.....	.17	.....	...do.....	239	3 strands at the pin.
28	14 4	.18	3	5 yarns....	251	Do.
28	.....	.18	.....	...do.....	283	Do.
29	13 0	.14	3	2 yarns....	128	1 strand 6 in. from the pin.
29	.....	.14	.....	...do.....	214	3 strands at the pin.
30	17 0	.18	3	5 yarns....	280	Drew out the loop at eye of snap hook.
30	.....	.18	.....	...do.....	275	3 strands at the pin.
30	.....	.18	.....	...do.....	263	Do.
31	16 8	.17	3	...do.....	290	Do.
31	.....	.17	.....	...do.....	230	1 strand at the pin.
31	.....	.17	.....	...do.....	293	2 strands 5 in. from end of snap hook.
32	2 2	.18	3	...do.....	151	3 strands in the loop at eye of wire hook.
32	.....	.18	.....	...do.....	233	3 strands at the pin.
33	34 10	.18	3	...do.....	210	3 strands in the loop at eye of snap hook.
33	.....	.18	.....	...do.....	260	2 strands at the pin.
33	.....	.18	.....	...do.....	272	3 strands at the pin.
33	.....	.18	.....	...do.....	269	Do.
34	2 5	.18	3	...do.....	151	3 strands in the loop at eye of snap hook.
34	.....	.18	.....	...do.....	161	Straightened the wire hook.
35	34 0	.18	3	...do.....	245	3 strands at the pin.
35	.....	.18	.....	...do.....	231	Do.
35	.....	.18	.....	...do.....	243	Do.
36	34 9	.19	3	...do.....	244	3 strands in the loop at eye of snap hook.
36	.....	.19	.....	...do.....	310	3 strands at the pin.
36	.....	.19	.....	...do.....	245	Do.
36	.....	.19	.....	...do.....	295	Do.
37	34 10	.18	3	...do.....	205	2 strands in the loop at eye of snap hook.
37	.....	.18	.....	...do.....	223	1 strand at the pin.
37	.....	.18	.....	...do.....	240	3 strands at the pin.
37	.....	.18	.....	...do.....	242	2 strands 34 in. from the pin.
38	3 0	.20	3	4 yarns....	293	3 strands in the loop at eye of wire hook.
38	.....	.20	.....	...do.....	268	3 strands in the loop at eye of snap hook.
39	2 5.5	.18	3	5 yarns....	98	Fractured the wire hook.
39	.....	.18	.....	...do.....	192	2 strands in the loop at eye of snap hook.
40	33 8	.18	3	...do.....	190	3 strands in the loop at eye of snap hook.
40	.....	.18	.....	...do.....	220	3 strands at the pin.
40	.....	.18	.....	...do.....	240	2 strands at the pin.

[1] This lanyard was full of broken strands.

Tensile tests of used lanyards of Italian hemp log line—Continued.

No.	Length over all.	Approximate diameter.	Number of strands.	Number of threads or yarns in each strand.	Tensile strength.	Parted.
	Ft. in.	*In.*			*Lb.*	
40	.....	.18	.....	5 yarns ...	206	3 strands at the pin.
41	11 0	.22	3	2 yarns....	350	2 strands at the pin.
41	.....	.22	.....	...do.....	366	1 strand at the pin.
42	32 8	.18	3	5 yarns....	232	1 strand 24 in. from the pin.
42	.....	.18	.....	...do.....	203	1 strand at the pin.
42	.....	.18	.....	...do.....	216	2 strands at the pin.
42	.....	.18	.....	...do.....	206	3 strands at the pin.
43	11 0	.25	3	2 yarns....	352	1 strand at the pin.
43	.....	.25	.....	...do.....	223	2 strands at middle of length.
43	11 0	.24	3	...do.....	325	1 strand at the pin.
43	.....	.24	.....	...do.....	320	Do.
44	16 0	.25	3	...do.....	298	Opened the eye of wire hook.
44	.....	.25	.....	...do.....	326	1 strand at the pin.
44	.....	.25	.....	...do.....	300	Do.
45	24 8	.23	3	14 threads.	218	Opened the eye of wire hook.
45	.....	.23	.....	...do.....	211	1 strand at the pin.
45	.....	.23	.....	...do.....	195	Do.
45	.....	.23	.....	...do.....	187	Do.
46	24 8	.22	3	...do.....	240	3 strands at the pin.
46	.....	.22	.....	...do.....	232	2 strands at the pin.
46	.....	.22	.....	...do.....	220	Do.

TENSILE TESTS OF NEW LANYARDS AND NEW MATERIAL FOR MAKING SAME.

1. Long lanyards from Watervliet having 6 strands and a core of 7 threads.

2. Gunner's lanyard from Rock Island Arsenal having 4 strands and no core.

3. Italian hemp log line as furnished from the arsenal, 0.16 to 0.18 in. diameter.

4. Same as No. 3, except diameter 0.25 in.

No.	Length over all.	Approximate diameter.	Number of strands.	Number of threads or yarns in each strand.	Tensile strength.	Parted.
	Ft. in.	*In.*			*Lb.*	
1	30 2	0.18	6	7 threads..	198	Opened the eye of wire hook.
1	.....	.18	.....	...do.....	390	2 strands at the pin.
1	.....	.18	.....	...do.....	360	6 strands at the pin.
1	.....	.18	.....	...do.....	402	Do.
2	15 3	.22	4	10 threads.	279	2 in. from the eye of wire hook.
2	.....	.22	.....	...do.....	271	2 strands at the pin.
2	.....	.22	.....	...do.....	298	3 strands at the pin.
3	31 8	.15	4	8 threads..	244	4 strands at the pin.
3	.....	.15	.....	...do.....	285	Do.
3	.....	.15	.....	...do.....	325	Do.
3	.....	.15	.....	...do.....	306	Do.
4	30 5	.25	3	10 threads.	578	2 strands at the pin.
4	.....	.25	.....	...do.....	550	3 strands at the pin.
4	.....	.25	.....	...do.....	490	Do.
4	.....	.25	.....	...do.....	520	2 strands at the pin.

TENSILE TESTS OF ITALIAN HEMP LOG LINE USED FOR MAKING LANYARDS.

Loads were applied by means of dead weights.

Bowline knots, eye splices, and clove hitches were used for fastening the ends.

Length of samples between knots, splices, or hitches ranged from 12 in. to 40 in.

Where there are two tests under the same number the second test was made on the same sample as the first, a new hitch being made at the parted end, thus shortening the sample.

No.	Style of hitch.	Diameter.	Number of strands.	Number of threads in each strand.	Tensile strength.	Parted.
		In.			*Lb.*	
1	Eye splices....	0.15 to 0.18	4	8	290	4 strands at the splice.
2	.....do.....	.15 to .18	4	8	281	2 strands 4 in. and 2 strands 6 in. from the splice.
2	.....do.....	.15 to .18	4	8	321	4 strands at middle of length.
3	Bowline knot.	.15 to .18	4	8	230	4 strands at knot.
3	.....do.....	.15 to .18	4	8	265	Do.
4	.....do.....	.15 to .18	4	8	222	Do.
5	.....do.....	.15 to .18	4	8	271	Do.
5	.....do.....	.15 to .18	4	8	290	Do.
6	Clove hitch....	.15 to .18	4	8	251	Do.
6	.....do.....	.15 to .18	4	8	276	Do.
7	Eye splices....	.25	3	10	676	2 strands at splice.
7	.....do.....	.25	3	10	619	Do.
8	.....do.....	.25	3	10	675	Do.
9	Bowline knot.	.25	3	10	465	2 strands at knot.
10	.....do.....	.25	3	10	481	3 strands at knot.
11	.....do.....	.25	3	10	501	Do.
12	Clove hitch....	.25	3	10	518	1 strand at hook.
13	.....do.....	.25	3	10	465	3 strands at hook.
14	.....do.....	.25	3	10	553	Do.

TENSILE TESTS OF BURLAP.

Samples 2 in. and 6 in. wide. Samples 6 in. wide were folded three times, so as to make a strip 2 in. wide and 3-ply.

Length of samples over all, 18 in.

Gaged length, 10 in.

Marks.	Elongation in 10 in. at maximum load.	Tensile strength.
	In.	*Lb.*
2-in. warp	0.30	129
Do	.32	129
Do	.30	115
6-in warp	.28	306
2-in. filling	.70	145
Do	.72	151
Do	.68	149
6-in. filling	.62	425

CONCRETE.

COMPRESSION TESTS OF CUBES AND PRISMS.

COMPRESSION TESTS OF SHELL CONCRETE CUBES FOR THE UNITED STATES ENGINEER OFFICER.

TAMPA, FLA.

Compressed surfaces faced with plaster of Paris to secure even bearing in the testing machine.

Composition of cubes: Nos. 1, 2, and 3, made July 13, 1909—1 cement, 2 sand, 4 shell. Nos. 4, 5, and 6, made July 24, 1909—1 cement, 3 sand, 6 shell.

Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per sq. in.
	In.	*In.*	*In.*	*Sq. in.*	*Lb.*	*Lb.*	*Lb.*
1	6.01	6.06	6.11	37.03	64 100	64 100	1 739
2	6.04	6.02	6.11	36.78	60 400	60 400	1 640
3	6.02	6.03	6.12	36.90	57 100	57 100	1 550
4	6.03	6.06	6.12	37.09	25 200	25 200	680
5	6.05	6.06	6.10	36.97	32 400	32 400	875
6	6.02	6.06	6.12	37.09	25 700	25 700	690

MILWAUKEE, WIS.

Marks, I.

Mixture: Alpha cement, 1 part; limestone dust, 2 parts; limestone ($\frac{1}{4}$ in. to 1 in.), 4 parts.

Weight of cube, 136 lb.

Height, 12.08 in.

Compressed surface, 12.10 in. by 11.63 in.

Sectional area, 140.72 sq. in.

Gaged length, 5 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
14 070	100	0.	0.	
28 140	200	0.	0.	
42 220	300	0.	0.	
56 290	400	0.	0.	
70 360	500	.0002	0.	
84 430	600	.0003	0.	
98 500	700	.0007	0.	
112 580	800	.0010	.0002	Modulus of elasticity between loads of 600 and 800 lb. per sq. in. 2 000 000 lb.
126 650	900	.0015	.0003	
140 720	1 000	.0021	.0005	
154 790	1 100	.0030	.0009	
168 860	1 200	.0045	.0018	
182 940	1 300	.0083	.0044	
188 400	1 340	.....	.....	Ultimate strength.

CONCRETE CUBES.

Marks, II.

Mixture: Alpha cement, 1 part; limestone dust, 2 parts; limestone (¼ in. to 1 in.), 4 parts.

Weight of cube, 137.5 lb.

Height, 12.10 in.

Compressed surface, 12.10 in. by 11.68 in.

Sectional area, 141.32 sq. in.

Gaged length, 5 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
14 130	100	0.	0.	
28 260	200	0.	0.	
42 400	300	.0001	0.	
56 530	400	.0001	0.	
70 600	500	.0002	0.	
84 790	600	.0004	.0001	
98 920	700	.0008	.0001	Modulus of elasticity between loads of 600 and 800 lb. per sq. in. 2 000 060 lb.
113 050	800	.0010	.0002	
127 190	900	.0014	.0003	
141 320	1 000	.0018	.0005	
155 450	1 100	.0025	.0007	
169 580	1 200	.0033	.0010	
183 720	1 300	.0046	.0017	
197 850	1 400	.0068	.0030	
206 600	1 460	.....	.....	Ultimate strength.

Marks, III.

Mixture: Alpha cement, 1 part; limestone dust, 2 parts; limestone (¼ in. to 1 in.), 4 parts.

Weight of cube, 138 lb.

Height, 12.09 in.

Compressed surface, 12.15 in. by 11.75 in.

Sectional area, 142.76 sq. in.

Gaged length, 5 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
14 270	100	0.	0.	
28 550	200	0.	0.	
42 830	300	.0001	0.	
57 100	400	.0002	.0001	
71 380	500	.0004	.0002	
85 650	600	.0007	.0003	
99 930	700	.0010	.0004	Modulus of elasticity between loads of 600 and 800 lb. per sq. in. 2 500 000 lb.
114 200	800	.0013	.0005	
128 480	900	.0018	.0006	
142 760	1 000	.0023	.0007	
157 040	1 100	.0030	.0010	
171 310	1 200	.0040	.0016	
185 590	1 300	.0056	.0027	
199 860	1 400	.0097	.0057	
200 400	1 403	.....	.....	First crack.
206 300	1 445	.....	.....	Ultimate strength.

Marks, IIII.

Mixture: Universal cement, 1 part; limestone dust, 2 parts; limestone ($\frac{1}{4}$ in. to 1 in.), 4 parts.

Weight of cube, 135.5 lb.

Height, 12.08 in.

Compressed surface, 12.10 in. by 11.80 in.

Sectional area, 142.78 sq. in.

Gaged length, 5 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
14 280	100	0.	0.	
28 560	200	0.	0.	
42 830	300	.0002	0.	
57 110	400	.0002	.0001	
71 390	500	.0006	.0001	
85 670	600	.0010	.0002	
99 950	700	.0015	.0004	Modulus of elasticity between loads of 600 and 800 lb. per sq. in. 1 250 000 lb.
114 220	800	.0023	.0007	
128 500	900	.0035	.0013	
142 780	1 000	.0075	.0044	
150 200	1 050	.....	.....	Ultimate strength.

Marks, V.

Mixture: Universal cement, 1 part; limestone dust, 2 parts; limestone ($\frac{1}{4}$ in. to 1 in.), 4 parts.

Weight, 136.5 lb.

Height, 12.05 in.

Compressed surface, 12.05 in. by 11.86 in.

Sectional area, 142.91 sq. in.

Gaged length, 5 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
14 290	100	0.	0.	
28 580	200	0.	0.	
42 870	300	0.	0.	
57 160	400	.0001	0.	
71 450	500	.0002	0.	
85 750	600	.0007	0.	
100 040	700	.0011	.0001	Modulus of elasticity between loads of 600 and 800 lb. per sq. in 1 430 000 lb.
114 330	800	.0018	.0004	
128 620	900	.0027	.0009	
142 910	1 000	.0055	.0027	
154 700	1 080	.....	.....	Ultimate strength.

Marks, VI.
Mixture: Universal cement, 1 part; limestone dust, 2 parts; limestone (¼ in. to 1 in.), 4 parts
Weight of cube, 136.5 lb.
Height, 12.04 in.
Compressed surface, 12.08 in. by 11.75 in.
Sectional area, 141.94 sq. in.
Gaged length, 5 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
14 190	100	0.	0.	
28 390	200	0.	0.	
42 580	300	.0001	0.	
56 780	400	.0002	0.	
70 970	500	.0005	0.	
85 160	600	.0009	.0002	
99 360	700	.0013	.0003	Modulus of elasticity between loads of 600 and 800 lb. per sq. in. 1 667 000 lb.
113 550	800	.0020	.0007	
127 750	900	.0030	.0010	
141 940	1 000	.0047	.0020	
156 130	1 100	.0100	.0061	
163 700	1 150	.....	.....	Ultimate strength.

Concrete Prisms.

Marks, I.
Mixture: Alpha cement, 1 part; limestone dust, 2 parts; limestone (¼ in. to 1 in.), 4 parts.
Weight of prism, 51 lb.
Height, 17.97 in.
Compressed surface, 6.18 in. by 5.93 in.
Sectional area, 36.64 sq. in.
Gaged length, 10 in.

Applied loads.		In gage length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
3 660	100	0.	0.	
7 330	200	.0001	0.	
10 990	300	.0004	0.	
14 660	400	.0010	.0001	
18 320	500	.0017	.0002	
21 980	600	.0027	.0003	
25 650	700	.0040	.0008	Modulus of elasticity between loads of 600 and 800 lb. per sq. in. 1 538 000 lb.
29 310	800	.0051	.0014	
32 980	900	.0065	.0028	
36 640	1 000	.0131	.0097	Ultimate strength.

Prism contained numerous voids and failed at the bottom end.

Marks, II.

Mixture: Alpha cement, 1 part; limestone dust, 2 parts; limestone ($\frac{1}{4}$ in. to 1 in.), 4 parts.

Weight of prism, 50.5 lb.

Height, 18.05 in.

Compressed surface, 5.98 in. by 6.01 in.

Sectional area, 35.94 sq. in.

Gaged length, 10 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
3 590	100	0.	0.	
7 190	200	.0003	0.	
10 780	300	.0008	.0002	
14 380	400	.0014	.0003	
17 970	500	.0024	.0006	
21 560	600	.0036	.0010	
25 160	700	.0048	.0017	Modulus of elasticity between loads of 600 and 800 lb. per sq. in. 1 667 000 lb.
28 750	800	.0065	.0027	
32 350	900	.0096	.0048	
35 600	990	.....	.....	Ultimate strength.

Prism contained numerous voids and failed at bottom end.

Marks, III.

Mixture: Alpha cement, 1 part; limestone dust, 2 parts; limestone ($\frac{1}{4}$ in. to 1 in.), 4 parts.

Weight of prism, 52 lb.

Height 18 in.

Compressed surface, 6.10 in. by 6.03 in.

Sectional area, 36.78 sq. in.

Gaged length, 10 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
3 680	100	0.	0.	
7 360	200	.0007	.0005	
11 030	300	.0009	.0007	
14 710	400	.0014	.0011	
18 390	500	.0019	.0011	
22 070	600	.0021	.0008	
25 750	700	.0035	.0015	Modulus of elasticity between loads of 600 and 800 lb. per sq. in. 1 000 000 lb.
29 420	800	.0053	.0020	
33 100	900	.0073	.0045	
36 780	1 000	.0105	.0066	
42 800	1 160	.....	.....	Ultimate strength.

Marks, IIII.

Mixture: Universal cement, 1 part; limestone dust, 2 parts; limestone (¼ in. to 1 in.), 4 parts.

Weight of prism, 51 lb.

Height, 18.08 in.

Compressed surface, 5.92 in. by 6.07 in.

Sectional area, 35.93 sq. in.

Gaged length, 10 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
3 590	100	0.	0.	
7 190	200	.0003	.0001	
10 780	300	.0006	.0002	
14 370	400	.0012	.0004	
17 970	500	.0024	.0007	
21 560	600	.0037	.0012	
25 150	700	.0053	.0020	Modulus of elasticity between loads of 600 and 800 lb. per sq. in. 1 176 000 lb.
28 744	800	.0075	.0033	
32 340	900	.0122	.0070	
35 400	985	.....	.....	Ultimate strength.

Marks, V.

Mixture: Universal cement, 1 part; limestone dust, 2 parts; limestone (¼ in. to 1 in.), 4 parts.

Weight of prism, 51.5 lb.

Height, 18 in.

Compressed surface, 6.13 in. by 5.88 in.

Sectional area, 36.04 sq. in.

Gaged length, 10 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
3 600	100	0.	0.	
7 200	200	.0005	.0002	
10 810	300	.0011	.0004	
14 420	400	.0017	.0010	
18 020	500	.0028	.0011	
21 620	600	.0039	.0015	
25 230	700	.0060	.0025	Modulus of elasticity between loads of 600 and 800 lb. per sq. in. 1 111 000 lb.
28 830	800	.0087	.0045	
32 100	890	.....	.....	Ultimate strength.

Marks, VI.

Mixture: Universal cement, 1 part; limestone dust, 2 parts; limestone ($\frac{1}{4}$ in. to 1 in.), 4 parts.

Weight of prism, 52 lb.

Height, 18.05 in.

Compressed surface, 6.15 in. by 5.90 in.

Sectional area, 36.28 sq. in.

Gaged length, 10 in.

Applied loads.		In gaged length.		Remarks.
Total.	Per sq. in.	Compression.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
3 630	100	0.	0.	
7 260	200	.0005	.0001	
10 880	300	.0013	.0005	
14 510	400	.0025	.0008	
18 140	500	.0039	.0017	
21 770	600	.0061	.0032	
25 400	700	.0093	.0055	Modulus of elasticity between loads of 600 and 800 lb. per sq. in. 833 000 lb.
29 020	800	.0155	.0102	
31 600	870	.....	.....	Ultimate strength.

Prism contained numerous voids.

Tabulation of Results.

Marks.	Brand of cement.	Age when tested.	Height.	Dimensions compressed.	Surface.	Sectional area.	Ultimate strength.		Modulus of elasticity between loads per sq. in of 600 and 800 lb.
							Total.	Per sq. in.	
		Days.	*In.*	*In.*	*In.*	*Sq. in.*	*Lb.*	*Lb.*	*Lb.*
Cubes I	Alpha	10	12.08	12.10	11.63	140.72	188 400	1 340	2 000 000
II	...do	10	12.10	12.10	11.68	141.32	206 600	1 460	2 000 000
III	...do	10	12.09	12.15	11.75	142.76	206 300	1 445	2 500 000
IIII	Universal	10	12.08	12.10	11.80	142.78	150 200	1 050	1 250 000
V	...do	10	12.05	12.05	11.86	142.91	154 700	1 080	1 430 000
VI	...do	11	12.04	12.08	11.75	141.94	163 700	1 150	1 667 000
Prisms I	Alpha	11	17.97	6.18	5.93	36.64	36 640	1 000	1 538 000
II	...do	11	18.05	5.98	6.01	35.94	35 600	990	1 667 000
III	...do	11	18.00	6.10	6.03	36.78	42 800	1 160	1 000 000
IIII	Universal	12	18.08	5.92	6.07	35.93	35 400	985	1 176 000
V	...do	12	18.00	6.13	5.88	36.04	32 100	890	1 111 000
VI	...do	12	18.05	6.15	5.90	36.28	31 600	870	833 000

RUBBER.

TENSILE TESTS OF RUBBER FOR WATERTOWN ARSENAL.

Marks.	Dimensions.		Sectional area.	Tensile strength.		Elongation in 2 in.	
	Width.	Thickness.		Total.	Per sq. in.		
	In.	*In.*	*Sq. in.*	*Lb.*	*Lb.*	*In.*	*Per cent.*
1	0.54	0.33	0.178	71	398	5.50	275.0
2	.68	.33	.224	80	357	5.40	270.0
3	.62	.59	.365	142	389	1.25	62.5
4	.67	.57	.381	153	401	1.20	60.0
5	.65	.47	.305	102	334	1.05	52.5
6	.64	.49	.313	114	364	1.10	55.0
7	.64	.47	.300	90	300	8.00	400.0
8	.66	.48	.316	93	294	6.60	330.0
9	.65	.50	.325	130	400	1.50	75.0
10	.65	.50	.325	122	375	1.40	70.0
11	.66	.49	.323	112	346	1.30	65.0
12	.67	.47	.314	132	420	1.35	67.5
13	.69	.55	.379	152	401	1.45	72.5
14	.61	.56	.341	124	363	1.40	70.0
15	.70	.50	.350	159	454	1.20	60.0
16	.64	.49	.313	143	456	1.30	65.0
17	.97	.47	.456	289	633	4.15	207.5
18	.66	.56	.369	139	376	1.35	67.5
19	.65	.52	.338	198	585	3.85	192.5
20	.80	.35	.280	122	435	1.85	92.5
21	.80	.35	.280	161	575	[1] 2.05	205.0
22	.77	.54	.415	263	633	3.80	190.0
23	.77	.53	.408	265	649	3.95	197.5
24	1.04	.43	.447	214	478	3.70	185.0
25	1.02	.42	.428	209	488	3.60	180.0
26	1.09	.47	.512	235	458	2.85	142.5
27	1.08	.45	.486	249	512	3.20	160.0
28	1.02	.46	.469	253	539	2.95	147.5
29	1.02	.46	.469	245	522	2.60	130.0
30	.63	.37	.233	153	656	4.30	215.0
31	.63	.37	.233	157	673	4.60	230.0
32	.61	.37	.225	159	706	4.50	225.0
[2] 33	.60	.35	.210	141	671	4.40	220.0
34	.59	.46	.271	157	579	3.45	172.5
35	.60	.46	.276	149	539	3.75	187.5
[3] 36	.50	.41	.205	145	707	4.90	245.0
[3] 37	1.02	.42	.428	237	553	4.30	215.0
38	.70	.40	.280	157	561	3.38	169.0
[3] 39	.70	.40	.280	132	471	3.75	188.0
39	Retested.			100	357	More than 3.75	.....

[1] Elongation in 1 in. due to No. 21 being a retest of No. 20.
[2] Open seams on side of this sample before testing.
[3] Samples not broken.

TESTS OF RUBBER FOR INSULATION OF CONDUCTOR WIRE.

Length of samples over all, 5 in.
Gaged lengths of 2 in. taken.
Sample No. 1:
Sample stretched until gaged length was 6 in., then load was released. After one minute rest the gaged length was $2\frac{3}{8}$ in.
The sample was then stretched until gaged length was 9 in. and did not break.
Sample No. 2:
Sample stretched until gaged length was 6 in., then load was released. After one minute rest the gaged length was $2\frac{3}{16}$ in.
The sample was then stretched until the gaged length was $9\frac{1}{8}$ in., when it broke.
Sample No. 3:
This sample broke before gaged length was stretched to 6 in. at a point where the rubber had been injured in stripping from the wire.

TESTS OF ¾-IN. GARDEN HOSE.

Friction test:

First layer of fabric with cover removed and test made on next layer, a 10-lb. weight being used.

2⅛ in. of fabric was removed during 5 minutes.

Tube test:

Four tubes were prepared by cutting off inch sections of hose, and stripping the fabric from the tube. As 2-in. gaged lengths could not be obtained by cutting them open, these rings were tested by pulling on wire fixtures.

Rupture occurred at the following values of distance between gage marks: 2 in., 2.25 in., 2.5 in., and 2.25 in.

Other specimens about 6 in. long were then stripped from the fabric, running lengthwise of hose. These were pulled with results as follows: (*a*) Width $\frac{15}{16}$ in., gaged length 2 in., stretched to 8 in. and released. New gaged length of 2 in. stretched to 7 in. and broke. (*b*) Width ⅝ in., gaged length 2 in., stretched to 7.5 in. and broke. (*c*) Width 1⅛ in., gaged length 2 in., stretched to 7 in. and broke.

BROWN AND BLUE PRINT PAPER.

BROWN-PRINT PAPER.

Samples 1 in. wide taken out lengthwise from paper.
Length between jaws, 3 in.
Thickness, 0.003 in.
Sectional area, 0.003 sq. in.
First test: 12 lb.[1]
Second test: 9 lb.[1]
Third test: 13 lb.
Fourth test: 12 lb.
Fifth test: 21 lb.
Mean: 13.4 lb.
Tensile strength, 4 467 lb. per sq. in.

REMARKS.—The sample submitted for test had several creases in it where the paper had been folded. The presence of these creases was detrimental to the tests, and it is believed they vitiated the results.

Samples 1 in. wide taken out lengthwise from paper.
Length between jaws, 3 in.
Thickness, 0.003 in.
Sectional area, 0.003 sq. in.
First test: 24 lb.
Second test: 21 lb.
Third test: 25 lb.
Fourth test: 25 lb.
Fifth test: 20 lb.
Mean, 23 lb.
Tensile strength, 7 700 lb. per sq. in.

[1] These fractures occurred at creases.

TENSILE TESTS OF PHOTOGRAPHIC BROWN-PRINT PAPER.

Samples 5 in. long, 1 in. wide, 3 in. between jaws.

Marks.	Taken out.	Thickness.	Tensile strength.				
			First test.	Second test.	Third test.	Mean.	Per sq. in.
		In.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
1	One way	0.0022	20.75	20.50	19.50	20.25	9 200
1	Other way	.0022	10.75	10.75	10.25	10.58	4 810
2	Lengthwise	.0030	20.75	21.25	21.00	21.00	7 000
3	....do	.0031	13.50	13.00	11.00	12.50	4 030
3	Other way	.0031	30.00	29.00	28.00	29.00	9 350
4	One way	.0030	33.00	34.00	32.00	33.00	11 000
4	Other way	.0030	17.00	18.00	17.25	17.41	5 830
5	One way	.0030	28.00	27.75	27.75	27.83	9 270
5	Other way	.0030	17.50	17.25	18.00	17.58	5 860
6	Lengthwise	.0028	9.00	9.25	10.50	9.58	3 420
6	Other way	.0028	22.50	22.75	22.25	22.50	8 030
7	Lengthwise	.0029	12.25	10.00	12.00	11.41	3 930
7	Other way	.0029	18.00	17.75	19.50	18.41	6 350
8	Lengthwise	.0029	14.25	14.50	15.00	14.58	5 020
8	Other way	.0029	28.75	28.00	28.75	28.50	9 820
9	Lengthwise	.0025	12.75	12.00	12.25	12.33	4 930
9	Other way	.0025	25.75	25.50	24.00	25.08	10 030
10	One way	.0028	15.75	15.00	14.75	15.16	5 410
11	Lengthwise	.0028	17.00	16.25	16.00	16.41	5 860
11	Other way	.0028	25.00	24.25	23.00	24.68	8 810
12	Lengthwise	.0031	13.00	13.25	14.50	13.58	4 380
12	Other way	.0031	31.00	31.75	31.25	31.33	10 100
13	Lengthwise	.0025	15.00	14.75	15.00	14.91	5 960
13	Other way	.0025	26.00	27.50	27.50	27.00	10 800
14	Lengthwise	.0028	9.75	12.00	11.00	10.91	3 900
14	Other way	.0028	26.25	26.00	26.75	26.33	9 350
15	Lengthwise	.0030	25.50	25.00	24.00	24.80	8 260
15	Crosswise	.0030	15.50	.....	.....	.....	5 160
[1] 16	Lengthwise	.0030	28.00	27.00	27.00	27.33	9 100
16	Crosswise	.0030	16.00	.....	.....	.....	5 330
17	Lengthwise	.0030	9.00	9.50	8.50	9.00	3 000
17	Crosswise	.0030	18.00	.....	.....	.....	6 000
[1] 18	Lengthwise	.0030	9.50	9.00	9.00	9.16	3 030
18	Crosswise	.0030	19.00	.....	.....	.....	6 330

[1] Printed and developed.

TENSILE TESTS OF PHOTOGRAPHIC BLUE-PRINT PAPER.

Samples 5 in. long over all, 1 in. wide, 3 in. between jaws.

Marks.	Taken out.	Thickness.	Tensile strength.				
			First test.	Second test.	Third test.	Mean.	Per sq. in.
		In.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
1	One way	0.0049	30.50	30.50	32.50	31.16	6 630
1	Other way	.0049	17.50	16.75	17.50	17.25	3 520
2	Lengthwise	.0043	39.50	38.50	38.50	38.83	9.130
3	....do	.0043	38.75	42.00	43.25	41.33	9 610
4	....do	.0058	19.50	21.50	22.75	21.25	3 660
4	Other way	.0058	40.50	38.75	41.00	40.08	6 910
5	Lengthwise	.0049	32.50	29.50	33.50	31.83	6 510
6	....do	.0042	34.50	37.25	37.50	36.41	8 670
7	One way	.0055	31.50	33.00	33.50	32.66	5 940
7	Other way	.0055	17.75	18.50	17.50	17.91	3 250
8	Lengthwise	.0052	24.50	23.75	24.50	24.25	4 660
8	Other way	.0052	43.50	42.75	43.50	43.25	8 330
9	Lengthwise	.0048	19.00	19.50	19.50	19.33	4 560
9	Other way	.0048	37.50	35.00	37.00	36.66	7 630
10	Lengthwise	.0040	19.50	19.75	19.50	19.58	4 860
10	Other way	.0040	31.00	31.75	31.50	31.41	7 850
11	Lengthwise	.0046	20.75	20.50	18.75	20.00	4 350
11	Other way	.0046	39.50	40.00	40.00	39.83	8 650
12	One way	.0040	22.50	23.50	21.75	22.58	5 640
12	Other way	.0040	40.75	38.75	31.50	37.00	9 250
13	Lengthwise	.0040	25.50	25.00	24.00	24.83	6 210
14	....do	.0050	23.75	23.50	23.00	23.41	4 680
14	Other way	.0050	36.00	37.50	38.00	37.16	7 430
15	One way	.0050	27.75	28.50	27.50	27.91	5 580
16	Lengthwise	.0051	31.50	31.50	31.75	31.58	6 380
17	....do	.0049	25.00	24.75	25.50	25.08	5 110
18	....do	.0042	19.00	18.50	18.25	18.58	4 420
18	Other way	.0042	39.00	35.50	38.25	37.58	8 950
19	Lengthwise	.0052	26.00	29.00	29.00	28.00	5 380
19	Crosswise	.0052	14.00				
[1] 20	Lengthwise	.0055	25.00	28.00	28.00	27.00	4 910
20	Crosswise	.0055	14.00				
21	Lengthwise	.0056	35.00	40.00	36.00	37.00	6 600
21	Crosswise	.0056	23.00				
[1] 22	Lengthwise	.0062	39.00	37.00	40.00	38.33	6 180
22	Crosswise	.0062	19.00				

[1] Printed and developed.

PRIVATE TESTS.

PRIVATE TESTS MADE DURING THE FISCAL YEAR ENDED JUNE 30, 1910.

Date.	Material.	Name.	City and State.
1909.			
July 1	Cast iron	Richmond Iron Works	Richmond Furnace, Mass.
8	Steel latch	Planter Compress	Boston, Mass.
9	Piers of building blocks.	Lyth Tile Co	Buffalo, N. Y.
9	Steel	Wyman & Gordon Co	Worcester, Mass.
13	Canvas belting	Boston Woven Hose & Rubber Co.	Cambridgeport, Mass.
13	Steel	Wyman & Gordon Co	Worcester, Mass.
13	Steel wire	American Steel & Wire Co	Do.
16	Rail anchors	The Robinson Co	Boston, Mass.
17	Steel	Wyman & Gordon Co	Worcester, Mass.
17	Steel bolts	Waltham Watch Co	Waltham, Mass.
21	Bronze	The Portland Co	Portland, Me.
23	Rails	American Railway Engineering & Maintenance of Way Association, R. Trimble, Secretary.	Pittsburg, Pa.
24	do	do	Do.
26	do	do	Do.
27	do	do	Do.
26	Steel	Wyman & Gordon Co	Worcester, Mass.
26	do	J. W. Mitchell	Boston, Mass.
28	Rails	American Railway Engineering & Maintenance of Way Association.	Pittsburg, Pa.
29	do	do	Do.
30	Cotton duck	Hood Rubber Co	East Watertown, Mass.
Aug. 3	Concrete cubes	Bridgeport Brass Co	Bridgeport, Conn.
3	Concrete building blocks.	Alfred Vosseller	Buffalo, N. Y.
3	Bronze	Isthmian Canal Commission, United States Engineer Office.	Boston, Mass.
4	Cast-iron shelf supports.	Snead & Co. Iron Works	Jersey City, N. J.
5	Cast-iron connections and bars.	Golding Manufacturing Co	Franklin, Mass.
6	Rails	American Railway Engineering & Maintenance of Way Association.	Pittsburg, Pa.
7	do	do	Do.
7	Steel	Wyman & Gordon Co	Worcester, Mass.
9	do	do	Do.
9	Rails	American Railway Engineering & Maintenance of Way Association.	Pittsburg, Pa.
10	do	do	Do.
11	do	do	Do.
11	do	do	Do.
12	do	do	Do.
13	do	do	Do.
14	do	do	Do.
16	do	do	Do.
17	do	do	Do.
18	do	do	Do.
18	Steel	Wyman & Gordon Co	Worcester, Mass.
19	Rails	American Railway Engineering & Maintenance of Way Association.	Pittsburg, Pa.
20	do	do	Do.
23	do	do	Do.
23	Cement bricks	Buffalo Paragon Wall Plaster Co.	Buffalo, N. Y.
24	Manila rope	Standard Cordage Co	Brighton, Mass.
24	Vitrified building tiles.	Lyth Tile Co	Buffalo, N. Y.
25	Cast iron	Pickering Governor Co	Portland, Conn.
26	Steel column	J. C. Bland, Pennsylvania Lines.	Pittsburg, Pa.
31	Steel	Wyman & Gordon Co	Worcester, Mass.
Sept. 2	Bronze	Victor Metal Co	East Braintree, Mass.
2	Steel	Central Steel & Iron Co	Harrisburg, Pa.
3	do	Wyman & Gordon Co	Worcester, Mass.
8	Wire	Harold S. Bond Co	Boston, Mass.
9	Concrete columns	Daniel Buckley	Dorchester, Mass.
10	do	Miller Column Co	East Boston, Mass.
10	Steel	J. W. Mitchell	Boston, Mass.
11	do	Lundin Steel Casting Co	Neponset, Mass.
11	Brick	Buffalo Sandstone Brick Co	Buffalo, N. Y.
13	Clay building blocks	A. Lyth & Sons Co	Do.
15	Steel	Wyman & Gordon Co	Worcester, Mass.
18	do	J. W. Mitchell	Boston, Mass.
20	Bronze	The Portland Co	Portland, Me.
23	Steel	Wyman & Gordon Co	Worcester, Mass.

Private tests made during the fiscal year ended June 30, 1910—Continued.

Date.	Material.	Name.	City and State.
1909.			
Oct. 1	Bronze	Warren H. Manning	Boston, Mass.
13	Manila rope	Standard Cordage Co	Brighton, Mass.
13	Steel	Wyman & Gordon Co	Worcester, Mass.
15	....do	....do	Do.
18	Cement building blocks	Inspector of buildings	Lawrence, Mass.
19	Fire brick	Kiesel Fire Brick Works	Rochester, N. H.
19	Rail anchor	The Robinson Co	Boston, Mass.
19	Steel and wrought-iron chain.	Rockport Granite Co	Rockport, Mass.
19	Wire rope	American Steel & Wire Co	Worcester, Mass.
22	Canvas belting	Boston Woven Hose Co	Cambridge, Mass.
23	Steel	Wyman & Gordon Co	Worcester, Mass.
25	....do	....do	Do.
29	Manard steel	Pennsylvania Steel Co	Steelton, Pa.
30	Rail joints	American Rail Joint Co	Toronto, Canada.
Nov. 1	....do	....do	Do.
2	....do	....do	Do.
3	....do	....do	Do.
4	Swivel	Fletcher & Crowell Co	Portland, Me.
4	Lally columns	United States Column Co	Cambridge, Mass.
5	Rail joints	American Railway Engineering & Maintenance of Way Association.	Pittsburg, Pa.
6	....do	....do	Do.
8	....do	....do	Do.
9	....do	....do	Do.
8	Steel	Wyman & Gordon Co	Worcester, Mass.
10	Crane chain	Perrin, Seamans & Co	Boston, Mass.
10	Rail	American Rail Joint Co	Toronto, Canada.
11	....do	....do	Do.
11	Rail joints	American Railway Engineering & Maintenance of Way Association.	Pittsburg, Pa.
12	Steel	J. W. Mitchell	Boston, Mass.
12	....do	Wyman & Gordon Co	Worcester, Mass.
13	....do	....do	Do.
20	....do	....do	Do.
20	Concrete columns	United States Column Co	Cambridge, Mass.
22	....do	....do	Do.
24	Steel	Wyman & Gordon Co	Worcester, Mass.
Dec. 1	Concrete filled columns	Cambridge Architectural Works	Cambridgeport, Mass.
2	Bricks	H. H. Fahrig	Philadelphia, Pa.
2	Building stone	Structural Cement Stone Co	Lynn, Mass.
3	....do	....do	Do.
3	Shearing test of forging	Kilborn & Bishop Co	New Haven, Conn.
7	Chain	Harold L. Bond Co	Boston, Mass.
7	Tiller rope	Tucker & Carter Rope Co	New York, N. Y.
8	Wrought-iron chain	Niagara Falls Power Co	Niagara Falls, N. Y.
10	Aluminum cables	....do	Do.
11	....do	....do	Do.
13	Manganese bronze	Whitlock Coil Pipe Co	Hartford, Conn.
15	Concrete building blocks.	J. P. Rice	Somerville, Mass.
30	Steel	Wyman & Gordon Co	Worcester, Mass.
30	Chain	Harold L. Bond Co	Boston, Mass.
1910.			
Jan. 3	Hydraulic gage	Star Brass Co	Do.
5	Steel	Wyman & Gordon Co	Worcester, Mass.
8	Concrete building blocks.	J. C. Vreeland Building Co	New York, N. Y.
8	Steel	Wyman & Gordon Co	Worcester, Mass.
11	....do	James W. Sederquist	Boston, Mass.
12	Floor tile	Athens Fire Brick Co	Athens, Tex.
12	Berlin rhyolite	Wisconsin Granite Co	Chicago, Ill.
24	Steel	Wyman & Gordon Co	Worcester, Mass.
27	Hooks, shackles, links, and turnbuckles.	The Thomas Laughlin Co	Portland, Me.
27	Wrought iron	Hood Rubber Co	East Watertown, Mass.
28	Concrete cubes	Simpson Bros. (Corp.)	Boston, Mass.
28	Steel	Wyman & Gordon Co	Worcester, Mass.
Feb. 10	Mortar	David Stoneham	Boston, Mass.
11	Concrete building blocks.	Rockdale Concrete Co	Northbridge, Mass.
11	Cast-iron	The Pickering Governor Co	Portland, Conn.
14	Steel	Wyman & Gordon Co	Worcester, Mass.
14	Buoy shackles	Fletcher & Crowell Co	Portland, Me.
15	....do	....do	Do.
17	Wrought iron bar	B. M. Jones & Co. (Inc.)	Boston, Mass.
19	Cast-iron	Tredegar Iron Works	Richmond, Va.

Private tests made during the fiscal year ended June 30, 1910—Continued.

Date.	Material.	Name.	City and State.
1910.			
Feb. 21	Steel	Wyman & Gordon Co	Worcester, Mass.
24	do	do	Do.
25	Granite cubes	Woodbury Granite Co	Hardwick, Vt.
28	Steel	J. W. Mitchell	Boston, Mass.
Mar. 5	do	Wyman & Gordon Co	Worcester, Mass.
9	do	do	Do.
10	do	James W. Sederquist	Boston, Mass.
12	Concrete	Brigham, Coveney & Bisbee	Do.
12	do	H. A. Carson	Do.
14	Rail joint	American Railway Engineering & Maintenance of Way Association.	Pittsburg, Pa.
15	do	do	Do.
16	Steel	Pennsylvania Railroad Co	Altoona, Pa.
19	do	American Railway Engineering & Maintenance of Way Association.	Pittsburg, Pa.
24	do	Wyman & Gordon Co	Worcester, Mass.
25	do	do	Do.
30	Cast-iron	The Portland Co	Portland, Me.
31	Steel	American & British Manufacturing Co.	Providence, R. I.
Apr. 1	Eyebolts	Laconia Car Co	Laconia, N. H.
8	Concrete	Coolidge & Carlson	Boston, Mass.
8	Concrete building blocks.	William J. McCarthy Co	East Somerville, Mass.
16	Steel	Wyman & Gordon Co	Worcester, Mass.
21	Manila rope	Whitlock Cordage Co	New York, N. Y.
23	Steel plates	Pennsylvania Steel Co	Steelton, Pa.
25	do	do	Do.
26	do	do	Do.
29	Steel	Wyman & Gordon Co	Worcester, Mass.
May 2	Concrete piles	New England Foundation Co	Boston, Mass.
3	Steel	Wyman & Gordon Co	Worcester, Mass.
5	Granite cubes	Woodbury Granite Co	Hardwick, Vt.
6	do	do	Do.
9	Concrete pile	New England Foundation Co	Boston, Mass.
10	Rubber belting	Revere Rubber Co	Chelsea, Mass.
11	Concrete building blocks.	Highland Coal Co	Somerville, Mass.
16	Steel	A. H. Emery, jr	Stamford, Conn.
17	Buoy shackles	Fletcher & Crowell Co	Portland, Me.
17	Steel	Wyman & Gordon Co	Worcester, Mass.
18	Cement building blocks	John L. Christensen	Buffalo, N. Y.
18	Spring block	J. P. Mac Donald	East Boston, Mass.
19	Rail joints	American Rail Joint Co	Toronto, Canada.
20	do	do	Do.
21	do	do	Do.
23	do	do	Do.
23	Steel	Pennsylvania Railroad Co	Altoona, Pa.
24	Cement building blocks	Graves Bros	West Medford, Mass.
25	Steel	Aberthaw Construction Co	Boston, Mass.
26	do	do	Do.
26	do	Wyman & Gordon Co	Worcester, Mass.
27	do	do	Do.
June 6	Steel eyebars	A. H. Emery	Stamford, Conn.
7	do	do	Do.
8	do	do	Do.
9	do	do	Do.
10	do	do	Do.
11	do	do	Do.
13	do	do	Do.
14	do	do	Do.
18	Steel	Aberthaw Construction Co	Boston, Mass.
20	Steel eyebars	A. H. Emery	Stamford, Conn.
21	Concrete cubes	Simpson Bros. (Corp.)	Boston, Mass.
21	Concrete building blocks.	J. C. Vreeland Co	New York, N. Y.
21	Lally column	United States Column Co	Cambridge, Mass.
22	Concrete pile	New England Foundation Co	Boston, Mass.
22	Malleable iron links	Plymouth Cordage Co	Do.
23	Steel eyebars	A. H. Emery	Stamford, Conn.
24	do	do	Do.
25	do	do	Do.
27	do	do	Do.
28	do	do	Do.
29	do	do	Do.
30	do	do	Do.
30	Riveted joints	Pennsylvania Railroad Co	Altoona, Pa.

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