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TENSILE AND COMPRESSIVE PROPERTIES OF SOME STAINLESS-STEEL SHEETS

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ABSTRACT

Tensile and compressive tests were made on specimens from chromium-nickel (17-7 and 18-7) stainless-steel sheets, with cold-reductions from zero percent (annealed) to 50 percent, and thicknesses from 0.01 to 0.06 in. The tensile yield strengths ranged from 34 to 200 kips/in². The effect of a stress-relieving treatment at 300° C for 24 hours was investigated for one of the compositions.

The tensile tests were made on standard specimens. The compressive tests were made by the pack method developed at the National Bureau of Standards and by the cylinder method developed by Russell Franks, of the Union Carbide & Carbon Research Laboratories. Tests were made on both longitudinal and transverse specimens from each sheet.

The results are given in tables and stress-strain curves to facilitate application in the design of light-weight structures from these materials. The effect of the degree of cold-reduction and of the stress-relieving treatment on the shape of the stress-strain curves and on the tensile and compressive properties is discussed.

CONTENTS

I. INTRODUCTION

There is a definite trend in structural design to use less material and so design the members that they are more efficient under load. Although this trend is noticeable in stationary structures, it is particularly marked in mobile structures, such as aircraft, where reduction in weight contributes directly to increased pay load, increased cruising range, and higher speed.

Stainless steel, available in sheets of a wide range of thickness, has, when cold-worked, a high strength-weight ratio, and since it is quite highly resistant to corrosion, little, if any, loss of strength results during its service life.

To make the most efficient use of a material, particularly where thin sheets are employed, the designer must have accurate and reliable data on the tensile and compressive properties. Many aircraft members are subjected to high compressive stress—obviously compression members should not fail at loads below those required to produce tensile failure in some other part of the structure.

To provide data on the tensile and compressive properties of stainless-steel sheets, the following manufacturers sponsored an investigation at the National Bureau of Standards under the Research Associate Plan [1]: [1]

Allegheny Ludlum Steel Corporation.
American Rolling Mill Co.
American Steel & Wire Co.
Carnegie-Illinois Steel Corporation.
Crucible Steel Company of America.
Electro Metallurgical Co.
International Nickel Co.
Republic Steel Corporation.
Rustless Iron & Steel Corporation.

The members of the sponsors' committee representing the manufacturers were:

Milton Male, chairman, United States Steel Corporation.
L. S. Bergen, Crucible Steel Company of America.
V. B. Browne, Allegheny Ludlum Steel Corporation.
A. L. Feild, Rustless Iron & Steel Corporation.
Russell Franks, Union Carbide & Carbon Research Laboratories.
H. J. French, International Nickel Co.
T. F. Olt, American Rolling Mill Co.
E. C. Smith, Republic Steel Corporation.

The purpose of this investigation was to determine the tensile and compressive properties of stainless-steel sheets of two chemical compositions which are commercially available and particularly suitable for aircraft structures. Compressive tests were to be made on flat sheet by the pack method [2] developed at the National Bureau of Standards and on sheet rolled into cylinders by the cylinder method [3] developed by Franks and Binder.

II. MATERIAL

The stainless steel used in this investigation was obtained from two of the cooperating manufacturers. In this report the heat of steel from one manufacturer will be called "17–7 sheet" and the heat from the second manufacturer "18–7 sheet." The chemical compositions, given in table 1, were furnished by the manufacturers.

The sheets were cold-rolled to the nominal thickness after the final anneal in order to increase the mechanical properties. "Cold-reduction" is defined as the percentage decrease in thickness after the final anneal. The thickness and the cold-reduction for the 17–7 sheets are given in table 2 and for the 18–7 sheets in table 3. For indentification, the sheets were numbered consecutively as they were received.

[1] Numbers in brackets indicate the literature references at the end of this paper.

III. METHOD OF TESTING

1. TENSILE TESTS

From each 17–7 sheet, two tensile specimens were taken longitudinally and two transversely to the direction in which the sheets had been rolled. One specimen of each was stress-relieved by heating to 300° C for 24 hours, followed by air-cooling. From each 18–7 sheet, one tensile specimen was taken longitudinally and one transversely. None of the specimens of the 18–7 sheet was stress-relieved. The specimens were ASTM standard test specimens [4], ½ in. wide and 2-in. gage length. The cross-sectional area of each specimen was computed from its measured thickness and width.

The specimens were tested in a Baldwin-Southwark testing machine having a fluid-support, a Tate-Emery load-indicating mechanism, and scale ranges of 1, 10, and 20 kips.[2] Templin grips were used to hold the specimens.

The strain was measured by a pair of Tuckerman 2-in. optical strain gages, having 0.4-in. knife-edges and lozenges. Each division of the vernier scale for these gages corresponded to a strain of 0.000004. The readings were estimated to one-half a division. The strain gages were attached to opposite faces of the reduced section when the specimen was under an initial load, not exceeding 4.2 kips/in^2.

For stresses up to the yield strength, the loading rate was about (2 kips/in.^{2})/min. The speed of testing from yield strength to failure corresponded to a movement of the testing-machine head of 0.03 in./min. The value of initial strain, corresponding to the stress at the initial load, was obtained by a least-square extrapolation to zero stress.

Marks were spaced ¼ in. apart in the gage length, and the elongation was measured in accordance with AST Mspecifications [4].

2. PACK COMPRESSIVE TESTS

Pack compressive tests were made on both longitudinal and transverse specimens taken from all sheets having a thickness of 0.020 in. or greater. These tests were not made on the 0.010-in. sheet nor on any sheets which had been stress-relieved. Each pack consisted of several specimens taken from the same sheet and in the same direction. The specimens for the packs from 0.020-, 0.035-, and 0.040-in. sheet were cemented together with fused shellac, but the specimens from the 0.060-in. sheet were not cemented together. The fusing temperature was not higher than 66° C and the fusing time not more than 8 hours. The number of specimens and the lengths of the packs are given in tables 4 and 5. There was a steel clamp at each end of each pack.

For the packs tested in the subpress (see tables), the middle specimen was about 0.03 in. wider than the others. For all the other packs, all the specimens were of the same width to facilitate machining.

The cross-sectional area of each pack was determined by the weight method [5]. The length was measured before and the weight and density determined after the pack was tested and the shellac removed.

[2] A kip is 1,000 lb.

The packs were loaded in Baldwin-Southwark testing machines having fluid-supports, Tate-Emery load-indicating mechanisms, and scale ranges of 6, 24, and 120, or 1, 10, and 20 kips. They were tested between hardened and ground steel blocks. To apply the load uniformly, a shim of plaster of paris was cast between the upper block and the head of the testing machine.

The strain was measured by a pair of 1-in. Tuckerman optical strain gages, having 0.2 in. knife-edges and lozenges. Each division of the vernier scale of these gages corresponded to a strain of 0.000004. The readings were estimated to one-half a division. The strain gages were attached to the middle of the opposite edge faces when the pack was under the initial load, not exceeding 2.3 kip/in ^{2}.

The rate of loading was about (2 kips/in. ^{2})/min. The value of strain corresponding to the stress at the initial load was obtained by a least-square extrapolation to zero stress.

3. CYLINDER COMPRESSIVE TESTS

The specimens for the cylinder compressive tests were taken both longitudinally and transversely from all sheets except those having a thickness of 0.060 in. The specimens were rolled to shape and the axial butt joints soldered under the direction of Russell Franks at the Union Carbide and Carbon Research Laboratories.

Additional longitudinal and transverse cylinders from 17–7 sheets were given a stress-relieving treatment, before they were soldered, by heating at 300° C for 24 hours followed by air-cooling.

The dimensions of the cylinders are given in tables 4 and 5. The bases of the cylinders were plane and were parallel within 0.0004 in. The ends of the cylinders were restrained against crinkling by annular castings of Wood's metal having a thickness of about ¼ in. along the length of the cylinder. A clearance was maintained between the end face of the casting and the end face of the cylinder, to assure that the compressive load would act only on the cylinder. The cross-sectional area was determined by the weight method [5] after the specimens were machined but before they were rolled into cylinders.

The procedure for loading and measuring strain was the same for the cylinders as for the packs. The strain gages were attached to opposite elements of the outside cylindrical surface when the cylinder was under the initial load. Each of those elements was about an equal distance from the butt joint.

IV. RESULTS AND DISCUSSION

The stress-strain curves for each specimen are shown in figures 1 to 55. Figure 56 shows the individual points for the 18–7, 0.060-in. sheet having 47.7 percent cold-reduction (fig. 55) to indicate the order of agreement between the points and the curves drawn through them. The other stress-strain curves are drawn without indicating the individual points in order to facilitate the ease of obtaining tangent moduli. They are all plotted to the same scales, and a straight-line projection of these curves in all cases would pass through the origin at zero stress and zero strain. The slope of the straight line was determined from the low-load data by the method of least squares, which, although requiring a certain amount of computation, is less dependent upon judgment than is the drawing of a line through the points. The reason for obtaining this low-load (or initial) slope is that it permits the determination of the yield-strength value (offset=0.2 percent) for each specimen individually.

The tensile and compressive properties of the specimens are given in tables 4 and 5. For all sheets, except those that were stress-relieved, both the longitudinal and the transverse tensile strengths were significantly greater for the 18–7 stainless steel than for the 17–7 stainless steel with comparable cold-reduction. The elongations for the longitudinal specimens were consistently somewhat less for the 18–7 material than for the 17–7, but the elongations for the transverse specimens were nearly the same. There were no consistent differences between the yield strengths. In considering the elongations, it should be noted that the rates of loading are much lower than those customary in commercial practice and that, consequently, the elongations generally will be higher than those obtained commercially. For example, an increase in the rate of movement of the testing machine head from 0.03 to 0.10 in./min lowered the elongation of a representative sample from 32.0 to 15.5 percent.

Certain differences were found in the shape of the stress-strain curves, depending upon the orientation of the specimens in the sheet and the nature of the loading; that is, tension or compression. For the annealed sheets (zero cold-reduction), the tensile and pack compressive stress-strain curves were almost the same. The ordinates of each cylinder compressive stress-strain curve were in all cases larger than the corresponding ordinates of both the tensile and pack compressive stress-strain curves. This was shown by the cylinder compressive yield strengths, which exceeded the pack compressive yield strengths by more than 14 percent.

For the cold-reduced sheets, regardless of thickness, the tensile stress-strain curves for the longitudinal specimens and for the transverse specimens were significantly different in shape. However, the tensile yield strengths for the longitudinal specimens were about the same as for the transverse specimens. There were large differences in shape between the compressive stress-strain curves for the longitudinal packs, or cylinders, and for the transverse packs, or cylinders. These differences were greater with increased cold-reduction.

For the cold-reduced sheets, the ordinates of the compressive stress-strain curves for *transverse* packs, or cylinders, were significantly larger than the corresponding ordinates of the tensile curves for either the longitudinal or transverse specimens. However, the ordinates of the compressive stress-strain curves for the *longitudinal* packs, or cylinders, were markedly smaller than the corresponding ordinates of the tensile curves for either the longitudinal or the transverse specimens.

For the cold-reduced sheets, the compressive yield strengths for the transverse cylinders and for the transverse packs were nearly the same. However, the compressive yield strengths for the longitudinal cylinders exceeded those for the longitudinal packs by more than 7 percent.

The stress-strain curves for stress-relieved specimens from the cold-reduced sheets were significantly different in shape from the curves from corresponding specimens which were not stress-relieved. The curves for the stress-relieved specimens did not change in slope as rapidly over the lower portion of the curve but, particularly for cold-reductions up to 20 percent, changed more rapidly over the upper portion of the curve in the neighborhood of the yield strength.

The curves of strengths and elongations plotted against cold-reductions (figs. 57 to 66) were not smooth, but they were remarkably regular considering that they were obtained from only one specimen for each cold-reduction. They suggest an approximate relationship between strength or elongation and cold-reduction independent of thickness. They show that the strengthening effect of cold-reduction is much greater on the yield strength than upon the tensile strength and that this effect is more pronounced in compression for transverse packs or cylinders than for longitudinal packs or cylinders.

For the 17–7 sheets, the tensile strengths for stress-relieved specimens were nearly the same as those for the specimens not stress-relieved. However, the elongations for the former were significantly greater than for the latter. For cold-reductions less than 20 percent, stress-relieving had very little effect on the tensile yield strength. For cold-reductions greater than 20 percent, stress-relieving significantly increased the tensile yield strengths. Stress-relieving caused no difference in compressive yield strength for transverse cylinders when the cold-reduction was small. At 20-percent cold-reduction, however, the yield strength of stress-relieved transverse cylinders was significantly greater than that of the nonstress-relieved cylinders, and the difference increased with the degree of cold-reduction.

V. CONCLUSIONS

The stress-strain graphs and the tensile and compressive properties of 17–7 and 18–7 stainless steel sheets, with longitudinal tensile yield strengths from 34 to 200 kips/in.[2] (corresponding to a range of sheets from annealed to 50-percent cold-reduction) and with thicknesses from 0.01 to 0.06 in., justify the following conclusions:

1. For annealed sheet, the stress-strain curves and the yield strengths from both tensile and pack compressive tests were about the same. The ordinates of the compressive stress-strain curves for either longitudinal or transverse cylinders were in all cases larger than the corresponding ordinates for tensile or pack compressive stress-strain curves.

2. For cold-reduced sheet, the tensile stress-strain curves for longitudinal specimens differed in shape from the tensile stress-strain curves for transverse specimens but the yield strengths for the longitudinal and transverse specimens were about the same.

3. For cold-reduced sheet, the compressive stress-strain curves for the longitudinal packs, or cylinders, and for the transverse packs, or cylinders, differed widely in shape. The yield strengths for the longitudinal packs, or cylinders, were markedly less than those for the transverse packs, or cylinders.

4. For cold-reduced sheet, the ordinates of the compressive stress-strain curves for transverse packs, or cylinders, were significantly larger than the corresponding ordinates of the tensile stress-strain curves for either longitudinal or transverse specimens. But the ordinates of the compressive stress-strain curves for longitudinal packs, or cylinders, were appreciably smaller than the corresponding ordinates

of the tensile stress-strain curves for either longitudinal or transverse specimens.

5. With comparable cold-reduction, the tensile strengths and the tensile and compressive yield strengths were about the same for all thicknesses of sheet investigated.

6. Stress-relieving increased the tensile and compressive yield strengths in both longitudinal and transverse directions. This effect was more marked the greater the amount of cold-reduction.

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VI. REFERENCES

[1] Research associates at the Bureau of Standards, NBS Circular C296 (1926).
[2] C. S. Aitchison and L. B. Tuckerman, The "Pack" Method for Compressive Tests of Thin Specimens of Materials Used in Thin-Wall Structures, NACA Rep. 649 (1939).
[3] Russell Franks and W. O. Binder, *The stress-strain characteristics of cold-rolled austenitic stainless steels in compression as determined by the cylinder test method*, Proc. ASTM **41,** 629 (1941).
[4] Tentative Methods of Tension Testing of Metallic Materials, E8–40T. ASTM Standards, 1940 supplement, pt. 1, Metals, p. 453.
[5] James A. Miller, *Determination of cross-sectional areas of structural members*, J. Research NBS **23,** 329 (1939) RP1237.

TABLE 1.—*Chemical compositions of sheet*

[Analysis as determined by the producers]

Elements	17–7 sheet	18–7 sheet
	Percent	*Percent*
Carbon	0.12	0.11
Manganese	1.26	.56
Phosphorus	0.015	.014
Sulfur	.009	.015
Silicon	.36	.272
Chromium	17.44	17.90
Nickel	7.18	6.72

TABLE 2.—*Thickness and cold-reduction of 17–7 sheets*

Sheet number	Thickness, nominal	Cold-reduction [1]
	Inch	*Percent*
225	0.01	0.0
214	.01	8.2
219	.01	18.0
221	.01	28.0
223	.01	37.0
218	.02	0.0
216	.02	8.2
204	.02	18.0
202	.02	30.5
200	.02	37.5
197	.04	0.0
211	.04	9.2
209	.04	23.6
207	.04	28.5
205	.04	38.8

[1] Values reported by the producer.

TABLE 3.—*Thickness and cold-reduction of 18–7 sheet*

Sheet number	Thickness, nominal	Cold-reduction [1]	Sheet number	Thickness, nominal	Cold-reduction [1]
	Inch	*Percent*		*Inch*	*Percent*
51	0.01	0.0	36	0.035	0.0
50	.01	12.0	25	.035	7.5
52	.01	19.6	26	.035	7.5
53	.01	31.5	27	.035	19.6
54	.01	40.0	86	.035	29.2
59	.01	50.0	37	.035	39.7
55	.01	52.5	38	.035	47.0
57	.02	0.0	39	.035	47.0
68	.02	.0	41	.06	0.0
58	.02	5.3	7	.06	6.7
69	.02	5.3	8	.06	18.1
44	.02	18.3	11	.06	30.5
45	.02	18.3	29	.06	36.9
46	.02	29.8	13	.06	47.7
47	.02	29.8			
56	.02	37.5			
66	.02	37.5			
48	.02	50.0			
49	.02	50.0			
35	.035	0.0			

[1] Values reported by the producer.

TABLE 4.—*Results of tensile and compressive tests on 17-7 stainless stee*

Cold-reduction	Tension						Pack compression					Cylinder compression				
	Specimen number	Slope of straight line [1]	Yield strength;[2] offset = 0.2%	Tensile strength	Elongation in 2 in.	Remarks[3]	Pack number	Length	Number of specimens in pack	Slope of straight line [1]	Yield strength;[2] offset = 0.2%	Cylinder number	Length	Outside diameter, nominal	Slope of straight line [1]	Yield strength;[2] offset = 0.2%
							0.010 IN. THICK, AS-ROLLED, LONGITUDINAL									
Percent		*Kips/in.*^{2}	*Kips/in.*^{2}	*Kips/in.*^{2}	%			*Inches*		*Kips/in.*^{2}	*Kips/in.*^{2}		*Inches*	*Inches*	*Kips/in.*^{2}	*Kips/in.*^{2}
0.0	225-B1L	29,100	39.0	136.3	72.0	d (71.0)	None					225-CX3L	1.749	0.40	28,900	43.7
8.2	214-B1L	27,400	77.9	155.6	60.0	d (58.0)	do					214-CX3L	1, 744	.40	26,100	60.5
18.0	219-B2L	28,500	103.8	167.3	49.0	b	do					219-CX3L	1,750	.40	27,700	73.7
28.0	221-B1L	27,300	133.1	174.7	46.0	b	do					221-CX3L	1.745	.40	25,700	90.2
37.0	223-B2L	26,500	150.3	187.5	40.0	c	do					223-CX3L	1.753	.40	26,400	98.3
							0.010 IN. THICK, AS-ROLLED, TRANSVERSE									
0.0	225-B1T	29,100	38.5	120.9	53.0	b	None					225-CX3T	1.746	0.40	33,200	42.6
8.2	214-B1T	28,500	76.7	152.7	53.5	b	do					214-CX3T	1.750	.40	30,000	81.5
18.0	219-B1T	28,400	100.8	161.9	40.5	b	do					219-CX3T	1.752	.40	30,500	104.4
28.0	221-B1T	29,000	121.0	176.9	42.0	c	do					221-CX3T	1.740	.40	29,400	137.8
37.0	223-B1T	28,900	138.8	186.4	39.0	d (35.5)	do					223-CX3T	1.746	.40	28,600	150.0
							0.010 IN. THICK, STRESS-RELIEVED, LONGITUDINAL									
0.0	225-Y3L	30,300	39.2	135.5	84.5	c	None					225-CX4L	1.749	0.40	29,700	43.5
8.2	214-Y3L	28,800	78.2	149.7	67.0	c	do					214-CX4L	1.744	.40	28,100	71.6
18.0	219-Y4L	28,400	108.4	162.9	54.0	c	do					219-CX4L	1.747	.40	31,500	89.7
28.0	221-Y3L	27,900	141.5	174.4	53.0	b	do					221-CX4L	1.750	.40	28,600	109.7
37.0	223-Y4L	29,400	171.7	198.2	37.0	b	do					223-CX4L	1.749	.40	29,200	123.4

[1] Obtai ned by least-square fit to lower portion of stress-strain graph.
[2] Using straight line with slope given in previous column.
[3] Letters describe location of fracture in accordance with section 24 and figure 19, page 462 of ASTM Specification E8-40T. Numbers in parentheses are alternate elongation values determined from sum of the distances *A* to *F* and *B* to *E* shown in that figure.

TABLE 4.—*Results of tensile and compressive tests on 17–7 stainless steel*—Continued

Cold-reduction	Tension						Pack compression					Cylinder compression				
	Specimen number	Slope of straight line [1]	Yield strength;[2] offset=0.2%	Tensile strength	Elongation in 2 in.	Remarks[3]	Pack number	Length	Number of specimens in pack	Slope of straight line [1]	Yield strength;[2] offset=0.2%	Cylinder number	Length	Outside diameter, nominal	Slope of straight line [1]	Yield strength;[2] offset=0.2%
0.010 IN. THICK, STRESS-RELIEVED, TRANSVERSE																
Percent		*Kips/in.*	*Kips/in.*	*Kips/in.*	*%*			*Inches*		*Kips/in.*	*Kips/in.*		*Inches*	*Inches*	*Kips/in.*	*Kips/in.*
0.0	225–Y3T	29,400	39.0	135.9	81.5	c	None					225–CX4T	1.750	0.40	26,900	42.9
8.2	214–Y3T	28,000	77.7	148.6	67.5	b	do					214–CX4T	1.750	.40	26,600	80.3
18.0	219–Y3T	29,000	109.5	161.0	55.0	b	do					219–CX4T	1.750	.40	29,400	112.7
28.0	221–Y4T	28,800	139.8	176.6	58.0	c	do					221–CX4T	1.749	.40	29,900	146.6
37.0	223–Y3T	29,600	156.5	189.2	41.5	c	do					223–CX4T	1.754	.40	31,300	170.4
0.020 IN. THICK, AS-ROLLED, LONGITUDINAL																
0.0	218–B2L	29,000	36.7	136.4	77.0	b	218–CN2L	2.502	21	27,400	37.9	218–CX1L	1.998	0.80	32,400	43.3
8.2	216–B2L	28,600	78.3	158.0	55.0	b	216–CN1L	2.501	21	28,400	49.4	216–CX3L	1.995	.80	27,700	64.0
18.0	204–B2L	27,600	111.0	167.7	43.5	b	204–CN1L	2.501	21	28,600	67.2	204–CX1L	1.997	.80	28,700	77.7
30.5	202–B2L	27,800	129.8	175.7	47.0	b	202–CN1L	2.501	21	28,200	75.4	202–CX1L	1.998	.80	26,800	90.6
37.5	200–B2L	26,700	151.9	185.3	37.0	b	200–CN1L	2.501	21	27,600	83.8	200–CX1L	1.998	.80	27,900	96.7
0.020 IN. THICK, AS-ROLLED, TRANSVERSE																
0.0	218–B2T	29,000	36.7	134.9	76.0	d (73.5)	218–CN1T	2.500	21	28,500	37.5	218–CX3T	2.000	0.80	31,800	42.4
8.2	216–B2T	28,500	84.0	153.8	45.0	d (43.5)	216–CN1T	2.501	21	29,200	91.1	216–CX3T	2.000	.80	28,600	88.9
18.0	204–B2T	28,000	106.9	167.0	54.0	b	204–CN1T	2.501	21	28,600	117.3	204–CX1T	1.997	.80	28,100	114.8
30.5	202–B2T	28,500	123.9	179.4	38.0	b	202–CP3T [4]	2.497	9	28,900	140.0	202–CX1T	1.999	.80	28,900	139.2
37.5	200–B2T	29,300	143.0	188.2	35.5	b	200–CP2T [4]	2.501	9	29,800	165.0	200–CX1T	2.000	.80	28,800	165.0
0.020 IN. THICK, STRESS-RELIEVED, LONGITUDINAL																
0.0	218–Y4L	29,100	36.2	133.3	85.5	c	None					218–CX2L	1.996	0.80	32,800	41.7
8.2	216–Y4L	28,100	80.4	153.8	62.5	b	do					216–CX2L	2.002	.80	28,900	77.5
18.0	204–Y3L	28,200	116.4	163.3	52.0	b	do					204–CX2L	2.002	.80	31,100	98.0
30.5	202–Y3L	27,300	140.0	174.0	47.0	c	do					202–CX2L	2.002	.80	29,000	113.0
37.5	200–Y4L	27,000	160.4	180.8	39.5	b	do					200–CX4L	2.001	.80	27,400	134.5

0.020 IN. THICK, STRESS-RELIEVED, TRANSVERSE																
0.0	218-Y4T	28,400	36.0	136.2	86.5	b	None					218-CX2T	2.000	0.80	35,600	42.0
8.2	216-Y4T	28,800	83.1	148.0	69.0	c	do					216-CX2T	2.000	.80	29,000	86.8
18.0	204-Y3T	28,200	112.1	155.8	62.0	b	do					204-CX2T	1.977	.80	29,800	117.8
30.5	202-Y3T	28,800	136.0	172.0	46.5	b	do					202-CX2T	1.961	.80	29,600	146.7
37.5	200-Y4T	29,200	158.6	187.9	36.5	c	do					200-CX3T	1.993	.80	29,400	176.4
0.040 IN. THICK, AS-ROLLED, LONGITUDINAL																
0.0	197-B1L	29,900	37.7	127.7	87.0	c	197-CN1L	2.501	9	30,400	38.8	197-CX1L	1.999	1.53	30,100	45.0
9.2	211-B1L	28,700	83.9	160.0	61.0	c	211-CN1L	2.503	9	29,500	59.1	211-CX1L	1.993	1.53	31,200	68.6
23.6	209-B1L	27,600	113.1	162.0	49.0	c	209-CN1L	2.491	9	28,400	72.3	209-CX1L	2.002	1.53	29,200	83.3
28.5	207-B1L	26,500	135.5	182.2	45.0	d (42.0)	207-CN1L	2.500	9	27,800	83.1	207-CX1L	2.002	1.53	28,500	94.8
38.8	205-B1L	26,200	156.7	191.4	32.0	c	205-CN1L	2.501	9	26,700	88.9	205-CX1L	2.000	1.53	26,800	107.3
0.040 IN. THICK, AS-ROLLED, TRANSVERSE																
0.0	197-B1T	27,800	37.9	133.1	82.5	b	197-CN1T	2.500	9	29,400	38.5	197-CX1T	2.002	1.53	27,900	44.1
9.2	211-B1T	27,500	89.2	159.6	61.0	b	211-CN1T	2.502	9	28,300	96.1	211-CX1T	1.998	1.53	29,800	94.1
23.6	209-B1T	27,800	110.6	166.7	51.0	b	209-CN1T	2.502	9	28,800	122.7	209-CX1T	1.993	1.53	29,600	120.9
28.5	207-B1T	28,200	129.3	180.8	35.0	c	207-CN1T	2.501	9	29,800	144.5	207-CX1T	1.974	1.53	28,900	144.4
38.8	205-B2T	29,200	156.6	197.3	21.0	b	205-CN1T	2.502	9	30,200	175.1	205-CX1T	2.001	1.53	30,500	174.9
0.040 IN. THICK, STRESS-RELIEVED, LONGITUDINAL																
0.0	197-Y4L	30,200	38.1	132.3	87.0	d (84.5)	None					197-CX2L	2.002	1.53	30,700	43.8
9.2	211-Y3L	28,700	88.3	153.4	64.5	b	do					211-CX2L	2.000	1.53	31,200	83.7
23.6	209-Y3L	28,900	121.3	160.1	55.5	b	do					209-CX2L	2.000	1.53	29,000	104.5
28.5	207-Y3L	27,000	145.6	175.5	44.5	b	do					207-CX2L	2.000	1.53	29,100	121.7
38.8	205-Y3L	28,100	170.0	201.8	18.0	b	do					205-CX2L	2.000	1.53	27,600	145.5
0.040 IN. THICK, STRESS-RELIEVED, TRANSVERSE																
0.0	197-Y4T	28,600	37.5	127.5	82.5	c	None					197-CX2T	1.997	1.53	29,100	43.4
9.2	211-Y4T	28,200	90.3	153.2	65.5	c	do					211-CX2T	2.000	1.53	29,000	92.6
23.6	209-Y4T	28,700	118.1	158.9	63.0	c	do					209-CX2T	1.997	1.53	29,800	124.6
28.5	207-Y3T	29,200	139.2	173.6	38.5	b	do					207-CX2T	1.999	1.53	32,900	160.4
38.8	205-Y3T	30,100	171.2	206.4	9.5	b	do					205-CX2T	1.994	1.53	29,900	193.5

[1] [2] [3] See footnotes 1, 2, and 3, p. 507.
[4] One-half-inch-wide pack tested in subpress, lateral support, 39 pins on each side, 3/16-in. spacing.

TABLE 5.—*Results of tensile and compressive tests on 18–7 stainless steel*

Cold-reduction	Tension						Pack compression					Cylinder compression				
	Specimen number	Slope of straight line [1]	Yield strength;[2] offset =0.2%	Tensile strength	Elongation in 2 in.	Remarks[3]	Pack number	Length	Number of specimens in pack	Slope of straight line [1]	Yield strength;[2] offset =0.2%	Cylinder number	Length	Outside diameter, nominal	Slope of straight line [1]	Yield strength;[2] offset =0.2%
0.010 IN. THICK, AS-ROLLED, LONGITUDINAL																
Percent		*Kips/in.*^{2}	*Kips/in.*^{2}	*Kips/in.*^{2}	*Percent*			*Inches*		*Kips/in.*^{2}	*Kips/in.*^{2}		*Inches*	*Inches*	*Kips/in.*^{2}	*Kips/in.*^{2}
0.0	51-B1L	28,600	36.7	153.6	60.5	c	None					51-CX1L	1.743	0.40	32,100	44.4
12.0	50-B1L	26,500	74.3	170.0	47.5	b	do					50-CX1L	1.742	.40	30,400	59.7
19.6	52-B1L	27,400	102.6	182.6	35.5	b	do					52-CX1L	1.748	.40	28,700	74.5
31.5	53-B1L	26,700	149.7	204.0	28.5	b	do					53-CX1L	1.749	.40	26,900	100.9
40.0	54-B2L	26,300	174.5	211.9	25.0	b	do					54-CX1L	1.725	.40	29,900	109.0
50.0	59-B2L	25,800	216.0	231.7	11.0	b	do					59-CX1L	1.746	.40	26,000	142.2
52.5	55-B1L	26,400	246.4	261.0	3.0	b	do					55-CX1L	1.750	.40	26,300	166.8
0.010 IN. THICK, AS-ROLLED, TRANSVERSE																
0.0	51-B2T	28,400	36.4	154.4	60.0	b	None					51-CX1T	1.732	0.40	31,600	41.5
12.0	50-B2T	27,400	72.5	167.2	47.0	b	do					50-CX1T	1.751	.40	28,800	79.4
19.6	52-B1T	27,800	100.2	180.1	37.5	b	do					52-CX1T	1.743	.40	31,500	112.1
31.5	53-B1T	28,200	136.7	201.5	22.5	b	do					53-CX1T	1.748	.40	28,300	163.8
40.0	54-B2T	28,900	154.4	217.7	21.5	c	do					54-CX1T	1.728	.40	29,900	180.7
50.0	59-B1T	30,400	197.0	244.8	11.0	d(9.0)	do					59-CX1T	1.746	.40	30,200	231.6
52.5	55-B1T	30,700	218.5	285.1	4.5	b	do					55-CX1T	1.744	.40	31,100	248.2
0.020 IN. THICK, AS-ROLLED, LONGITUDINAL																
0.0	68-B1L	28,400	36.2	152.1	63.0	b	57-C2L	3.501	31	29,500	36.7	57-CX1L	1.994	0.80	30,700	43.8
5.3	69-B2L	27,800	80.4	169.9	49.0	b	58-C1L	3.500	31	28,500	47.4	58-CX1L	1.993	.80	26,400	66.8
18.3	45-B1L	26,600	115.5	186.3	32.5	b	44-C2L	3.497	31	27,800	82.0	45-CX1L	1.992	.80	26,300	87.8
29.8	47-B2L	27,000	138.7	198.9	28.0	b	46-C2L	3.498	31	27,400	94.3	47-CX1L	1.996	.80	26,700	101.7
37.5	66-B2L	26,300	152.6	205.1	25.0	b	66-CP4L [7]	2.500	7	27,000	104.7	56-CX1L	1.994	.80	25,700	120.4
50.0	49-B1L	26,300	201.6	236.8	27.5	c	49-CN1L	2.502	21	26,400	135.1	49-CX1L	1.998	.80	24,800	147.8
0.020 IN. THICK, AS-ROLLED, TRANSVERSE																
0.0	68-B1T	28,000	35.8	153.1	62.0	b	57-C1T	3.502	31	29,800	37.8	57-CX1T	1.995	0.80	31,800	43.1
5.3	69-B2T	27,700	82.9	174.1	44.5	b	58-C1T	3.500	31	28,800	88.1	58-CX1T	1.995	.80	28,600	86.6
18.3	45-B2T	28,100	115.8	186.3	37.0	b	44-C1T	3.502	31	28,500	132.0	45-CX1T	1.996	.80	28,800	127.7
29.8	47-B2T	28,800	136.6	203.5	29.0	c	47-CP6T [7]	2.500	7	28,900	158.1	47-CX1T	1.996	.80	29.300	155.3
37.5	66-B2T	28,600	154.7	208.2	27.0	d(24.0)	66-CP3T [7]	2.500	7	29,500	173.8	56-CX2T	1.999	.80	29,000	173.1
50.0	49-B1T	30,400	198.3	243.2	6.0	b	48-CS2T	1.801	31	31,800	228.8	49-CX1T	1.994	.80	29,600	212.5

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0.035 IN. THICK, AS-ROLLED, LONGITUDINAL																
0.0	35-B2L	29,200	37.5	147.2	67.0	b	36-C1L	3.502	19	29,900	37.8	35-CXIL	1.979	1.46	31,200	45.1
7.5	26-B2L	29,300	55.4	154.9	54.5	b	25-C1L	3.502	19	30,000	40.1	25-CX1L	1.984	1.46	30,000	53.2
19.6	27-B2L	27,900	89.5	173.7	45.0	b	27-C2L	3.501	19	27,900	55.9	27-CX1L	1.982	1.46	28,200	77.3
29.2	86-B2L	26,800	148.2	198.5	34.0	d (30.0)	86-CN3L	2.501	10	26,800	94.8	86-CX1L	1,980	1.46	27,100	113.5
39.7	37-B2L	26,300	177.7	215.4	27.5	c	37-CN6L	2.500	10	27,100	105.5	37-CX1L	1.992	1.46	26,000	135.0
47.0	38-B2L	25,900	200.9	235.5	21.0	d (17.5)	39-C1L	3.501	19	26,700	133.5	38-CX1L	2.006	1.46	25,600	163.2
0.035 IN. THICK, AS-ROLLED, TRANSVERSE																
0.0	35-B2T	29,500	37.7	148.4	65.0	b	36-C1T	3.501	19	29,800	38.2	35-CX1T	1.987	1.46	32,000	45.4
7.5	26-B2T	28,800	59.1	158.8	59.0	b	25-C2T	3.501	19	29,000	61.0	25-CX1T	1.986	1.46	28,600	61.3
19.6	27-B2T	28,100	91.8	172.1	49.0	c	27-C1T	3.501	19	29,400	101.2	27-CX1T	1.996	1.46	28,100	100.2
29.2	86-B2T	28,200	143.0	200.8	35.0	d (31.0)	86-CN2T	2.498	10	29,300	165.6	86-CX1T	1.990	1.46	29,200	172.1
39.7	37-B1T	29,400	167.0	219.6	19.0	c	37-C1T	3.501	19	29,200	189.1	37-CX1T	1.997	1.46	30,000	183.8
47.0	38-B2T	29,800	200.4	246.1	7.5	b	38-CS4T	1.801	19	31.600	229.5	38-CX1T	1.981	1.24	30,200	221.5
0.060 IN. THICK, AS-ROLLED, LONGITUDINAL																
0.0	41-B1L	28,600	34.1	146.9	72.5	b	41-CN1L	2.485	5	31,400	35.3	None	—	—	—	—
6.7	7-B2L	26,900	81.5	[4] 168.8	[4] 52.5	b	7-CN1L	2.488	5	27,600	57.8	do	—	—	—	—
18.1	8-B2L	27,700	103.7	178.7	37.5	b	8-CN1L	2.463	5	27,700	69.4	do	—	—	—	—
30.5	11-B2L	26,600	148.6	202.2	31.0	c	11-CN1L	2.479	5	27,200	97.4	do	—	—	—	—
36.9	29-B1L	26,300	173.7	209.5	27.0	c	29-CN1L	2.486	5	26,900	104.3	do	—	—	—	—
47.7	13-B1L	26,300	194.3	225.0	16.0	c	13-CN2L	2.474	5	26,600	125.1	do	—	—	—	—
0.060 IN. THICK, AS-ROLLED, TRANSVERSE																
0.0	41-B2T	28,500	34.1	[5] 142.6	[5] 72.0	b	41-CN1T	2.500	5	31,100	35.5	None	—	—	—	—
6.7	7-B2T	28,300	88.3	[6] 166.2	[6] 56.0	b	7-CN1T	2.501	5	28,500	96.3	do	—	—	—	—
18.1	8-B2T	28,200	105.2	179.3	43.0	c	8-CN1T	2.502	5	28,300	120.7	do	—	—	—	—
30.5	11-B1T	28,600	141.4	206.0	32.0	c	11-CN1T	2.494	5	29,400	176.0	do	—	—	—	—
36.9	29-B2T	28,700	153.8	215.9	24.0	c	29-CN1T	2.483	5	29,300	185.3	do	—	—	—	—
47.7	13-B1T	29,600	185.3	234.0	10.0	b	13-CN1T	2.492	5	30,500	228.2	do	—	—	—	—

[1] Obtained by least-square fit to lower portion of stress-strain graph.
[2] Using straight line with slope given in previous column.
[3] Letters describe location of fracture in accordance with section 24 and figure 19, page 462 of ASTM Specification E8-40T. Figures in parentheses are alternate elongation values determined from sum of the distances *A* to *F* and *B* to *E* shown in that figure.
[4] Loaded at 0.02 in./min.
[5] 41-B2T broke in grip; duplicate specimen (41-B1T) tested for tensile strength and elongation.
[6] 7-B2T broke outside of gage length, duplicate specimen (7-B1T) tested for tensile strength and elongation.
[7] One-half-inch-wide pack, tested in subpress, lateral support 39 pins on each side, 3/16-in. spacing.

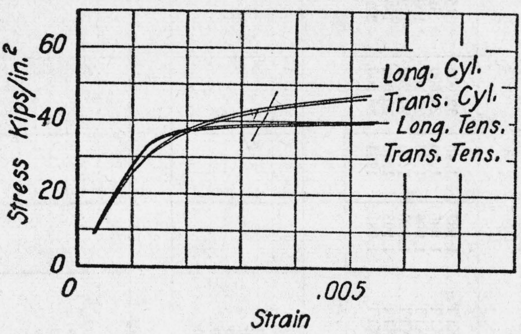

FIGURE 1.—*17-7, 0.01-inch sheet, annealed.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	*Kips/in.*²	*Kips/in.*²
Tensile	39.0	38.5
Cylinder compressive	43.7	42.6

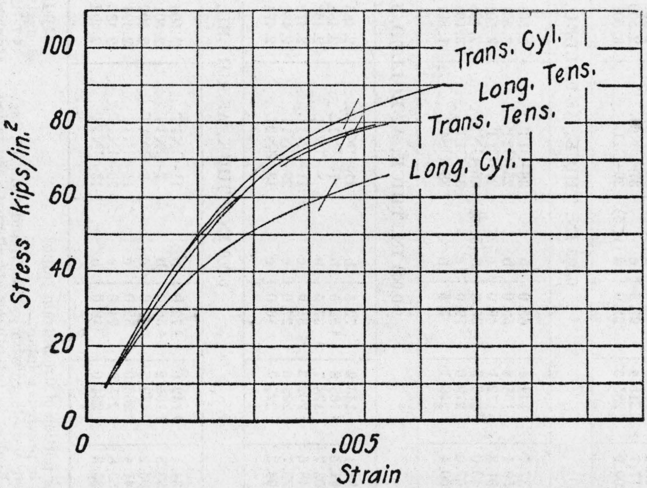

FIGURE 2.—*17-7, 0.01-inch sheet, 8.2 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	*Kips/in.*²	*Kips/in.*²
Tensile	77.9	76.7
Cylinder compressive	60.5	81.5

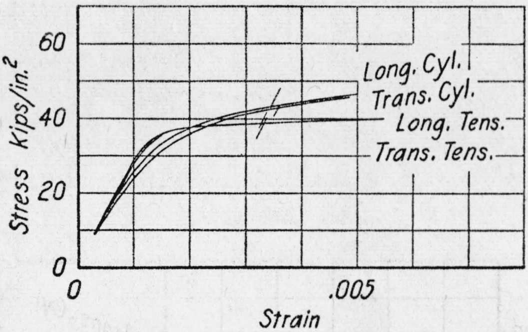

FIGURE 3.—*17–7, 0.01-inch sheet, annealed, stress-relieved.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	39.2	39.0
Cylinder compressive	43.5	42.9

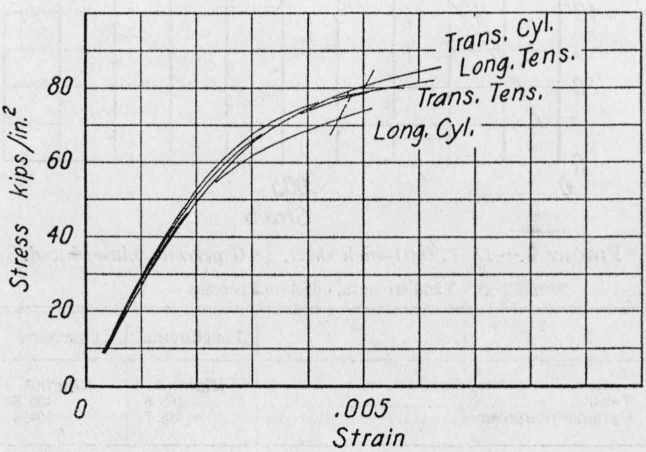

FIGURE 4.—*17–7, 0.01-inch sheet, 8.2 percent cold-reduced, stress-relieved.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	78.2	77.7
Cylinder compressive	71.6	80.3

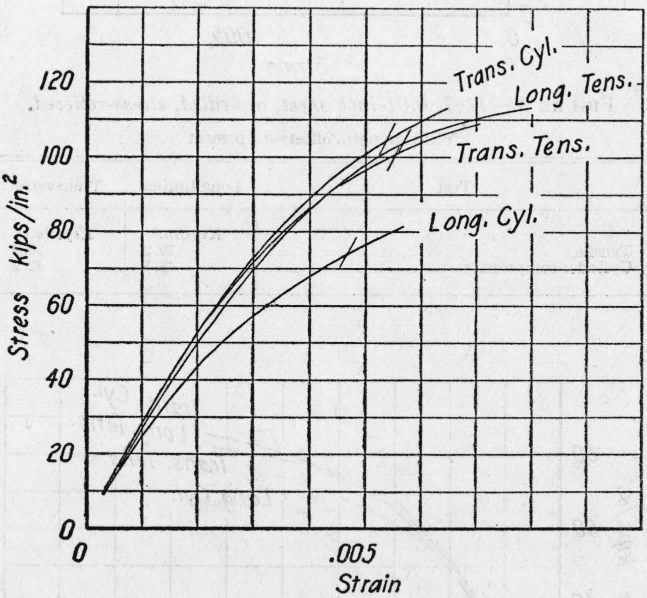

FIGURE 5.—*17–7, 0.01-inch sheet, 18.0 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.^{2}	*Kips/in.*^{2}
Tensile	103.8	100.8
Cylinder compressive	73.7	104.4

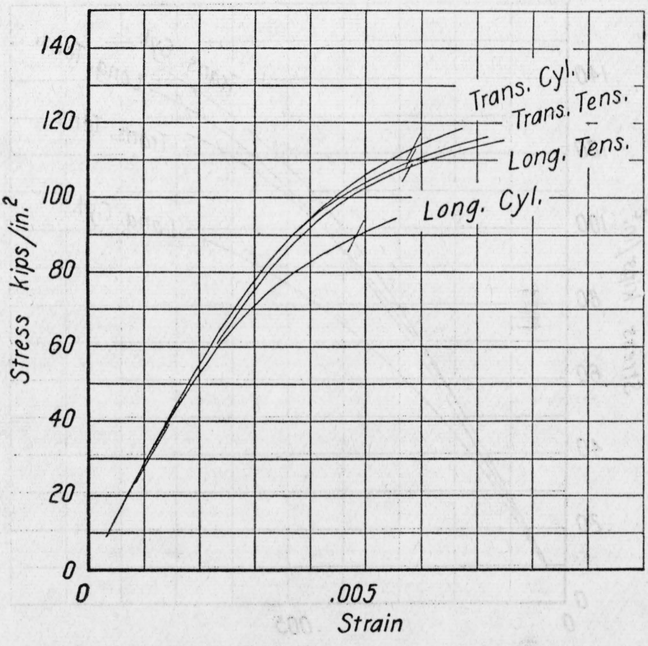

FIGURE 6.—*17–7, 0.01-inch sheet, 18.0 percent cold-reduced, stress-relieved.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	108.4	109.5
Cylinder compressive	89.7	112.7

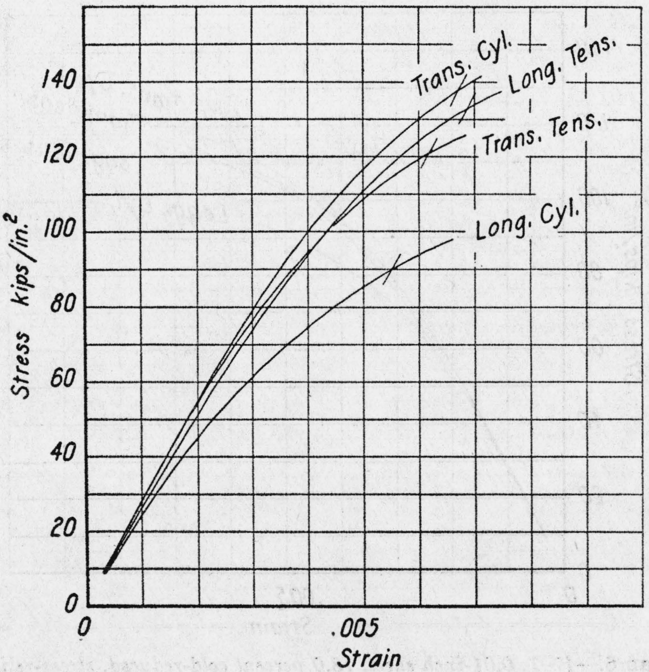

FIGURE 7.—*17–7, 0.01-inch sheet, 28.0 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	*Kips/in.*²	*Kips/in.*²
Tensile	133.1	121.0
Cylinder compressive	90.2	137.8

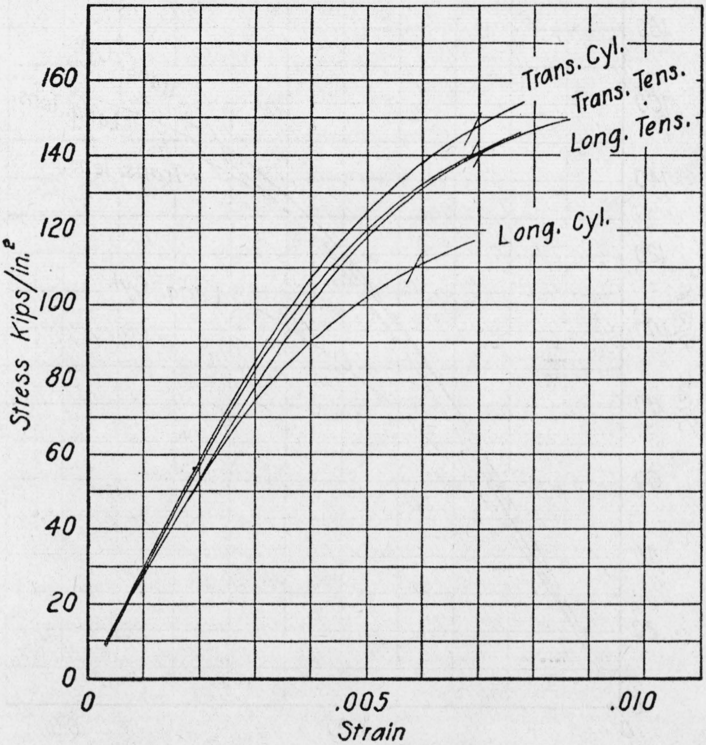

FIGURE 8.—*17–7, 0.01-inch sheet, 28.0 percent cold-reduced, stress-relieved.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	141.5	139.8
Cylinder compressive	109.7	146.6

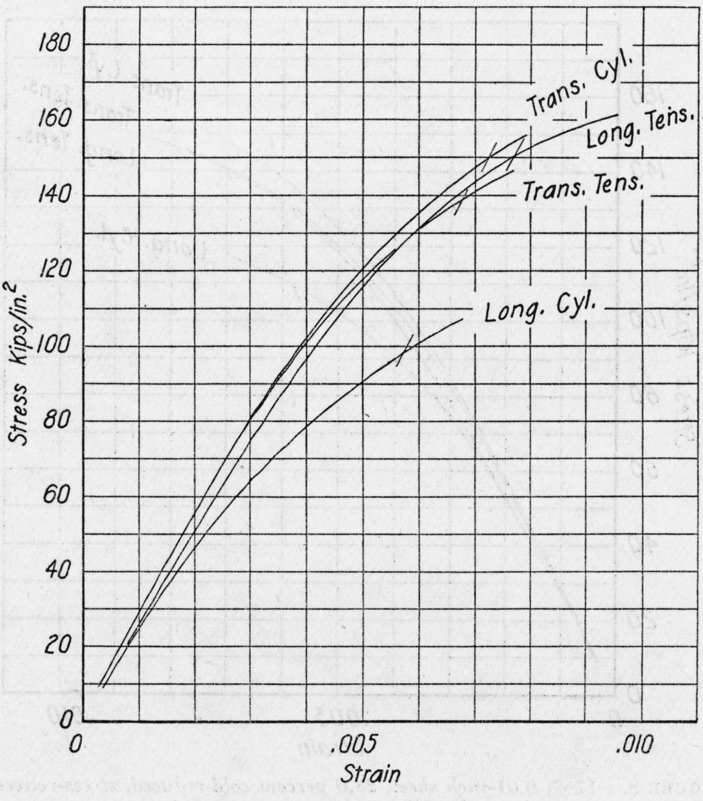

FIGURE 9.—*17–7, 0.01-inch sheet, 37.0 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	150.3	138.8
Cylinder compressive	98.3	150.0

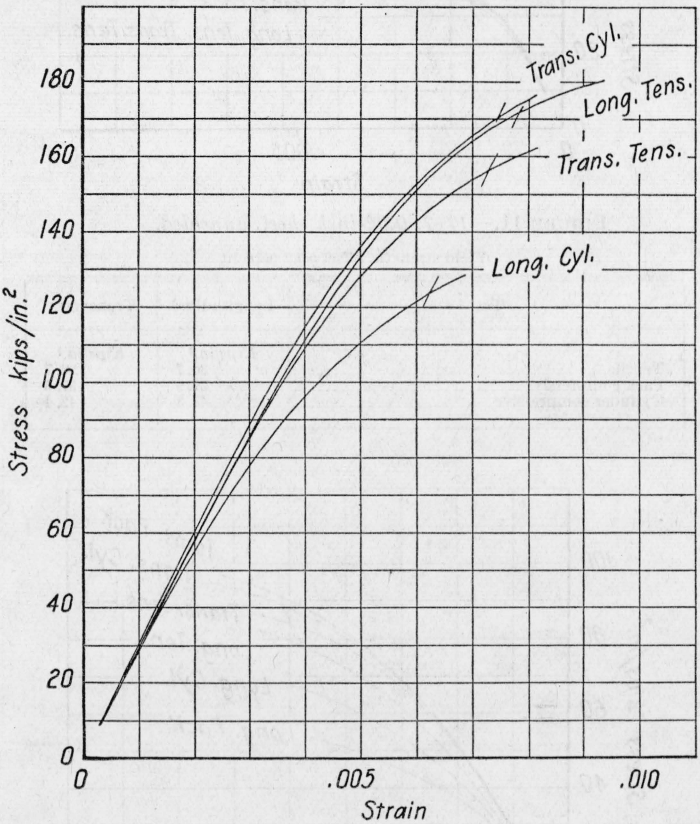

FIGURE 10.—*17-7, 0.01-inch sheet, 37.0 percent cold-reduced, stress-relieved.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	171.7	156.5
Cylinder compressive	123.4	170.4

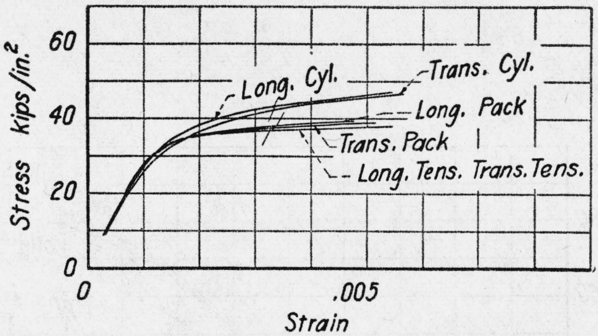

FIGURE 11.—*17–7, 0.02-inch sheet, annealed.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	36.7	36.7
Pack compressive	37.9	37.5
Cylinder compressive	43.3	42.4

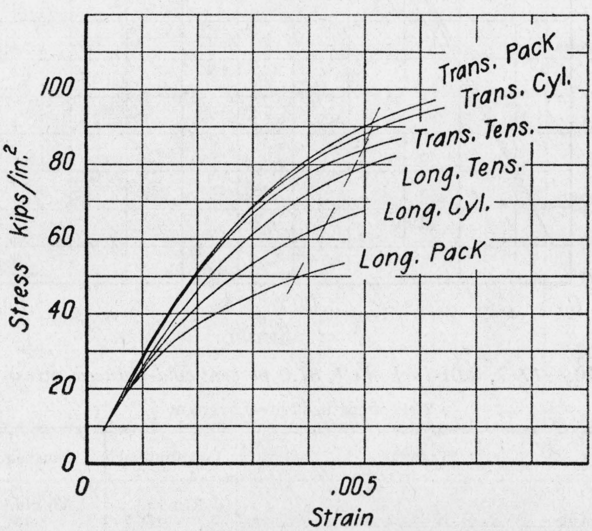

FIGURE 12.—*17–7, 0.02-inch sheet, 8.2 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	78.3	84.0
Pack compressive	49.4	91.1
Cylinder compressive	64.0	88.9

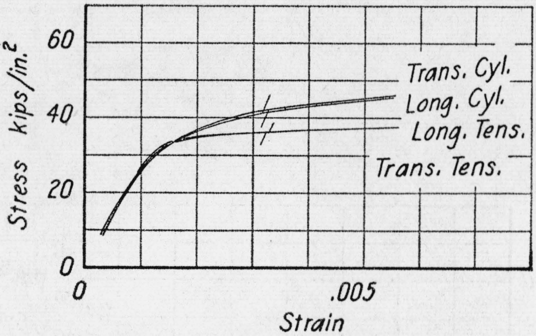

FIGURE 13.—*17–7, 0.02-inch sheet, annealed, stress-relieved.*

Yield strength, offset = 0.2 percent

Test	Longitudinal	Transverse
	*Kips/in.*²	*Kips/in.*²
Tensile	36.2	36.0
Cylinder compressive	41.7	42.0

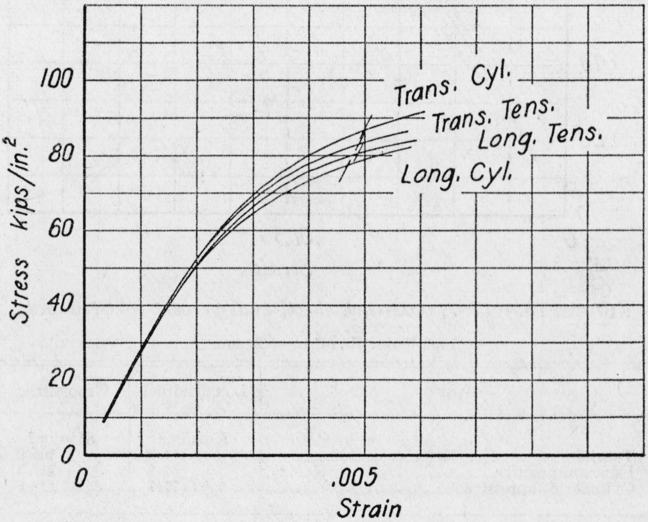

FIGURE 14.—*17–7, 0.02-inch sheet, 8.2 percent cold-reduced, stress-relieved.*

Yield strength, offset = 0.2 percent

Test	Longitudinal	Transverse
	*Kips/in.*²	*Kips/in.*²
Tensile	80.4	83.1
Cylinder compressive	77.5	86.8

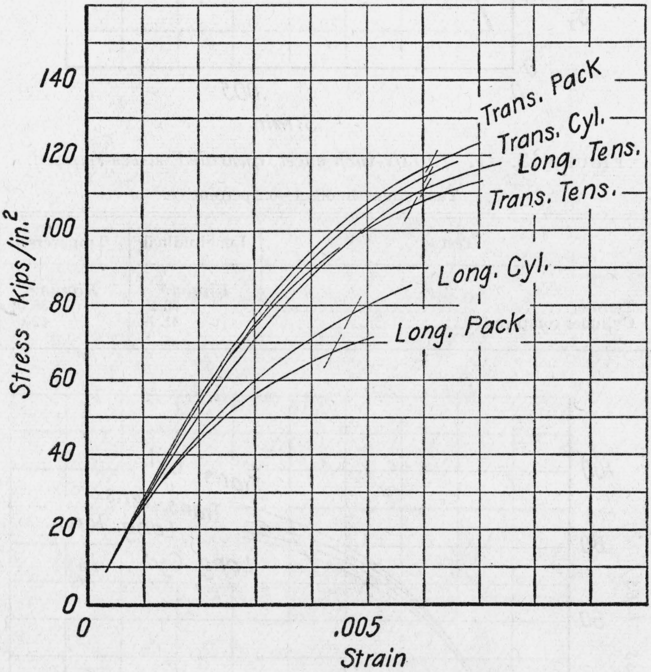

FIGURE 15.—*17-7, 0.02-inch sheet, 18.0 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	111.0	106.9
Pack compressive	67.2	117.3
Cylinder compressive	77.7	114.8

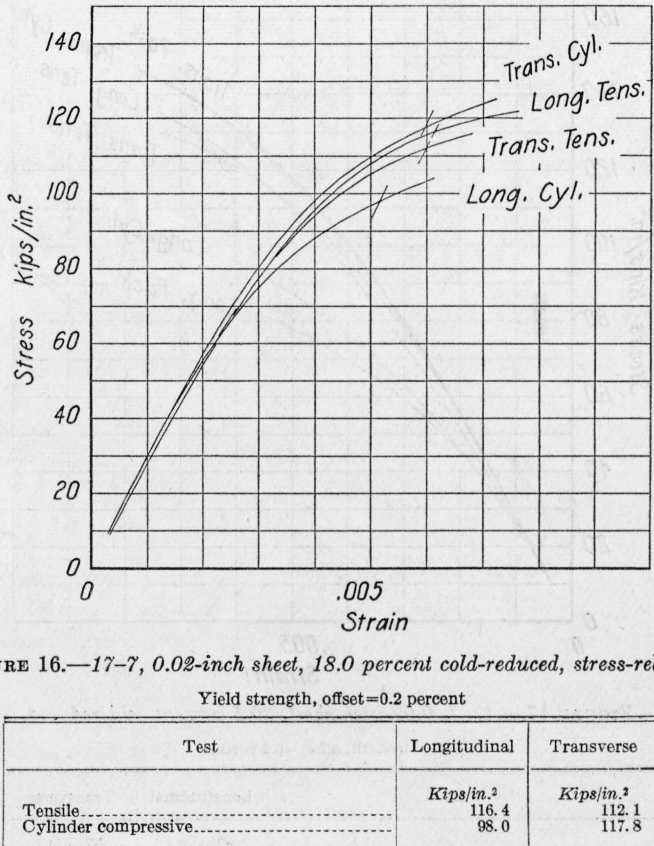

FIGURE 16.—*17–7, 0.02-inch sheet, 18.0 percent cold-reduced, stress-relieved.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	116. 4	112. 1
Cylinder compressive	98. 0	117. 8

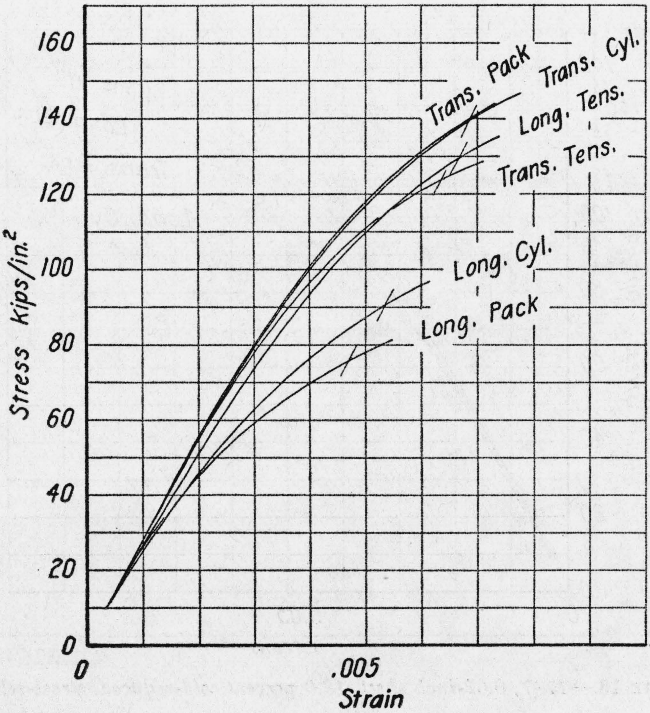

FIGURE 17.—*17–7, 0.02-inch sheet, 30.5 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.^{2}	*Kips/in.*^{2}
Tensile	129.8	123.9
Pack compressive	75.4	140.0
Cylinder compressive	90.6	139.2

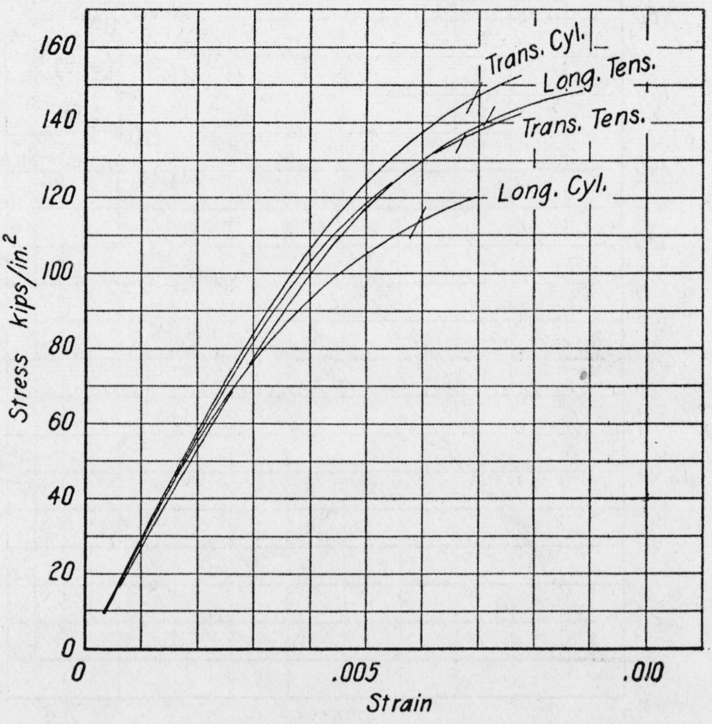

FIGURE 18.—*17–7, 0.02-inch sheet, 30.5 percent cold-reduced, stress-relieved.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	*Kips/in.*²	*Kips/in.*²
Tensile	140.0	136.0
Cylinder compressive	113.0	146.7

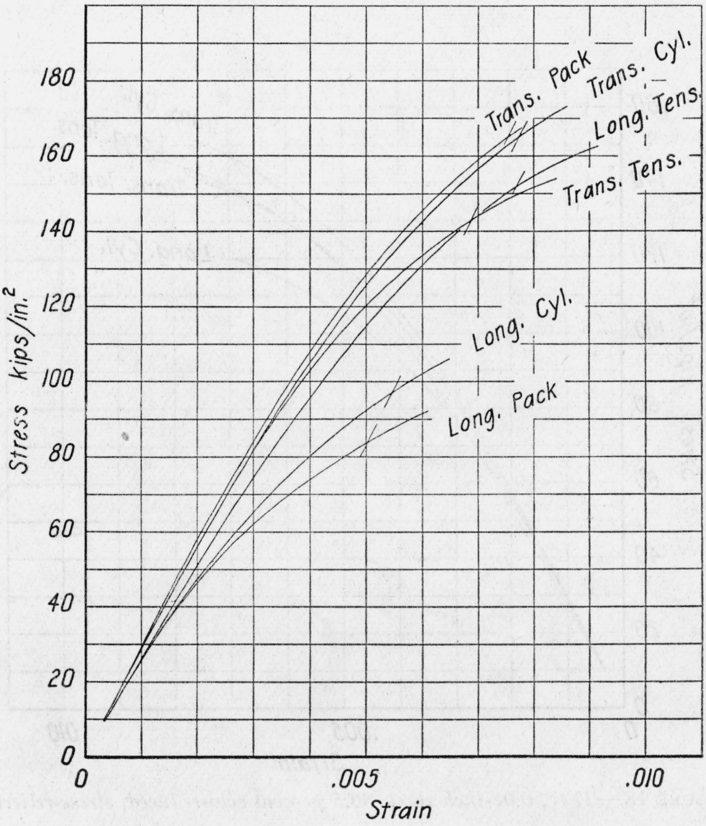

FIGURE 19.—*17–7, 0.02-inch sheet, 37.5 percent cold-reduced.*

Yield strength, offset = 0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	151.9	143.0
Pack compressive	83.8	165.0
Cylinder compressive	96.7	165.0

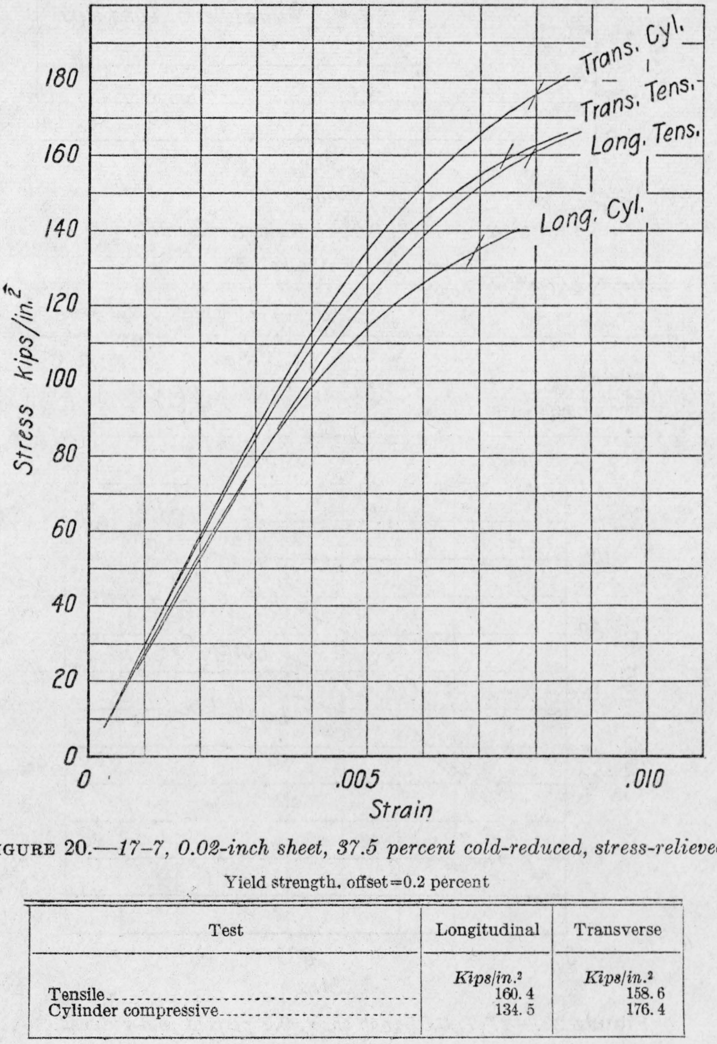

FIGURE 20.—*17-7, 0.02-inch sheet, 37.5 percent cold-reduced, stress-relieved.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	160.4	158.6
Cylinder compressive	134.5	176.4

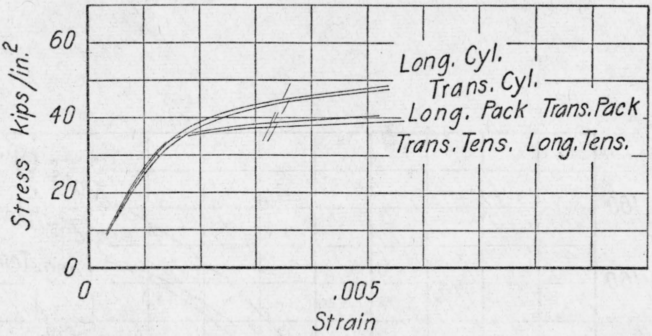

FIGURE 21.—*17–7, 0.04-inch sheet, annealed.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	37.7	37.9
Pack compressive	38.8	38.5
Cylinder compressive	45.0	44.1

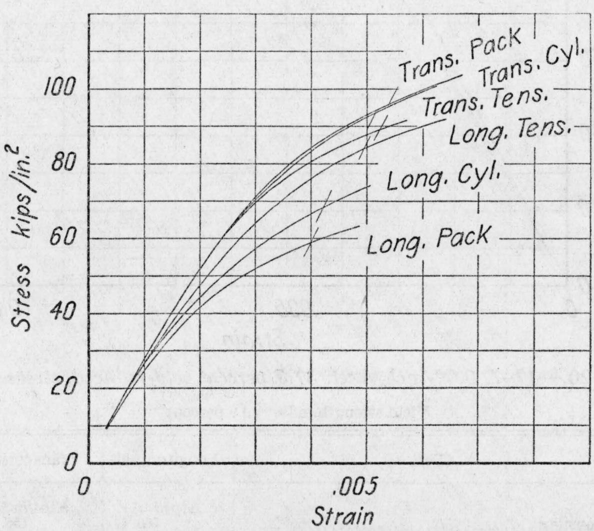

FIGURE 22.—*17–7, 0.04-inch sheet, 9.2 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	83.9	89.2
Pack compressive	59.1	96.1
Cylinder compressive	68.6	94.1

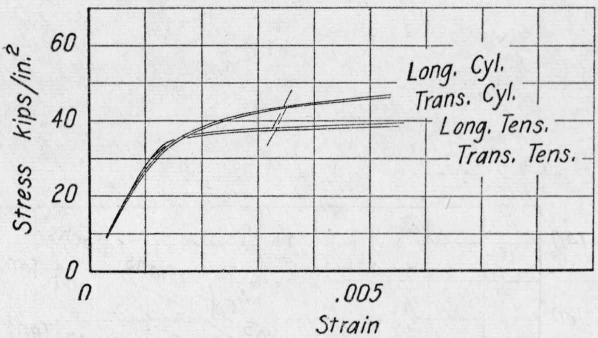

FIGURE 23.—*17–7, 0.04-inch sheet, annealed, stress-relieved.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	38.1	37.5
Cylinder compressive	43.8	43.4

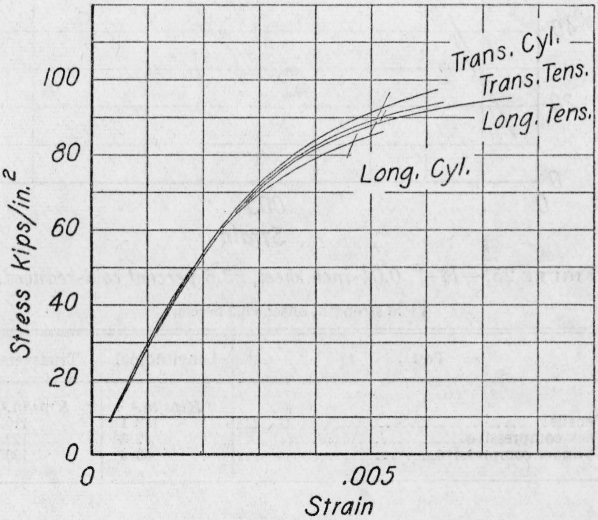

FIGURE 24.—*17–7, 0.04-inch sheet, 9.2 percent cold-reduced, stress-relieved.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	88.3	90.3
Cylinder compressive	83.7	92.6

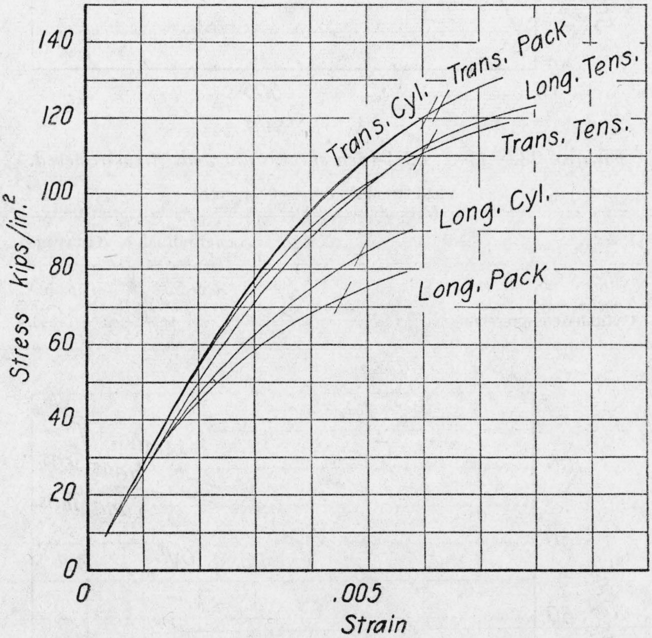

FIGURE 25.—*17–7, 0.04-inch sheet, 23.6 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	113.1	110.6
Pack compressive	72.3	122.7
Cylinder compressive	83.3	120.9

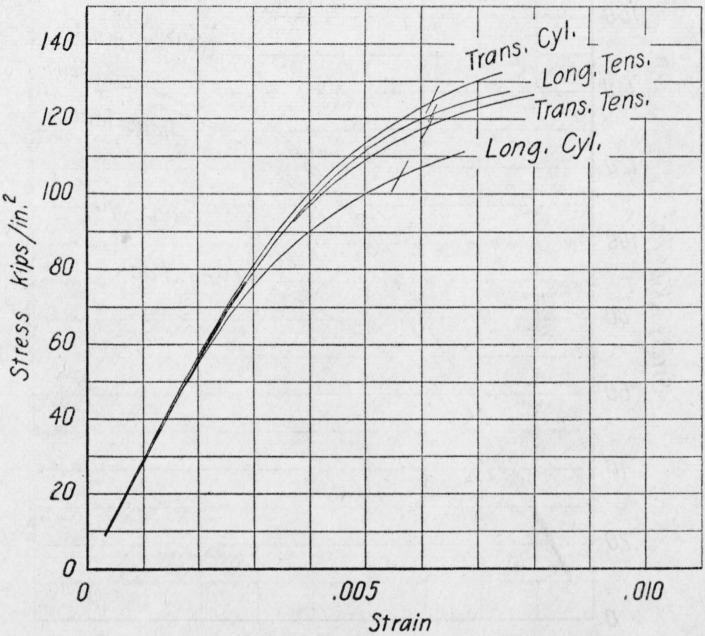

FIGURE 26.—*17–7, 0.04-inch sheet, 23.6 percent cold-reduced, stress-relieved.*

Yield strength, offset = 0.2 percent

Test	Longitudinal	Transverse
	*Kips/in.*²	*Kips/in.*²
Tensile	121.3	118.1
Cylinder compressive	104.5	124.6

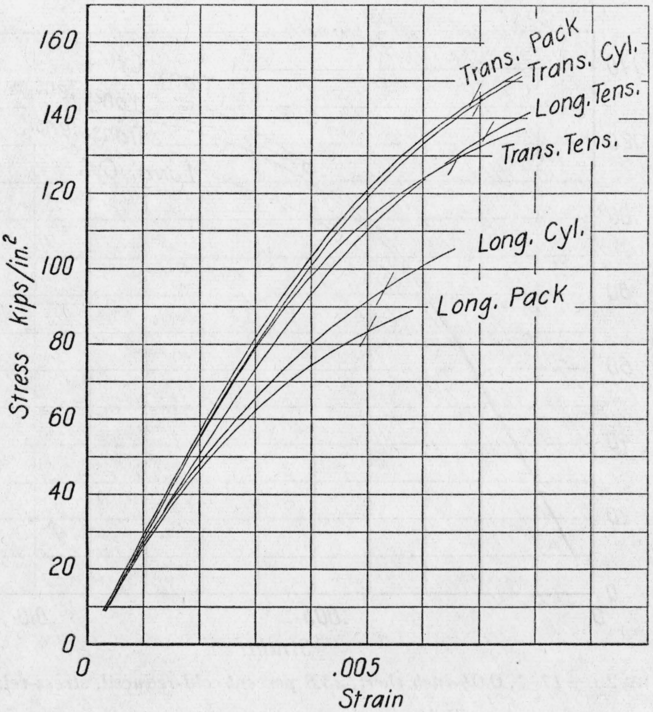

FIGURE 27.—*17-7, 0.04-inch sheet, 28.5 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	135.5	129.3
Pack compressive	83.1	144.5
Cylinder compressive	94.8	144.4

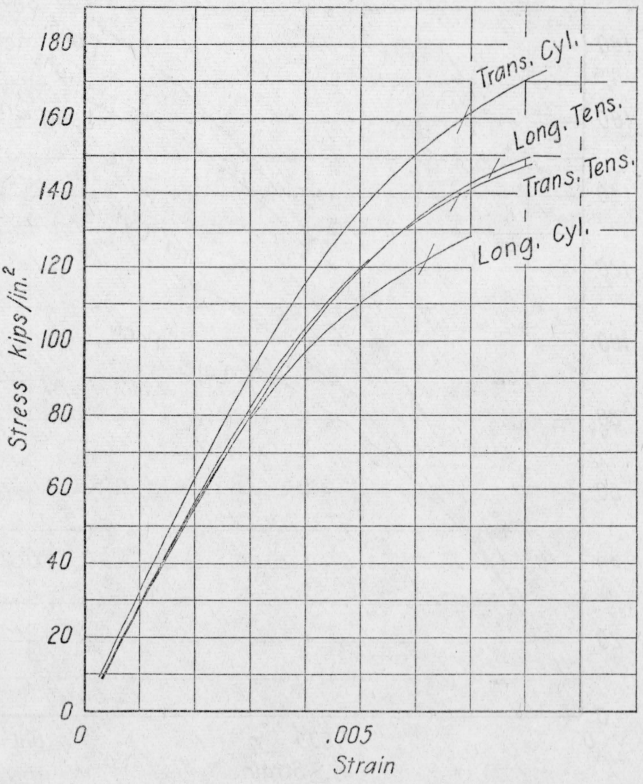

FIGURE 28.—*17–7, 0.04-inch sheet, 28.5 percent cold-reduced, stress-relieved.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	*Kips/in.*²	*Kips/in.*²
Tensile	145.6	139.2
Cylinder compressive	121.7	160.4

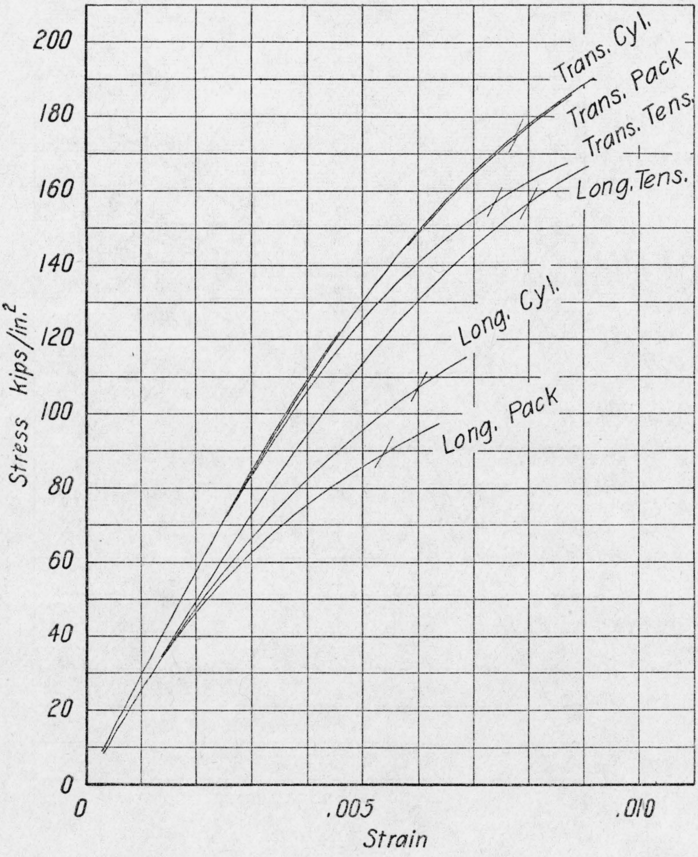

FIGURE 29.—*17-7, 0.04-inch sheet, 38.8 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.^{2}	*Kips/in.*^{2}
Tensile	156.7	156.6
Pack compressive	88.9	175.1
Cylinder compressive	107.3	174.9

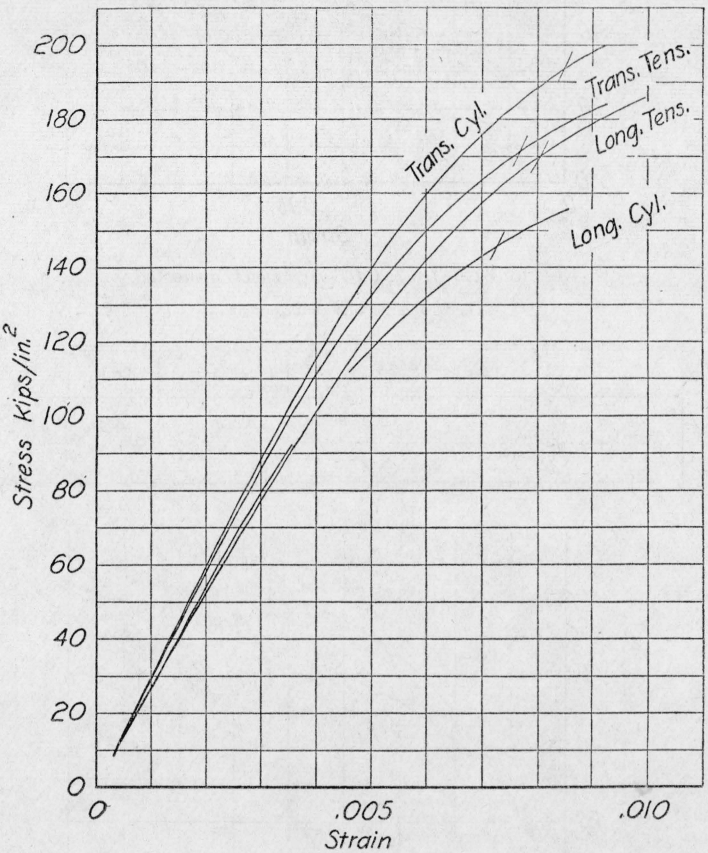

FIGURE 30.—*17–7, 0.04-inch sheet, 38.8 percent cold-reduced, stress-relieved.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	170.0	171.2
Cylinder compressive	145.5	193.5

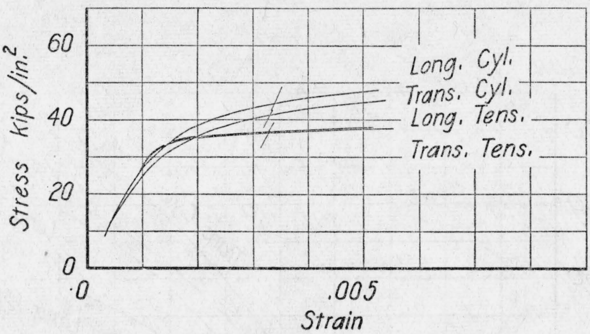

FIGURE 31.—*18–7, 0.01-inch sheet, annealed.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	36.7	36.4
Cylinder compressive	44.4	41.5

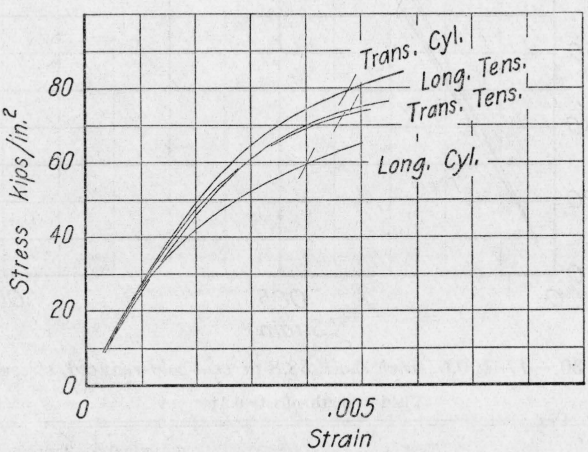

FIGURE 32.—*18–7, 0.01-inch sheet, 12.0 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	74.3	72.5
Cylinder compressive	59.7	79.4

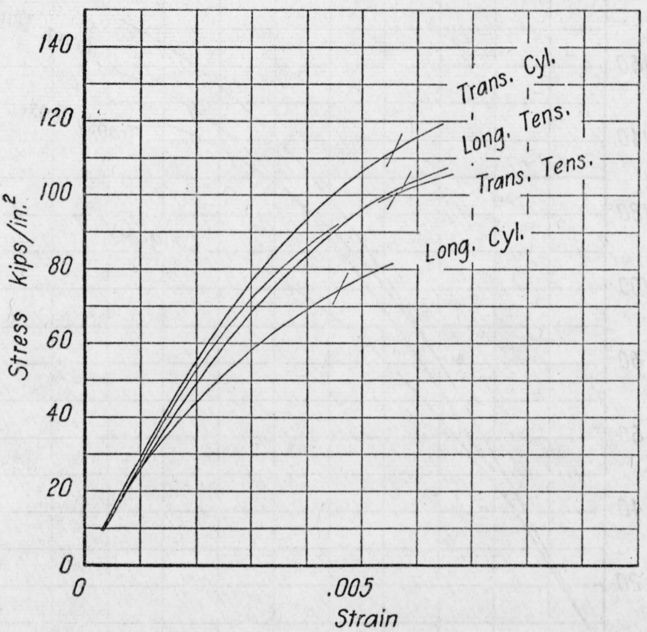

FIGURE 33.—*18–7, 0.01-inch sheet, 19.6 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	102.6	100.2
Cylinder compressive	74.5	112.1

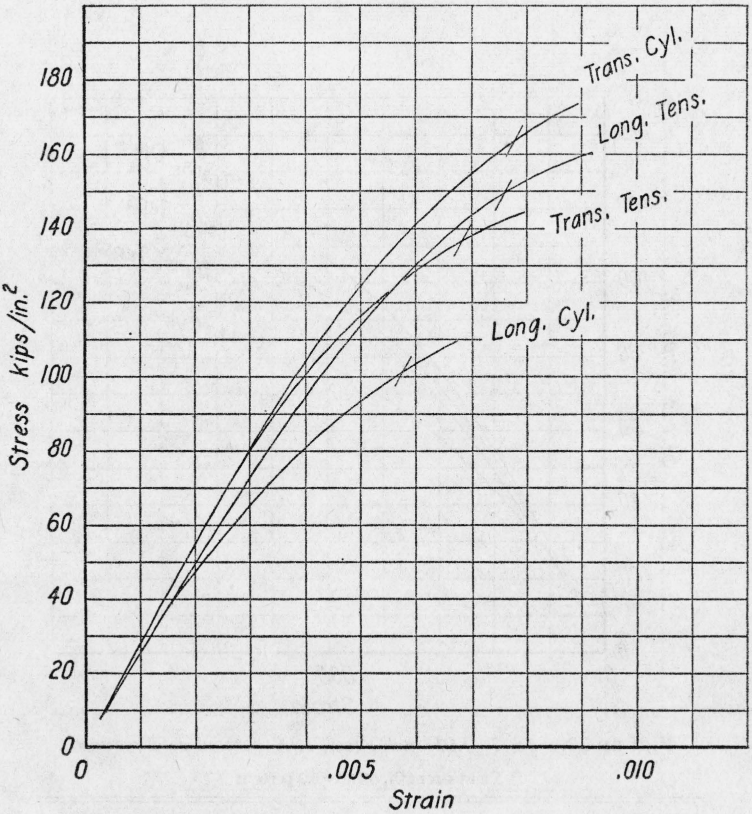

FIGURE 34.—*18–7, 0.01-inch sheet, 31.5 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	149.7	136.7
Cylinder compressive	100.9	163.8

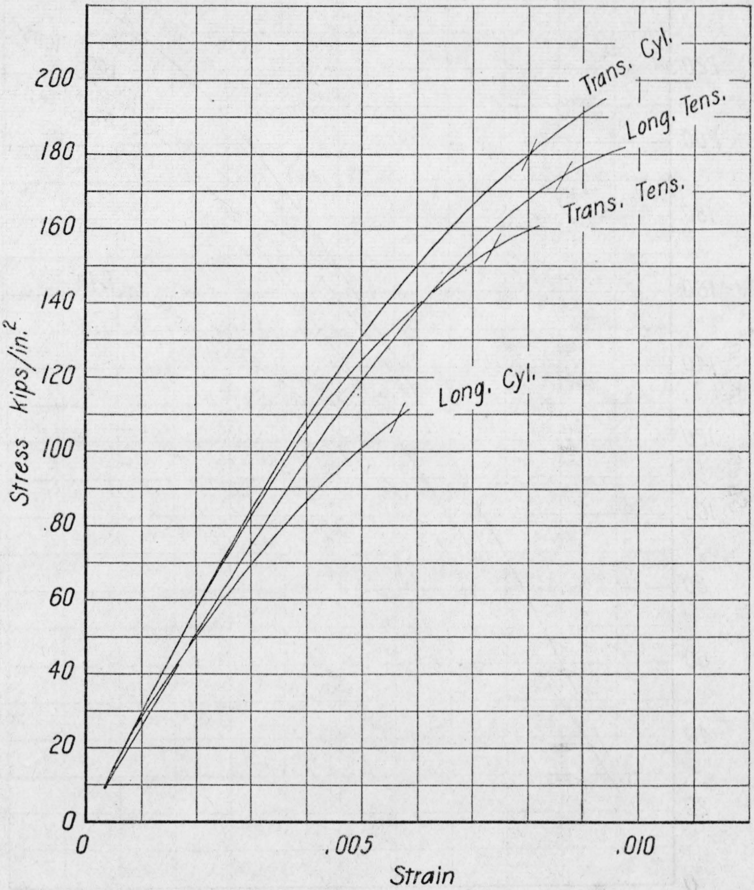

FIGURE 35.—*18–7, 0.01-inch sheet, 40.0 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	174.5	154.4
Cylinder compressive	109.0	180.7

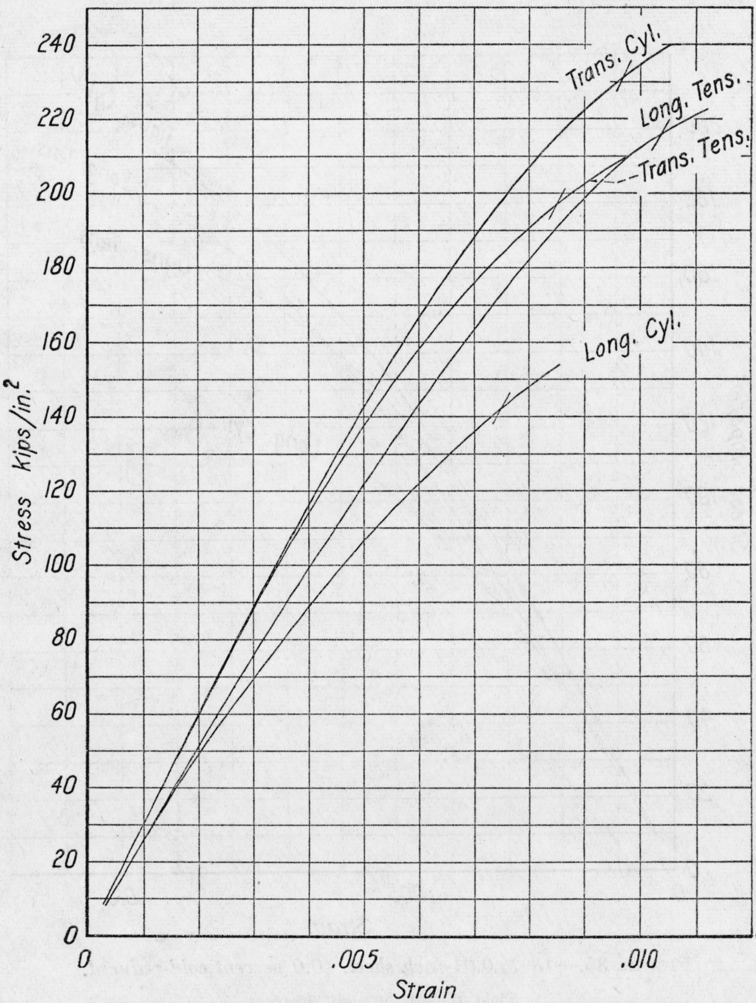

FIGURE 36.—*18–7, 0.01-inch sheet, 50.0 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	216.0	197.0
Cylinder compressive	142.2	231.6

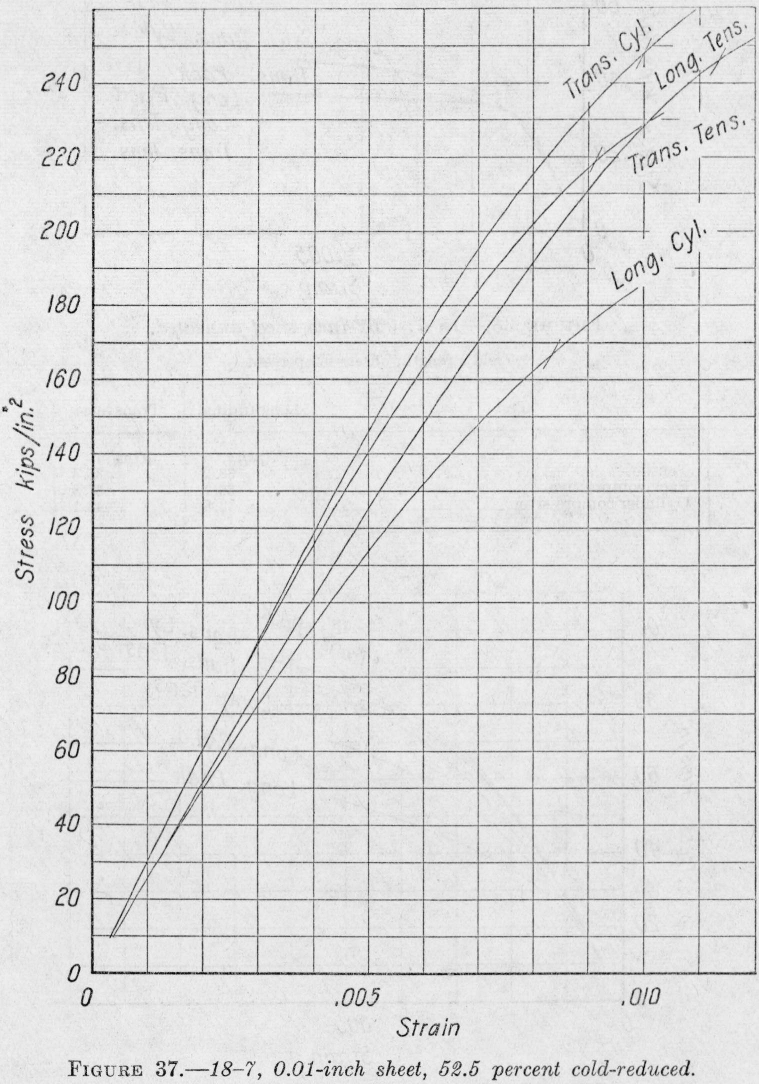

FIGURE 37.—*18–7, 0.01-inch sheet, 52.5 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	246.4	218.5
Cylinder compressive	166.8	248.2

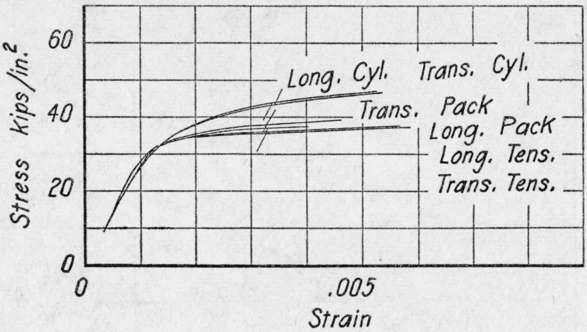

FIGURE 38.—*18-7, 0.02-inch sheet-annealed.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	36.2	35.8
Pack compressive	36.7	37.8
Cylinder compressive	43.8	43.1

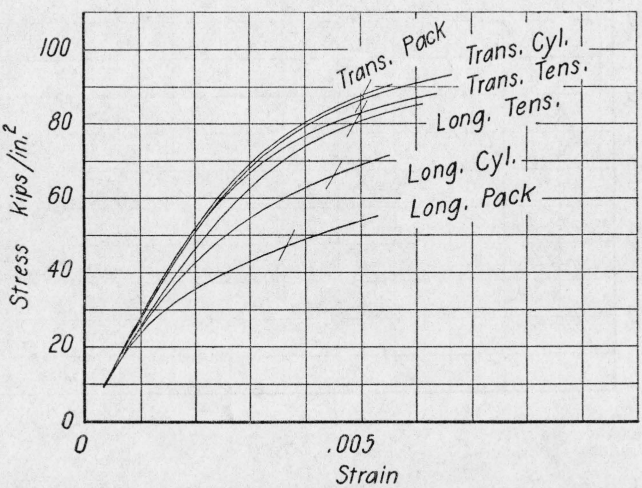

FIGURE 39.—*18-7, 0.02-inch sheet, 5.3 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	80.4	82.9
Pack compressive	47.4	88.1
Cylinder compressive	66.8	86.6

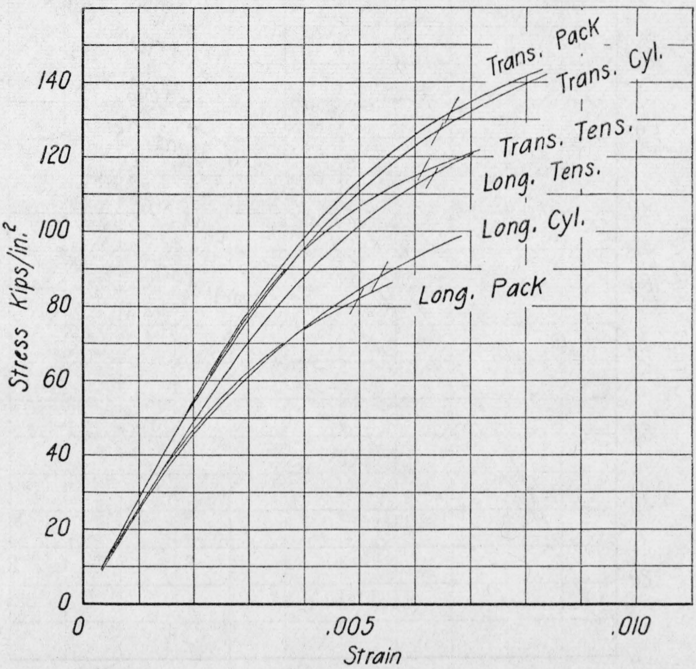

FIGURE 40.—*18–7, 0.02-inch sheet, 18.3 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	115.5	115.8
Pack compressive	82.0	132.0
Cylinder compressive	87.8	127.7

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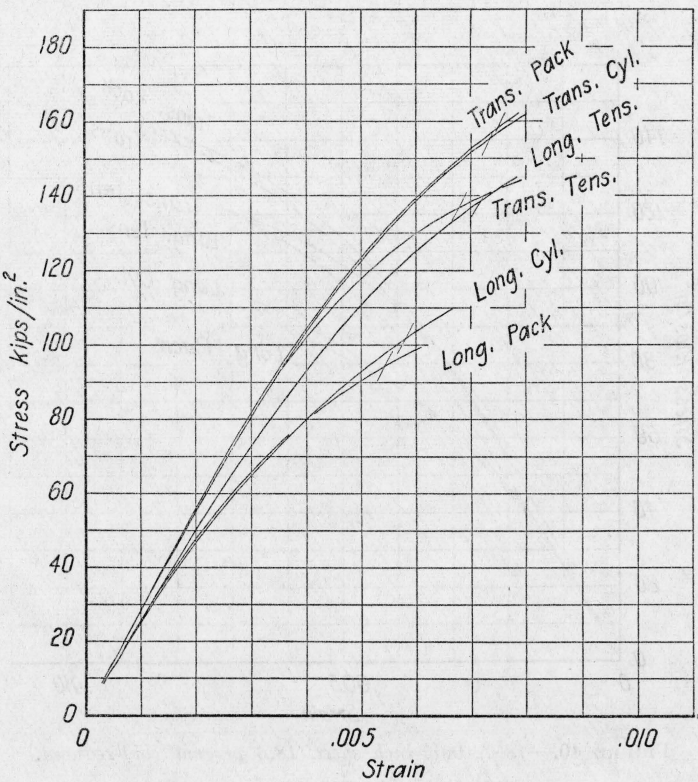

FIGURE 41.—*18–7, 0.02-inch sheet, 29.8 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	138.7	136.6
Pack compressive	94.3	158.1
Cylinder compressive	101.7	155.3

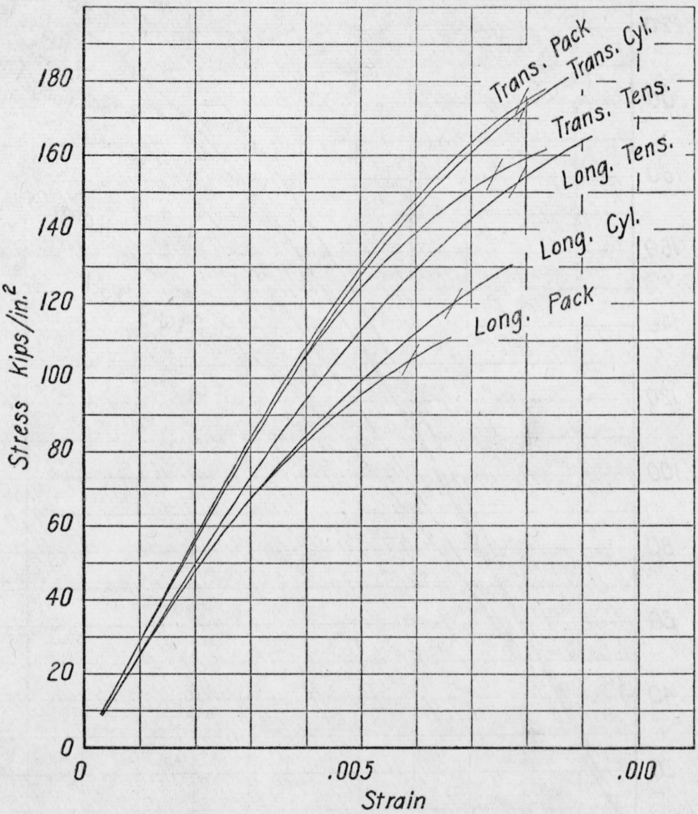

FIGURE 42.—*18–7, 0.02-inch sheet, 37.5 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	152.6	154.7
Pack compressive	104.7	173.8
Cylinder compressive	120.4	173.1

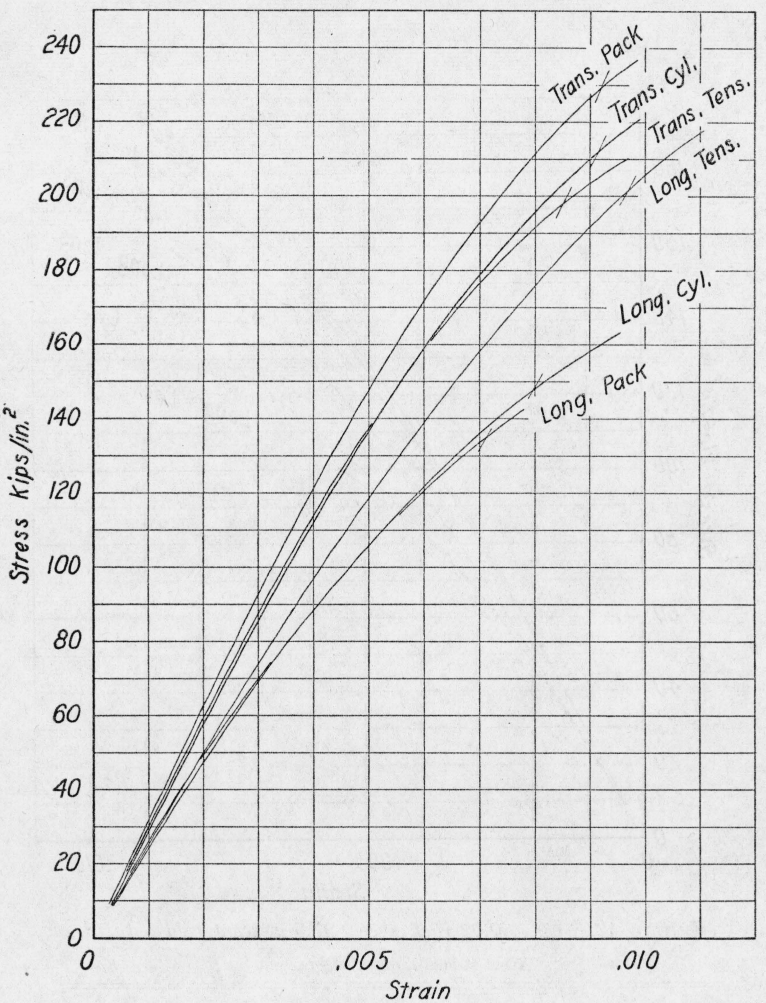

FIGURE 43.—*18–7, 0.02-inch sheet, 50.0 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	201.6	198.3
Pack compressive	135.1	228.8
Cylinder compressive	147.8	212.5

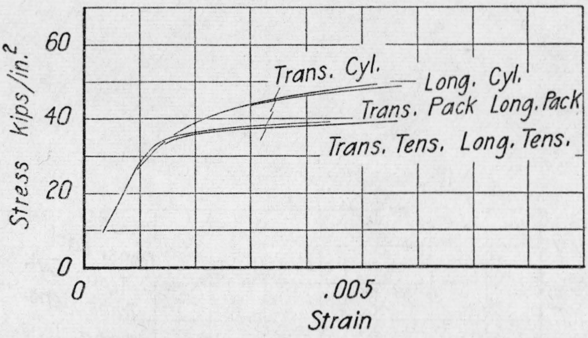

FIGURE 44.—*18–7, 0.035-inch sheet, annealed.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	37.5	37.7
Pack compressive	37.8	38.2
Cylinder compressive	45.1	45.4

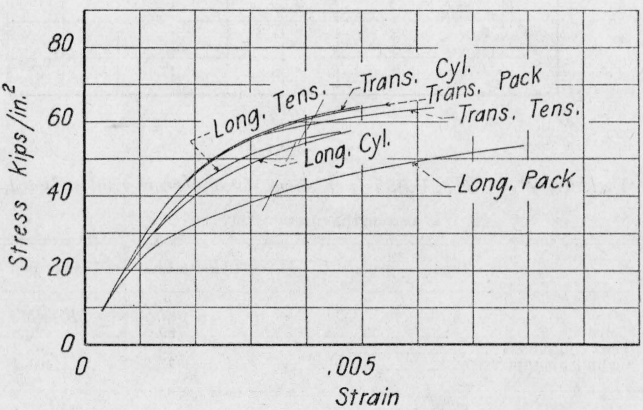

FIGURE 45.—*18–7, 0.035-inch sheet, 7.5 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	55.4	59.1
Pack compressive	40.1	61.0
Cylinder compressive	53.2	61.3

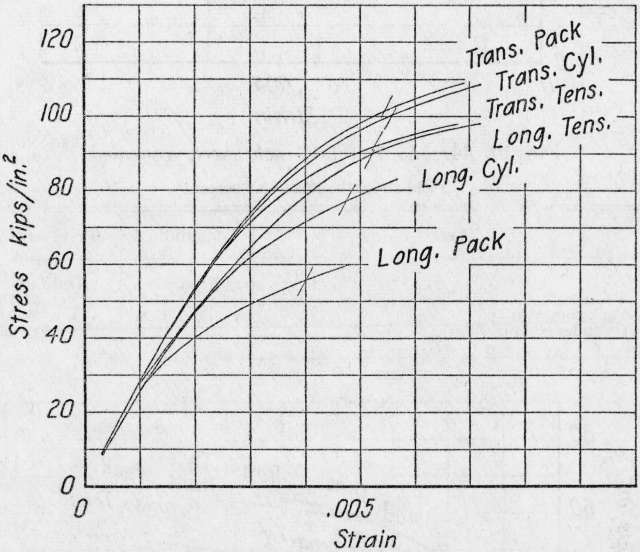

FIGURE 46.—*18–7, 0.035-inch sheet, 19.6 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	89.5	91.8
Pack compressive	55.9	101.2
Cylinder compressive	77.3	100.2

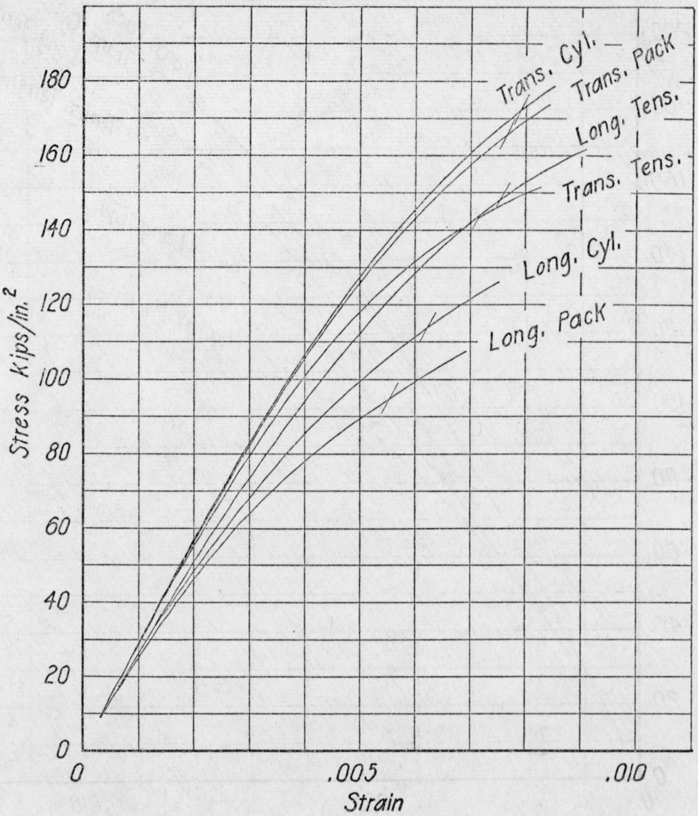

FIGURE 47.—*18–7, 0.035-inch sheet, 29.2 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.^{2}	*Kips/in.*^{2}
Tensile	148.2	143.0
Pack compressive	94.8	165.6
Cylinder compressive	113.5	172.1

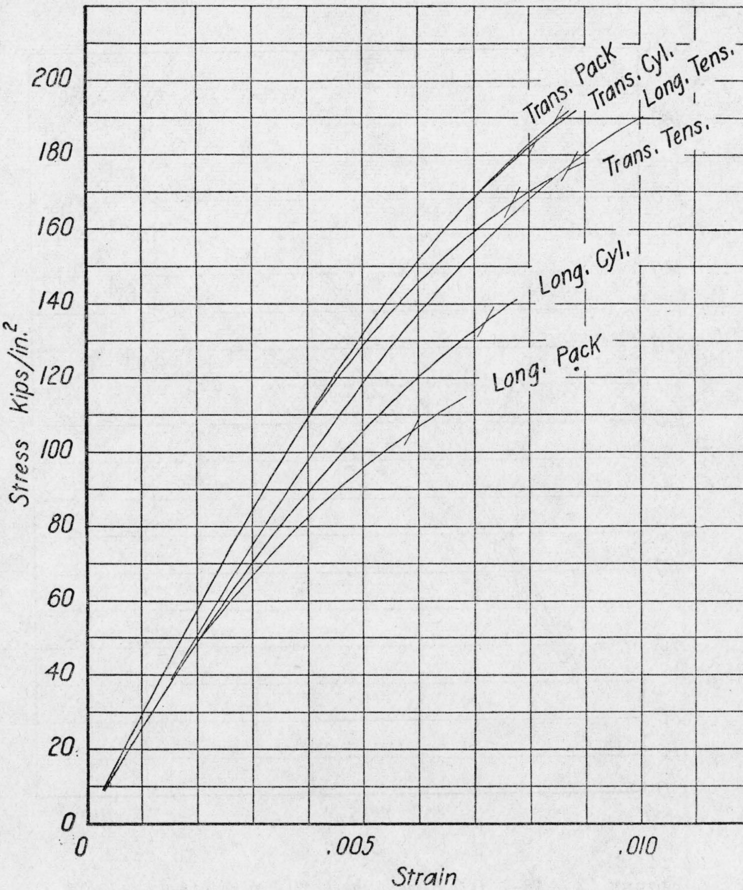

FIGURE 48.—*18–7, 0.035-inch sheet, 39.7 percent cold-reduced.*

Yield strength, offset = 0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	177.7	167.0
Pack compressive	105.5	189.1
Cylinder compressive	135.0	183.8

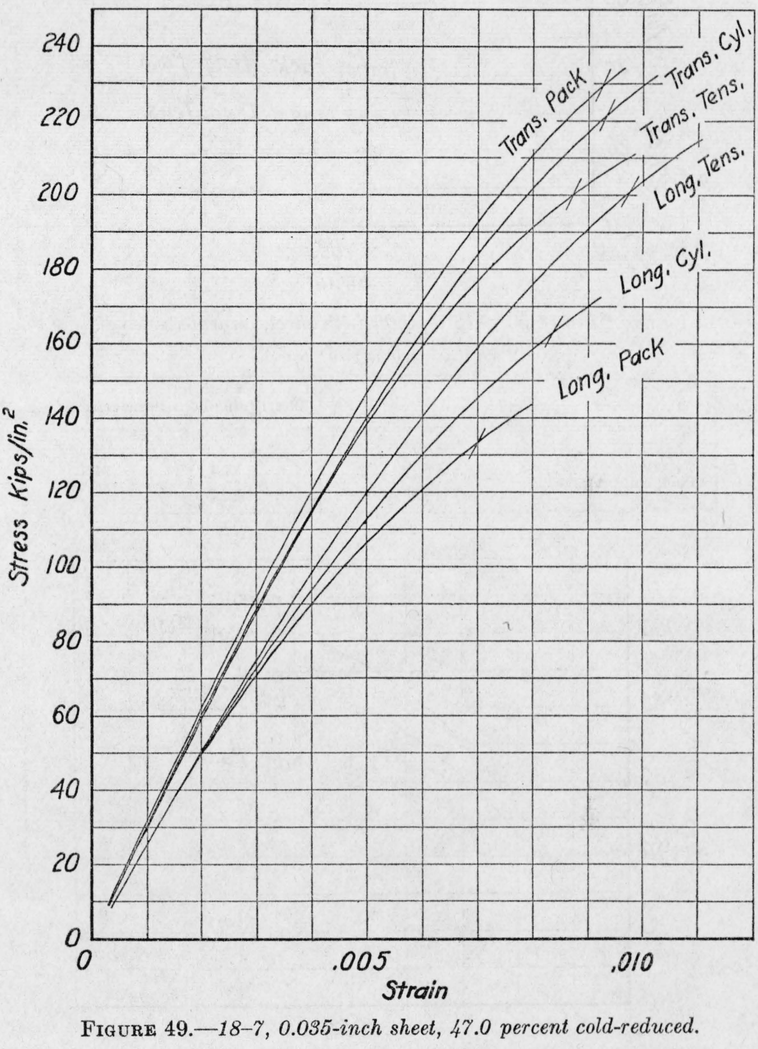

FIGURE 49.—*18–7, 0.035-inch sheet, 47.0 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	200.9	200.4
Pack compressive	133.5	229.5
Cylinder compressive	163.2	221.5

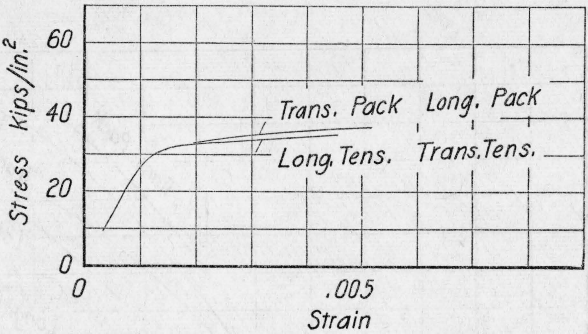

FIGURE 50.—*18–7, 0.06-inch sheet, annealed.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	34.1	34.1
Pack compressive	35.3	35.5

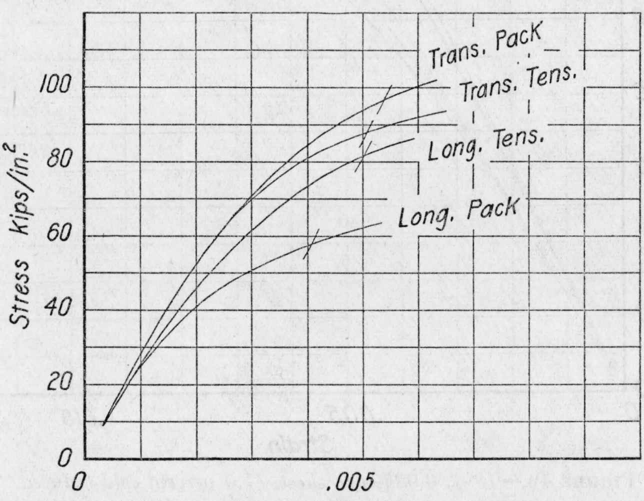

FIGURE 51.—*18–7, 0.06-inch sheet, 6.7 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	81.5	88.3
Pack compressive	57.8	96.3

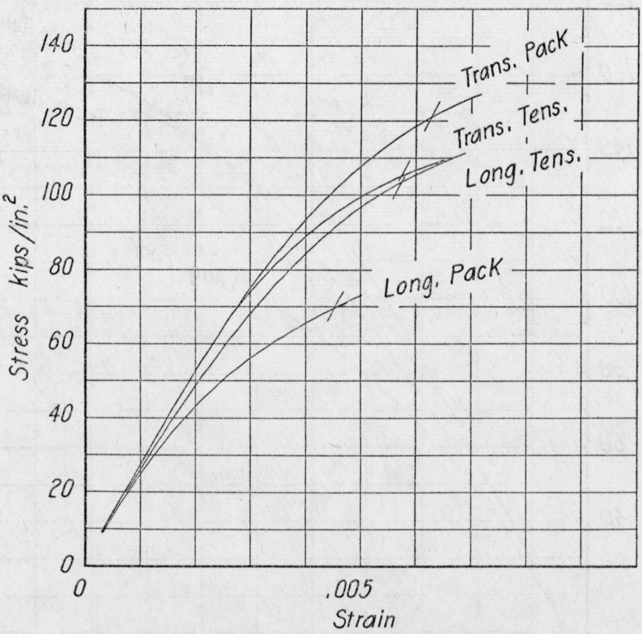

FIGURE 52.—*18-7, 0.06-inch sheet, 18.1 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	103.7	105.2
Pack compressive	69.4	120.7

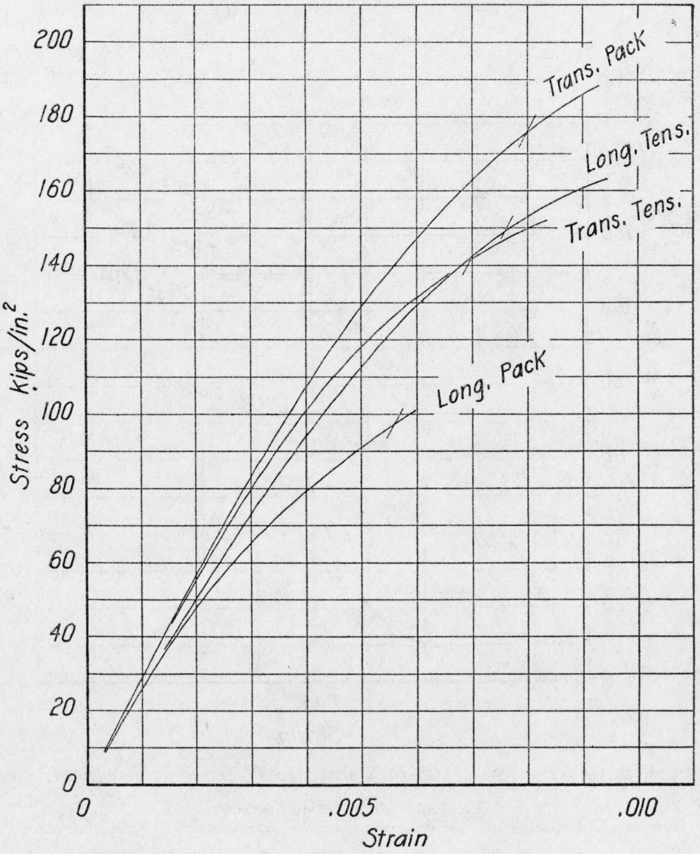

FIGURE 53.—*18-7, 0.06-inch sheet, 30.5 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	148.6	141.4
Pack compressive	97.4	176.0

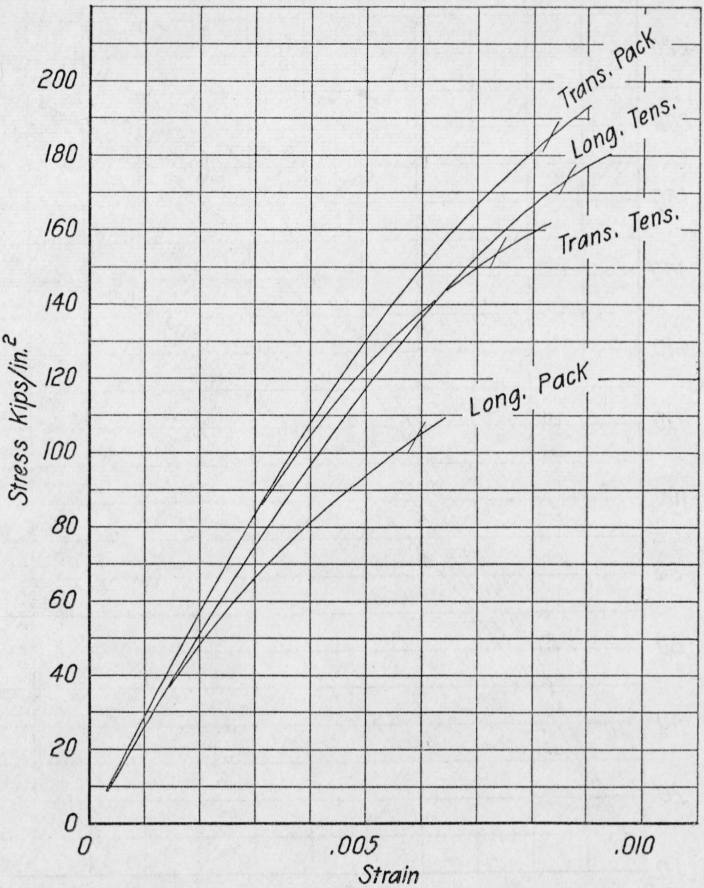

FIGURE 54.—*18–7, 0.06-inch sheet, 36.9 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	*Kips/in.*²	*Kips/in.*²
Tensile	173.7	153.8
Pack compressive	104.3	185.3

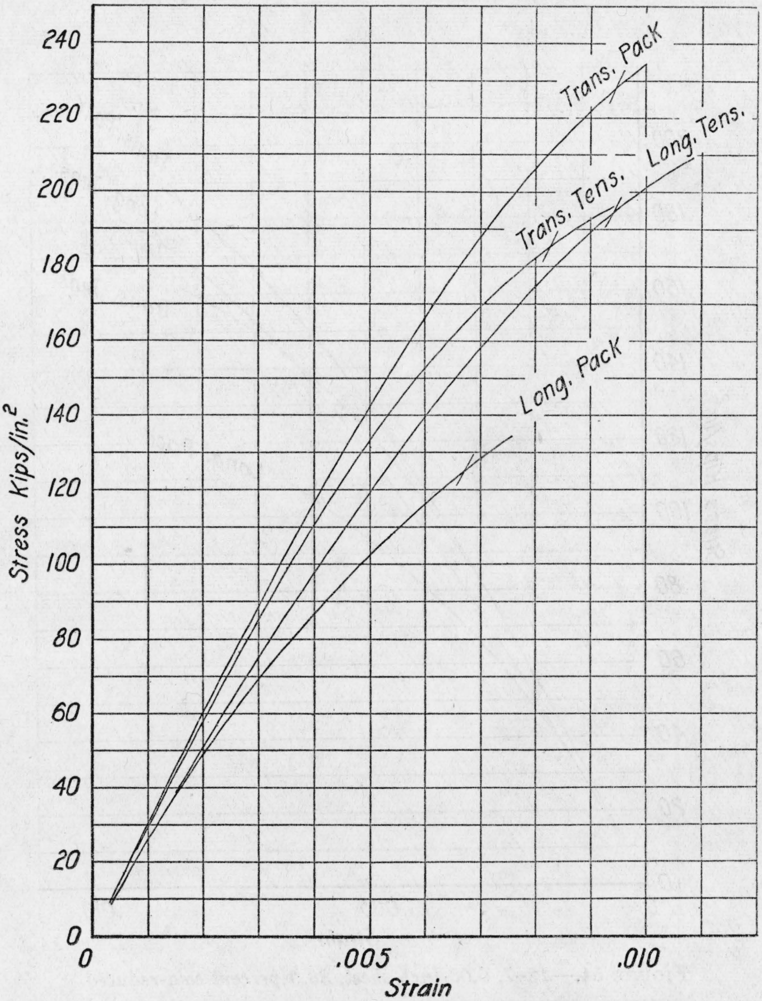

FIGURE 55.—*18-7, 0.06-inch sheet, 47.7 percent cold-reduced.*

Yield strength, offset=0.2 percent

Test	Longitudinal	Transverse
	Kips/in.²	*Kips/in.²*
Tensile	194.3	185.3
Pack compressive	125.1	228.2

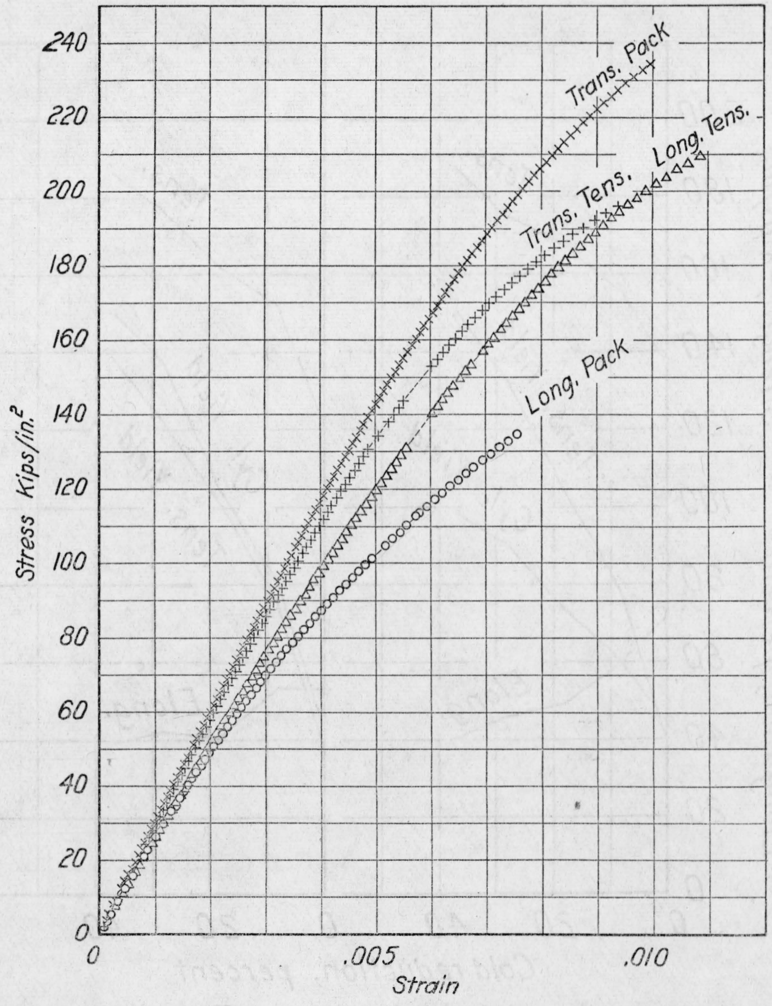

FIGURE 56.—*18–7, 0.06-inch sheet, 47.7 percent cold-reduced, individual points.*

Both strain gages were read simultaneously at increments of about 2.0 kips/in². Gaps in the readings were unavoidable, however, where occasional readings were missed or where, to avoid resetting the strain gage, both the tensile and compressive images were used.

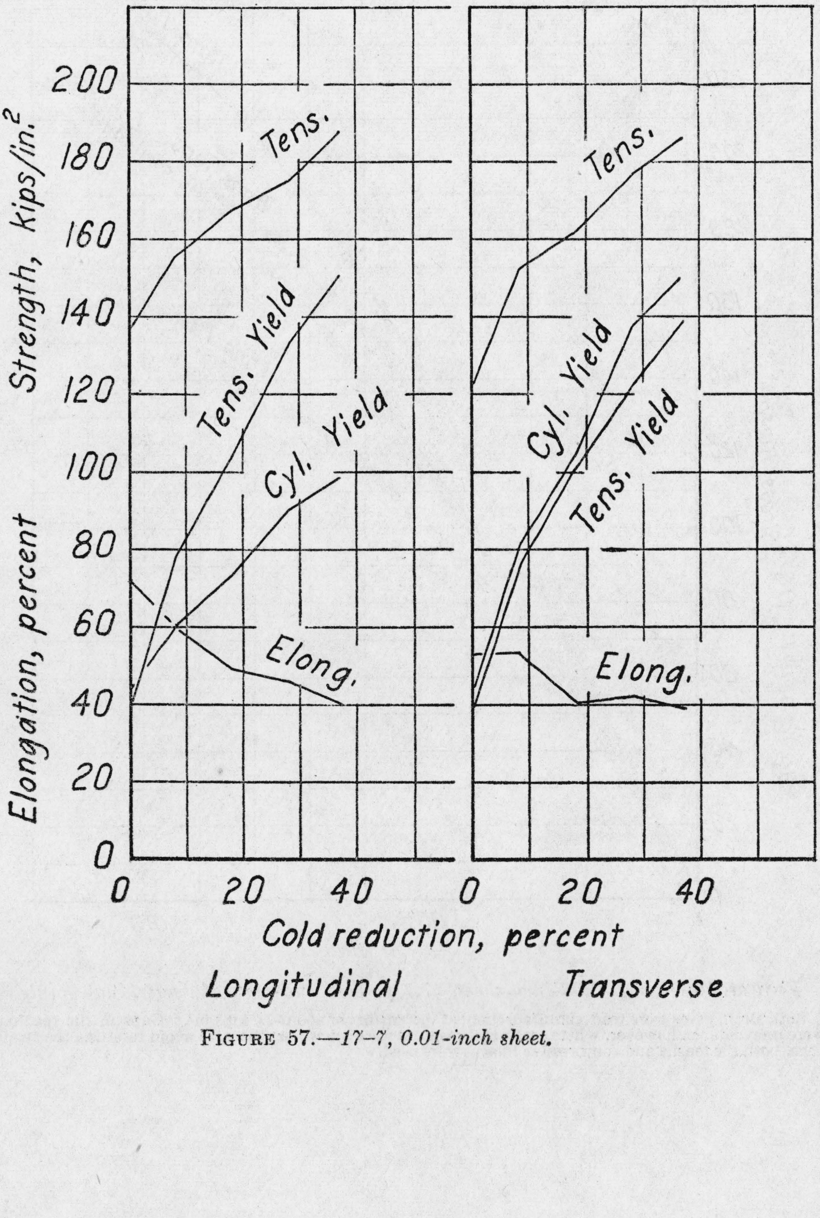

FIGURE 57.—17–7, 0.01-inch sheet.

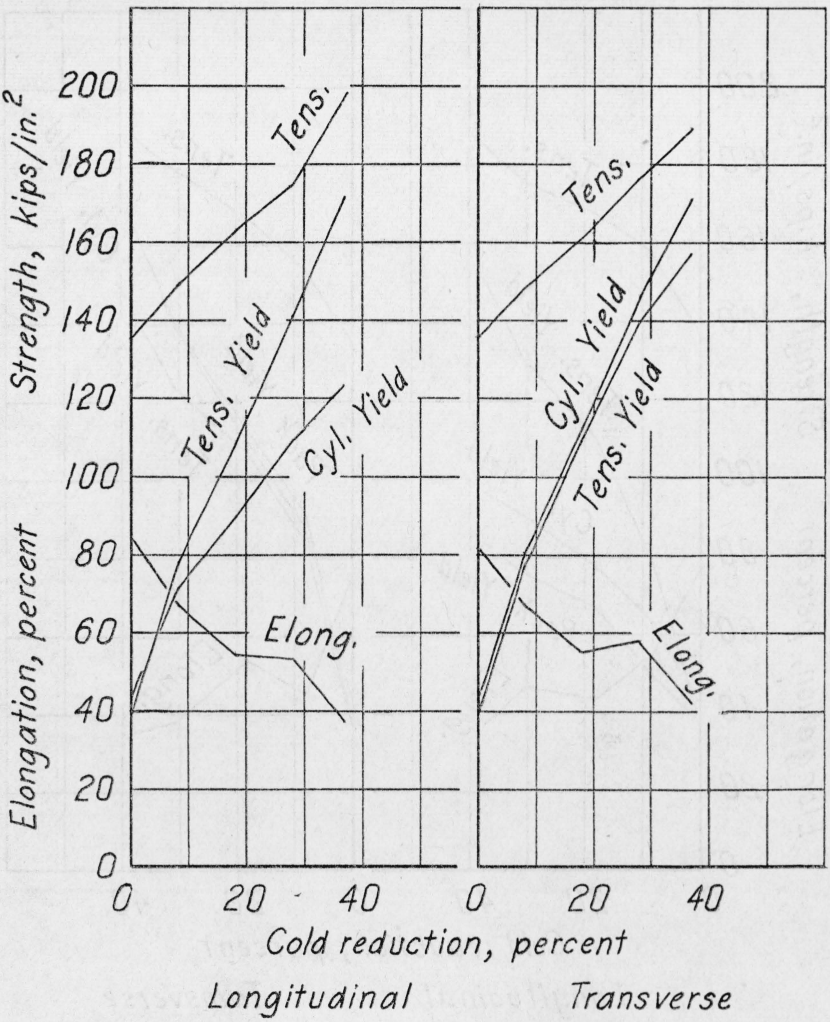

FIGURE 58.—*17-7, 0.01-inch sheet, stress-relieved.*

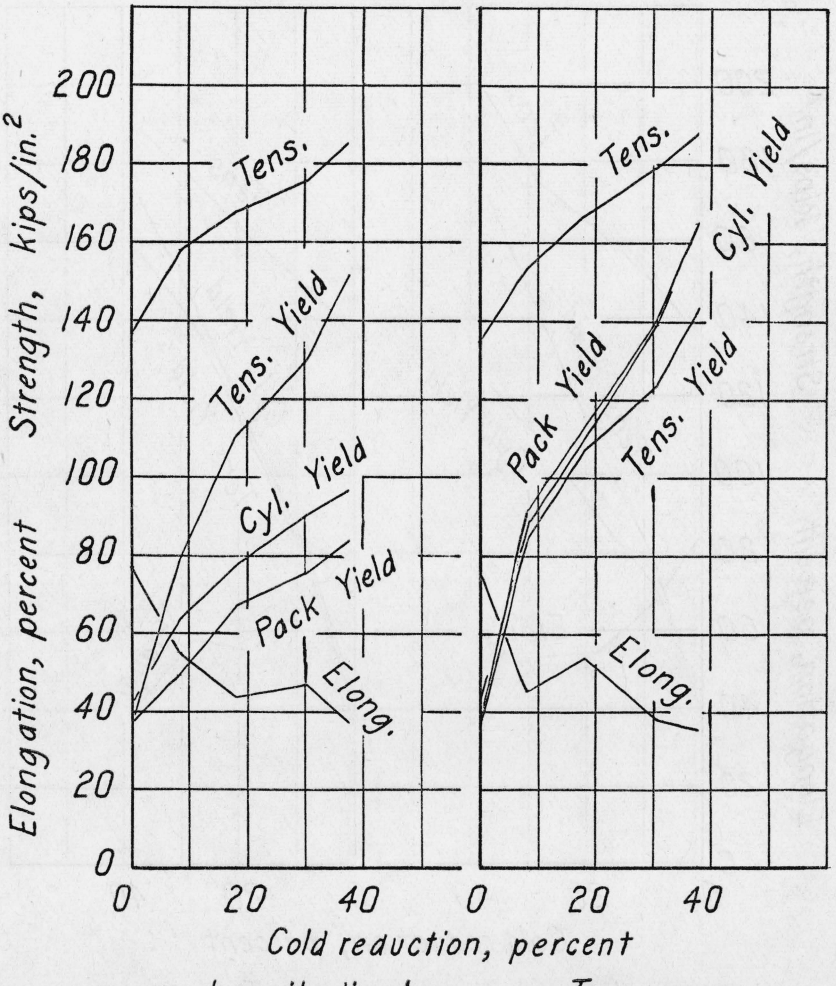

FIGURE 59.—*17–7, 0.02-inch sheet.*

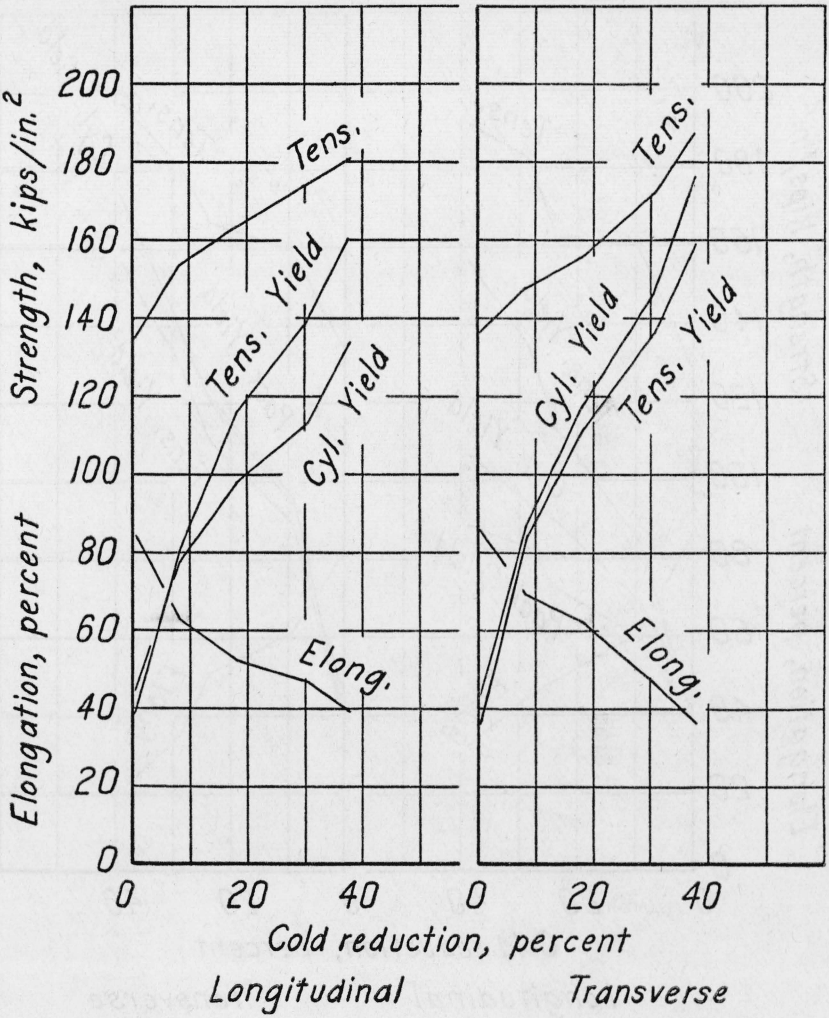

FIGURE 60.—*17–7, 0.02-inch sheet, stress-relieved.*

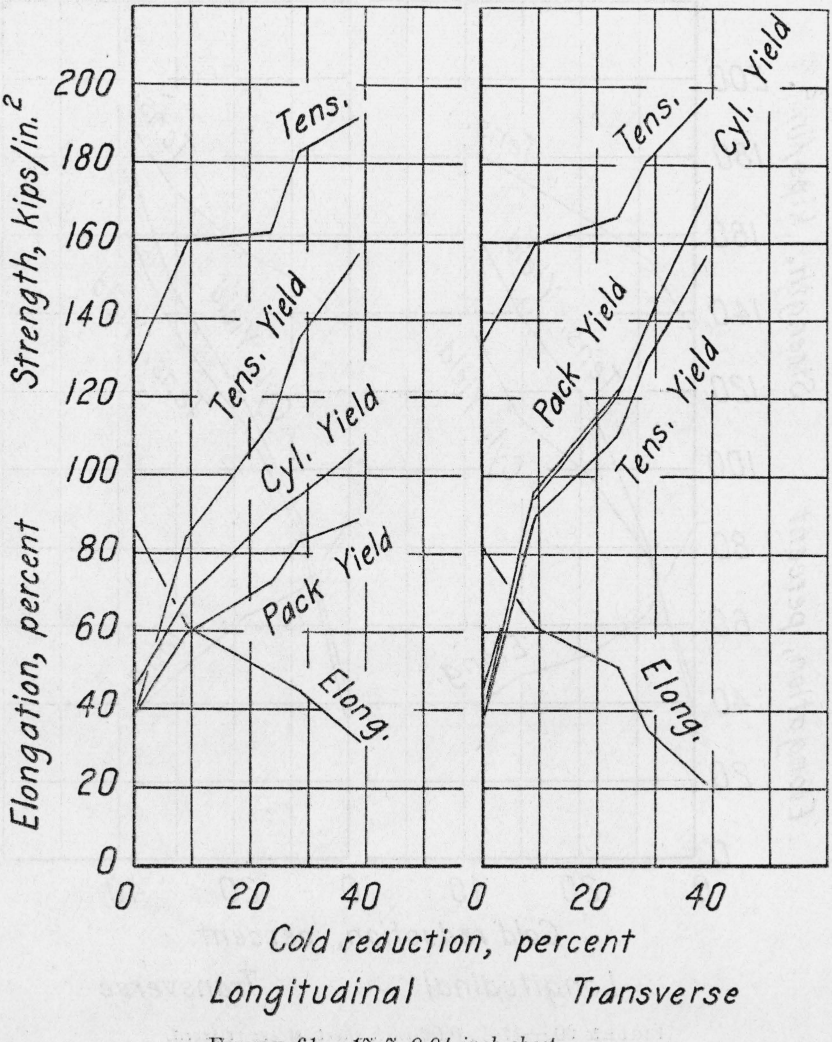

FIGURE 61.—*17–7, 0.04-inch sheet.*

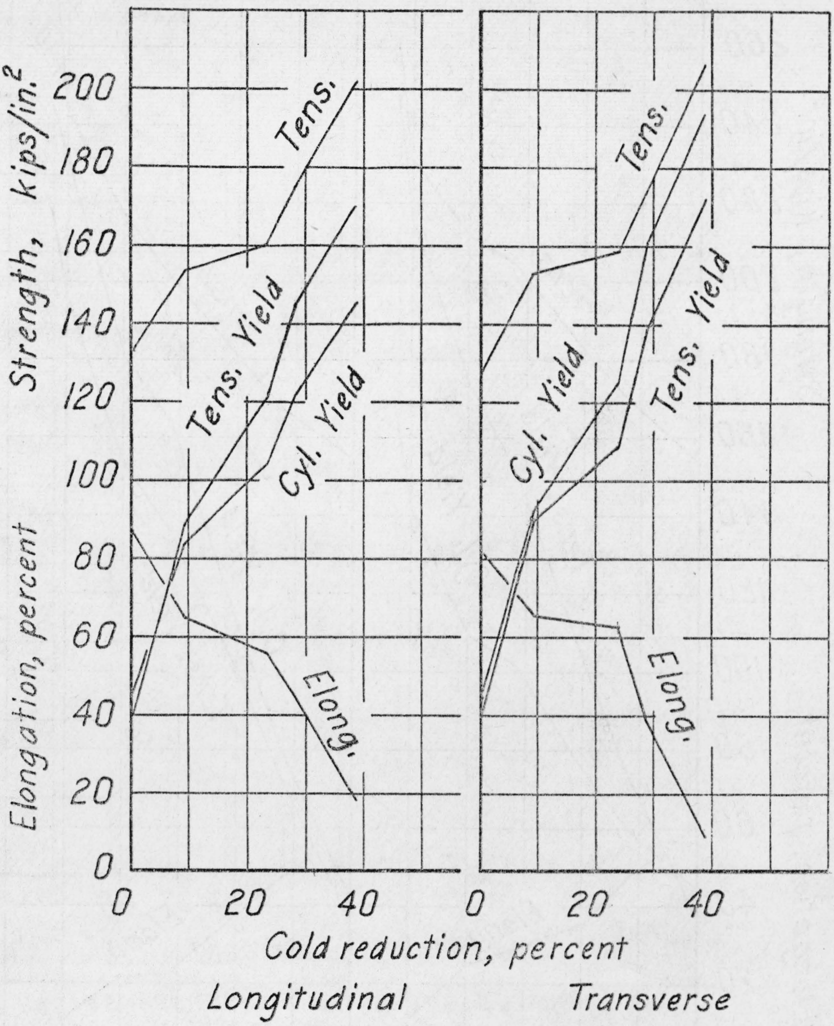

FIGURE 62.—*17-7, 0.04-inch sheet, stress-relieved.*

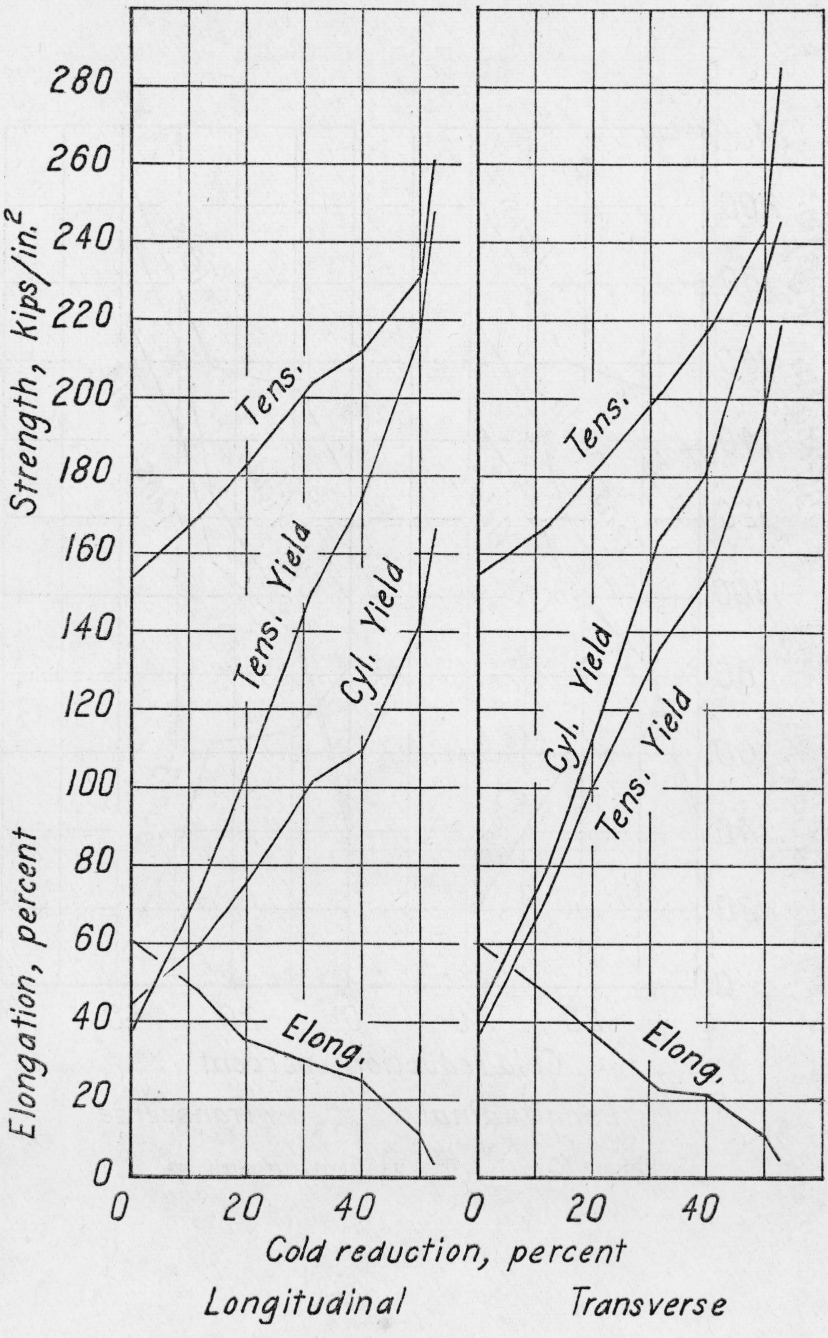

FIGURE 63.—*18–7, 0.01-inch sheet.*

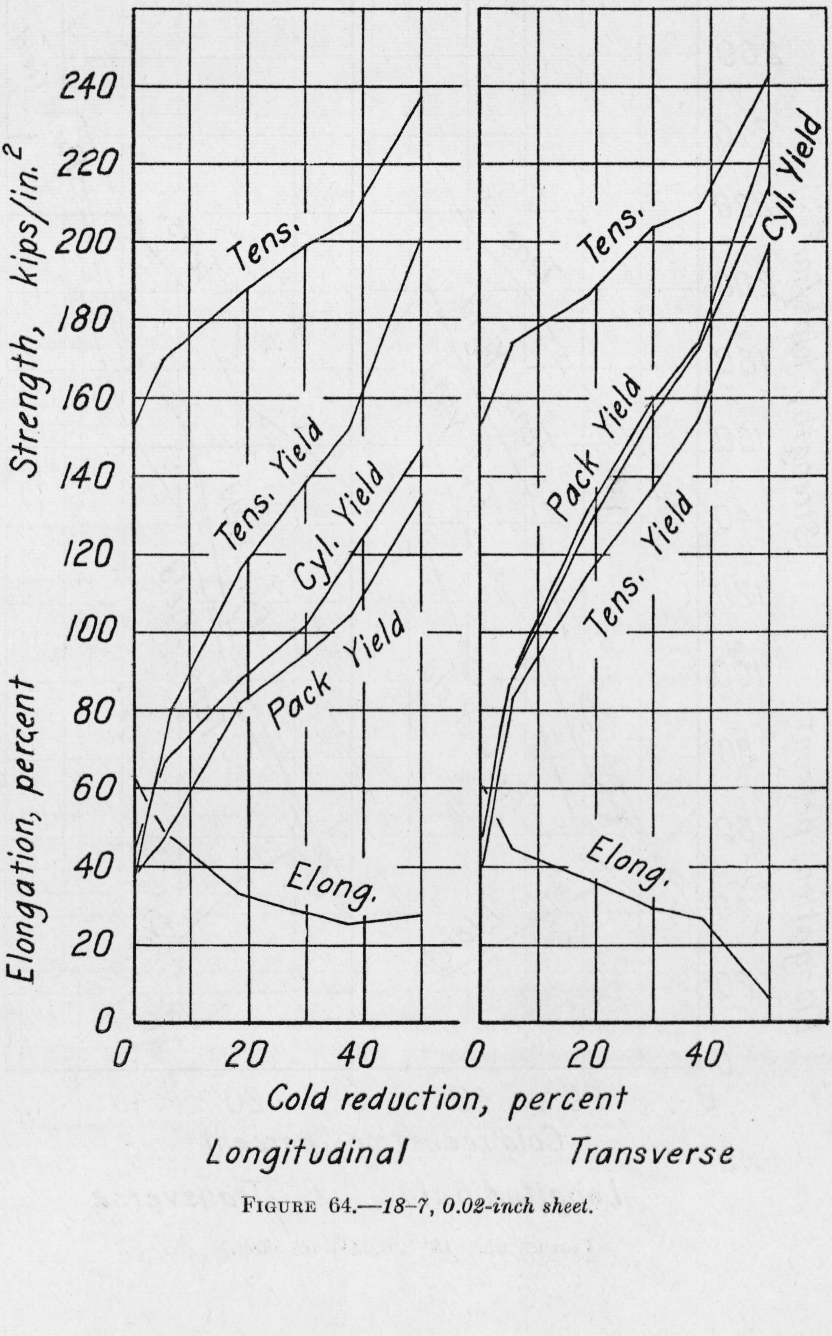

FIGURE 64.—*18–7, 0.02-inch sheet.*

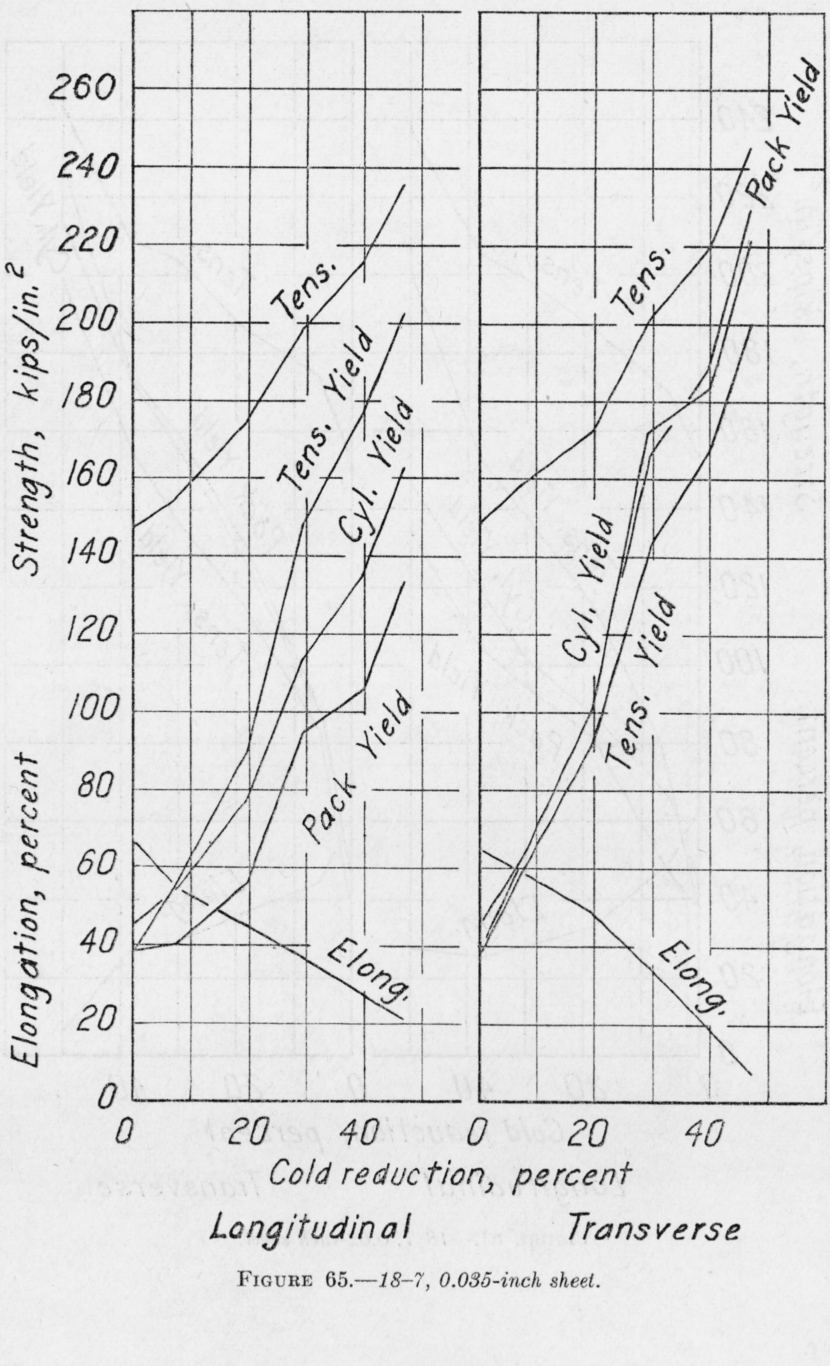

FIGURE 65.—*18–7, 0.035-inch sheet.*

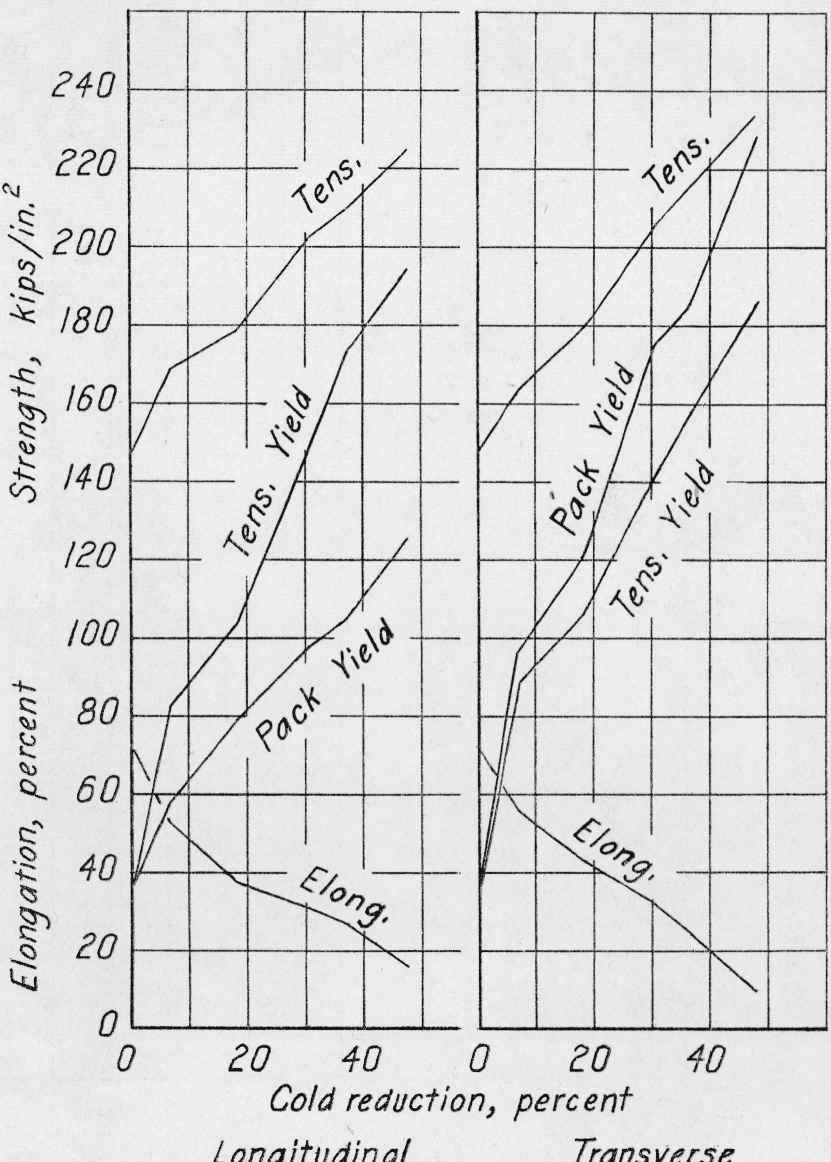

FIGURE 66.—*18–7, 0.06-inch sheet.*

WASHINGTON, March 2, 1942

○

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[Continued on p. 4 of cover]

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