Association has deprecated the use of any other system and encouraged the careful maintenance of these standards. See Proceedings 1872, pages 18 and 21; Proceedings 1879, pages 82 and 83; Proceedings 1882, page 229.

A set of gauges for standard screw threads and a standard inch scale, 2 feet long, are held in the office of the Secretary for reference.

Mr. Sellers, who proposed this system of screw threads, described it in an essay read before the Franklin Institute of Philadelphia, April 21, 1864, as follows:

"The proportions for the proposed thread and its comparative relation to the sharp and rounded threads, will be readily understood from the accompanying diagram in which Figs. 11 and 12 — the latter on an exaggerated scale — represent a sharp thread, Figs. 13 and 14 a rounded top and bottom to the English proportion, and Figs. 15 and 16 the flat top and bottom, all of the same pitch. The angle of the proposed thread is fixed at 60°, the same as the sharp thread, it being more readily obtained than 55°; and more in accordance with the general practice in this country. Divide the pitch, or, which is the same thing, the side of the

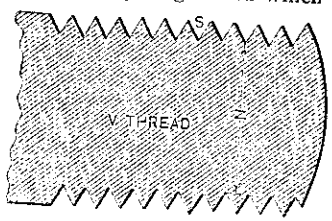


FIG. 11.

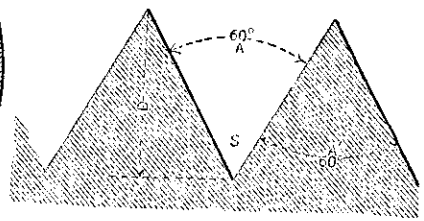


FIG. 12.

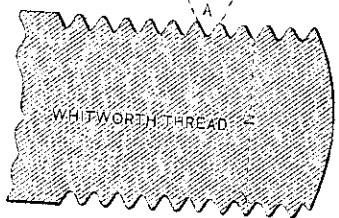


FIG. 13.

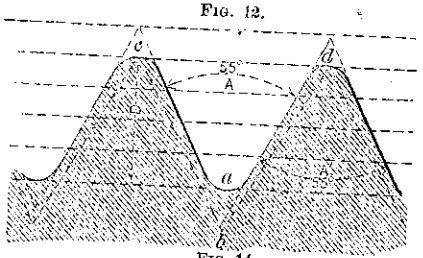


FIG. 14.

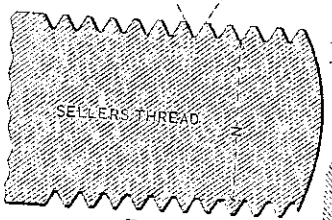


FIG. 15.

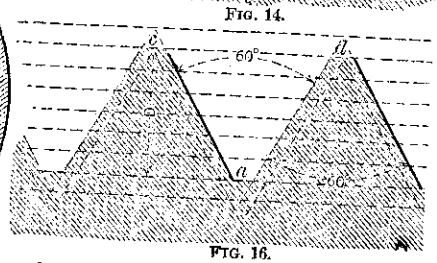


FIG. 16.



thread, into eight equal parts, take off one part from the top and fill in one part in the bottom of the thread, then the flat top and bottom will equal one-eighth of the pitch; the wearing surface will be three-quarters of the pitch, and the diameter of screw at bottom of the thread will be expressed by the formula:

$$\textit{Diameter} = \frac{1{,}299}{\textit{number of threads per inch.}}$$

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## SPECIFICATIONS FOR BOLTS AND NUTS.

In 1916, Specifications for Bolts and Nuts were drafted, these specifications to include the table given on page 843, M. C. B. 1915 Proceedings, which was enlarged.

1. **Scope.**— These specifications to apply to all bolts and nuts.

### I. MANUFACTURE.

2. **Process.**— The bolts and nuts may be made from wrought iron or steel, made in accordance with M. C. B. Specifications for Refined Wrought Iron Bars or Mild Steel Bars.

### II. CHEMICAL PROPERTIES AND TESTS.

3. **Chemical Composition.**— The steel for the bolts shall conform to the requirements of the M. C. B. Specifications for Mild Steel.

### III. PHYSICAL PROPERTIES AND TESTS.

4. **Tension Tests.**— The wrought iron or steel shall conform to the physical properties as specified in the M. C. B. Specifications for Refined Wrought Iron Bars and Mild Steel Bars.

### IV. PERMISSIBLE VARIATIONS.

5. **Gage of Bolts.**— Rods shall conform to the limits as specified in M. C. B. Specifications for Refined Wrought Iron Bars or Mild Steel Bars.

6. **Threads.**— Nuts shall be so tapped that a U. S. standard plug gage of normal size will pass through the nut, and in that position be snug and not show an appreciable shake. Bolts to be threaded so as to fit the nut in such a manner that it may be turned to within one thread of the end of the threaded portion of the bolt. When in this position there shall be no appreciable shake.

## TABLE No. 1.

| Diam. of Screw. | SCREW THREADS. Threads per In. | Diam. at Root of Thread. | Width of Flat. | NUTS. Hexagon and Square. Short Diameter. Rough. | Short Diameter. Finish. | Thickness. Rough. | Thickness. Finish. | HEADS. Hexagon and square. Short Diameter. Rough. | Short Diameter. Finish. | Thickness. Rough. | Thickness. Finish. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/4 | 20 | .185 | .0062 | 1/2 | 7/16 | 1/4 | 3/16 | 3/8 | 5/16 | 3/16 | 1/8 |
| 5/16 | 18 | .240 | .0074 | 19/32 | 1/2 | 5/16 | 1/4 | 15/32 | 13/32 | 15/64 | 9/64 |
| 3/8 | 16 | .294 | .0078 | 11/16 | 5/8 | 3/8 | 5/16 | 9/16 | 1/2 | 9/32 | 7/32 |
| 7/16 | 14 | .344 | .0089 | 25/32 | 23/32 | 7/16 | 3/8 | 21/32 | 19/32 | 21/64 | 17/64 |
| 1/2 | 13 | .400 | .0096 | 7/8 | 13/16 | 1/2 | 7/16 | 3/4 | 11/16 | 3/8 | 5/16 |
| 9/16 | 12 | .454 | .0104 | 31/32 | 29/32 | 9/16 | 1/2 | 27/32 | 25/32 | 27/64 | 23/64 |
| 5/8 | 11 | .507 | .0113 | 1 1/16 | 1 | 5/8 | 9/16 | 15/16 | 7/8 | 15/32 | 13/32 |
| 3/4 | 10 | .620 | .0125 | 1 1/4 | 1 3/16 | 3/4 | 11/16 | 1 1/8 | 1 1/16 | 9/16 | 1/2 |
| 7/8 | 9 | .731 | .0138 | 1 7/16 | 1 3/8 | 7/8 | 13/16 | 1 5/16 | 1 1/4 | 21/32 | 19/32 |
| 1 | 8 | .837 | .0156 | 1 5/8 | 1 9/16 | 1 | 15/16 | 1 1/2 | 1 7/16 | 3/4 | 11/16 |
| 1 1/8 | 7 | .940 | .0178 | 1 13/16 | 1 3/4 | 1 1/8 | 1 1/16 | 1 11/16 | 1 5/8 | 27/32 | 25/32 |
| 1 1/4 | 7 | 1.065 | .0178 | 2 | 1 15/16 | 1 1/4 | 1 3/16 | 1 7/8 | 1 13/16 | 15/16 | 7/8 |
| 1 3/8 | 6 | 1.160 | .0208 | 2 3/16 | 2 1/8 | 1 3/8 | 1 5/16 | 2 1/16 | 2 | 1 3/32 | 31/32 |
| 1 1/2 | 6 | 1.284 | .0208 | 2 3/8 | 2 5/16 | 1 1/2 | 1 7/16 | 2 1/4 | 2 3/16 | 1 1/8 | 1 1/16 |
| 1 5/8 | 5 1/2 | 1.389 | .0227 | 2 9/16 | 2 1/2 | 1 5/8 | 1 9/16 | 2 7/16 | 2 3/8 | 1 7/32 | 1 5/32 |
| 1 3/4 | 5 | 1.491 | .0250 | 2 3/4 | 2 11/16 | 1 3/4 | 1 11/16 | 2 5/8 | 2 9/16 | 1 5/16 | 1 1/4 |
| 1 7/8 | 5 | 1.616 | .0250 | 2 15/16 | 2 7/8 | 1 7/8 | 1 13/16 | 2 13/16 | 2 3/4 | 1 13/32 | 1 11/32 |
| 2 | 4 1/2 | 1.712 | .0277 | 3 1/8 | 3 1/16 | 2 | 1 15/16 | 3 | 2 15/16 | 1 1/2 | 1 7/16 |
| 2 1/4 | 4 1/2 | 1.961 | .0277 | 3 1/2 | 3 7/16 | 2 1/4 | 2 3/16 | 3 3/8 | 3 5/16 | 1 11/16 | 1 5/8 |
| 2 1/2 | 4 | 2.175 | .0312 | 3 7/8 | 3 13/16 | 2 1/2 | 2 7/16 | 3 3/4 | 3 11/16 | 1 7/8 | 1 13/16 |
| 2 3/4 | 4 | 2.425 | .0312 | 4 1/4 | 4 3/16 | 2 3/4 | 2 11/16 | 4 1/8 | 4 1/16 | 2 1/16 | 2 |
| 3 | 3 1/2 | 2.629 | .0357 | 4 5/8 | 4 9/16 | 3 | 2 15/16 | 4 1/2 | 4 7/16 | 2 1/4 | 2 3/16 |
| 3 1/4 | 3 1/2 | 2.879 | .0357 | 5 | 4 15/16 | 3 1/4 | 3 3/16 | 4 7/8 | 4 13/16 | 2 7/16 | 2 3/8 |
| 3 1/2 | 3 1/4 | 3.100 | .0384 | 5 3/8 | 5 5/16 | 3 1/2 | 3 7/16 | 5 1/4 | 5 3/16 | 2 5/8 | 2 9/16 |
| 3 3/4 | 3 | 3.317 | .0416 | 5 3/4 | 5 11/16 | 3 3/4 | 3 11/16 | 5 5/8 | 5 9/16 | 2 13/16 | 2 3/4 |
| 4 | 3 | 3.567 | .0416 | 6 1/8 | 6 1/16 | 4 | 3 15/16 | 6 | 5 15/16 | 3 | 2 15/16 |
| 4 1/4 | 2 7/8 | 3.798 | .0434 | 6 1/2 | 6 7/16 | 4 1/4 | 4 3/16 | 6 3/8 | 6 5/16 | 3 3/16 | 3 1/8 |
| 4 1/2 | 2 3/4 | 4.028 | .0454 | 6 7/8 | 6 13/16 | 4 1/2 | 4 7/16 | 6 3/4 | 6 11/16 | 3 3/8 | 3 5/16 |
| 4 3/4 | 2 5/8 | 4.255 | .0475 | 7 1/4 | 7 3/16 | 4 3/4 | 4 11/16 | 7 1/8 | 7 1/16 | 3 9/16 | 3 1/2 |
| 5 | 2 1/2 | 4.480 | .0500 | 7 5/8 | 7 9/16 | 5 | 4 15/16 | 7 1/2 | 7 7/16 | 3 3/4 | 3 11/16 |
| 5 1/4 | 2 1/2 | 4.730 | .0500 | 8 | 7 15/16 | 5 1/4 | 5 3/16 | 7 7/8 | 7 13/16 | 3 15/16 | 3 7/8 |
| 5 1/2 | 2 3/8 | 4.953 | .0526 | 8 3/8 | 8 5/16 | 5 1/2 | 5 7/16 | 8 1/4 | 8 1/16 | 4 1/8 | 4 1/16 |
| 5 3/4 | 2 3/8 | 5.203 | .0526 | 8 3/4 | 8 11/16 | 5 3/4 | 5 11/16 | 8 5/8 | 8 9/16 | 4 5/16 | 4 1/4 |
| 6 | 2 1/4 | 5.423 | .0555 | 9 1/8 | 9 1/16 | 6 | 5 15/16 | 9 | 8 15/16 | 4 1/2 | 4 7/16 |

902

## TABLE II.

### PROPORTIONS FOR SELLERS' STANDARD NUTS AND BOLTS.

Rough Nut = one and one-half diameter of bolt + 1/8.

Finished Nut = one and one-half diameter of bolt + 1/16.

Rough Nut = diameter of bolt.

Finished Nut = diameter of bolt — 1/16.

Rough Head = one and one-half diameter of bolt + 1/8.

Finished Head = one and one-half diameter of bolt + 1/16.

Rough Head = one-half distance between parallel sides of head.

Finished Head = diameter of bolt — 1/8

903

NOTE. — In 1899 the following dimensions for square bolt heads were adopted as Recommended Practice: The side of the head shall be one and one-half times the diameter of the bolt, and the thickness of the head shall be one-half the side of the head. See Recommended Practice. In 1900 these dimensions were adopted as Standard.

7. **Finished Bolt and Nut.**— The finished bolt and nut shall conform in its finished dimensions to Tables No. 1 and No. 2 shown on pages 904 and 905. The permissible variation from this to be as follows: For nuts under ½ in., 1-16 in. under and 1-64 in. over. For nuts ½ in. and larger, 1-16 in. under and 3-64 in. over. All other dimensions of nuts and heads of bolts, 1-16 in. variation either way will be permitted, except for bolts and nuts under ½ in. 1-32 variation either way will be permitted.

8. **Tapping of Nuts.**— The nuts shall be tapped so that, when applied, the angle between the bearing surfaces shall not exceed two deg., as shown by the cut.


9. **Length.**— The finished length of the bolt shall not vary more than ⅛ in. from the ordered dimension and, unless otherwise specified, the threads shall be cut 2½ times the diameter of the bolt.

V. WORKMANSHIP AND FINISH.

10. **Workmanship.**—The heads of all bolts shall be neatly formed, firmly joined to the body of the bolt, free from large projecting fins and no nicking or reduction of the size of the body of the bolt by dies.

11. **Threads.**— Bolts and nuts shall be cut with a U. S. and M. C. B. standard thread, the threads being cut full and clean. Unless otherwise specified, each bolt shall be furnished with a nut screwed on.

12. **Finish.**— Where the keyways are cut in the ends of bolts, they shall be full and clean and the metal around them shall show that it has not been injured by cutting the keyways more than is necessary.

VI. INSPECTION AND REJECTION.

13. **Inspection.**—(a) The inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works which concern the manufacture of the material ordered. The manufacturer shall afford the inspector, free of cost, all reasonable facilities to satisfy him that the material is being furnished in accordance with these specifications.

(b) The purchaser may make the tests and inspection to govern the acceptance or rejection of the material in his own laboratory or elsewhere. Such tests and inspection shall be made at the expense of the purchaser.

(c) All tests and inspection shall be so conducted as not to interfere unnecessarily with the operation of the works.



14. **Rejection.**— Material which, subsequently to above tests at the mills or elsewhere and its acceptance, develops weak spots or imperfections, or fails to pass any one of the tests herein required, or properly thread or weld, when so specified, will be rejected and shall be replaced by the manufacturer at his own expense.

15. **Rehearing.**— Samples tested in accordance with this specification, which represent rejected material, shall be preserved for fourteen days from date of test report. In case of dissatisfaction with results of tests, the manufacturer may make claim for a rehearing within that time.

SQUARE BOLT HEADS. STANDARD.

In 1899 the following dimensions for square bolt heads were adopted as Recommended Practice:

The side of the head shall be one and one-half times the diameter of the bolt, and the thickness of the head shall be one-half the side of the head.

In 1900 these dimensions were adopted as a Standard.

END FOR HOPPER DOOR OPERATING SHAFT. STANDARD.

Sheet M. C. B. 28.

In 1913 a 2-inch square end for hopper door operating shaft was adopted as Recommended Practice. In 1914 advanced to Standard.

M. C. B. REPORTS. STANDARD.

In 1893 a standard size of 6 inches by 9 inches was adopted for M. C. B. reports. See Proceedings 1893.

PAMPHLETS, CATALOGUES, SPECIFICATIONS, ETC. STANDARD.

In 1894 standard sizes for publications of this nature were adopted and the size of postal card circular was changed in 1895 so that they are now as follows:

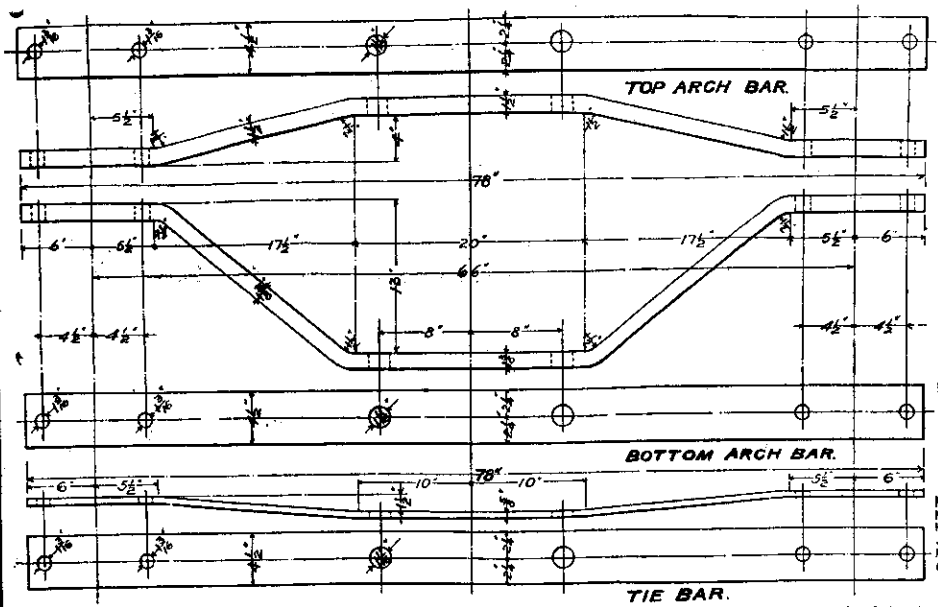
For postal card circulars, 3½ inches by 5½ inches.

For pamphlets and trade catalogues { 3½ inches by 6 inches. / 6 inches by 9 inches. / 9 inches by 12 inches.

For specifications and letter paper, 8 inches by 10½ inches.

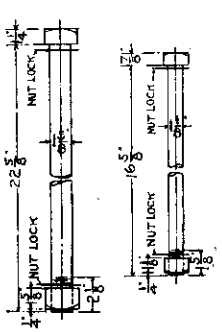
In connection with these standards it was decided that a standard practice should be to have the proper standard dimensions, and the word "standard" printed on the upper left-hand corner of title-page or cover whenever practicable.

In 1912 the standard size of specifications and letter paper was changed to the Government standard, namely, 8 by 10½ inches.

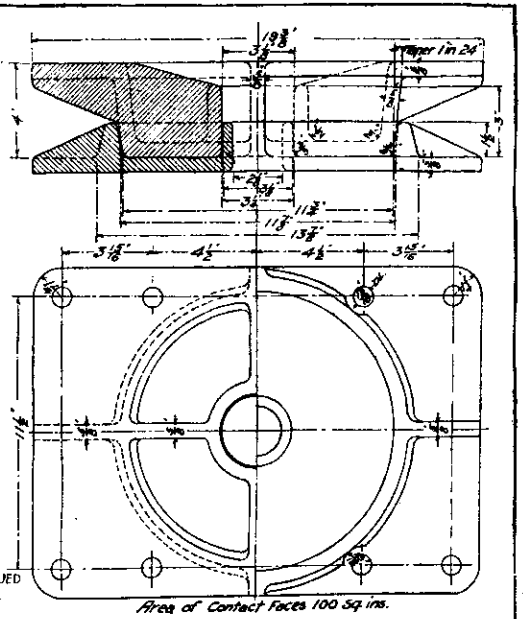



NOTE:
WHEN CAST WASHER IS USED UNDER HEAD OF BOLT IN PLACE OF NUT LOCK, IT SHALL BE CONSTRUCTED TO PREVENT HEAD FROM TURNING.

NOTE:
NUT LOCK TO BE USED UNDER HEAD AND NUT OF COLUMN AND JOURNAL BOX BOLTS AND DOUBLE NUTTING OF SAME TO BE DISCONTINUED ON TRUCKS OF EVERY CAPACITY.




ARCH BARS AND COLUMN AND JOURNAL BOX BOLTS, FOR 80,000 LBS. CAPACITY CARS.

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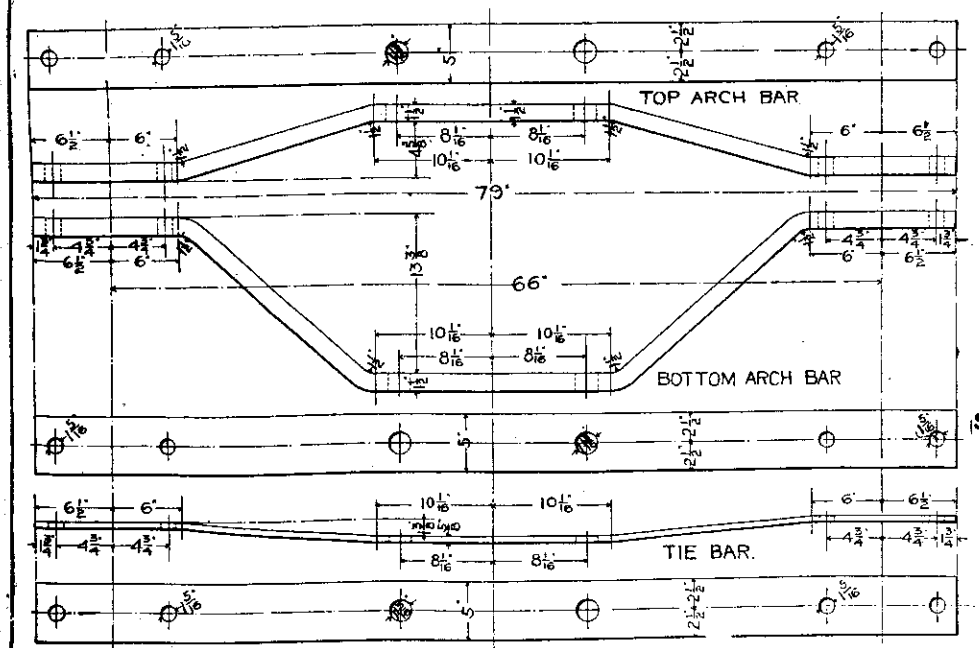


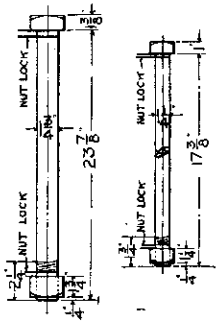


ARCH BARS AND COLUMN AND JOURNAL BOX BOLTS FOR 100,000 LBS. CAPACITY CARS.

# MASTER CAR BUILDERS' ASSOCIATION.

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**FOR**
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