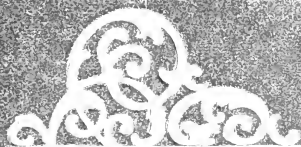


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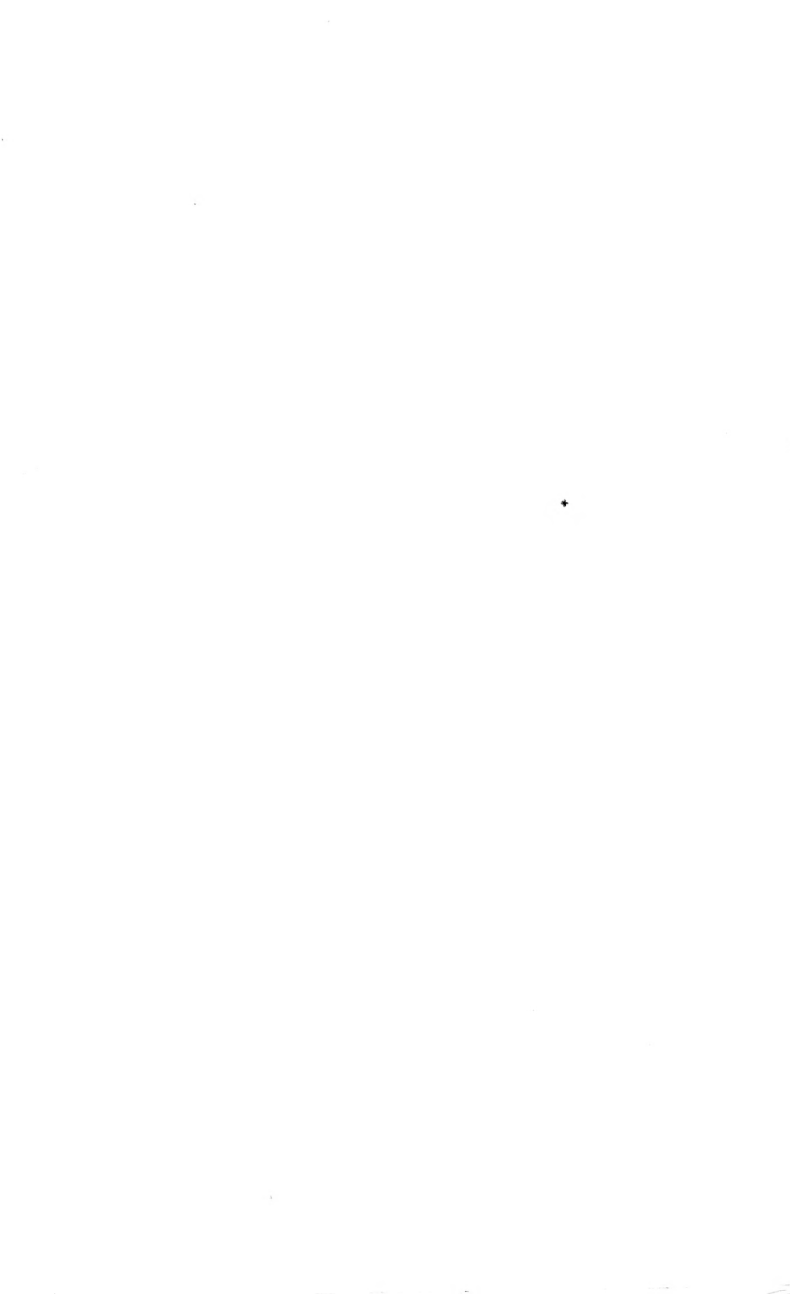


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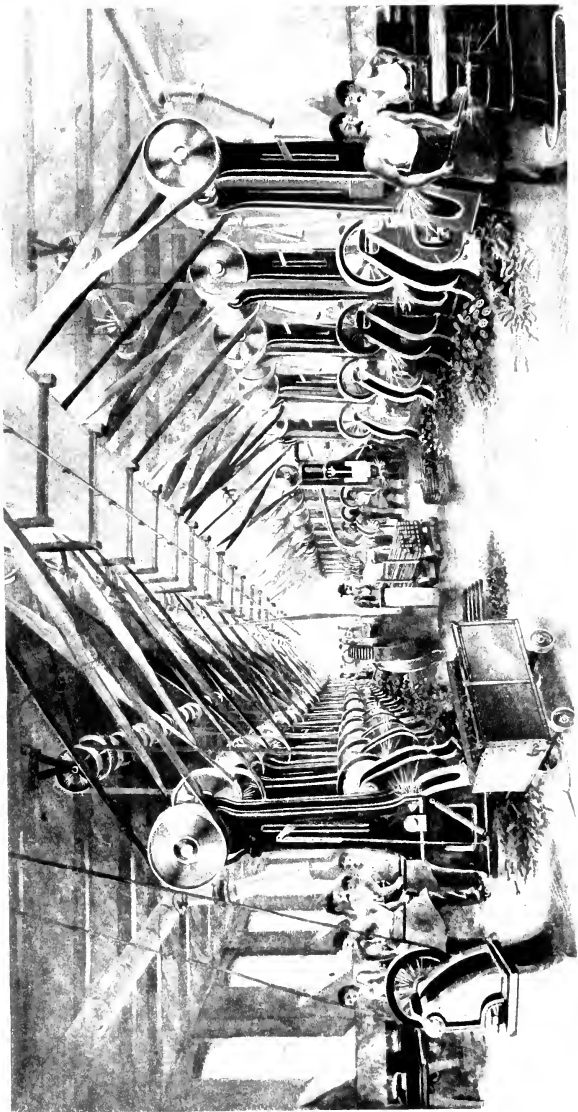
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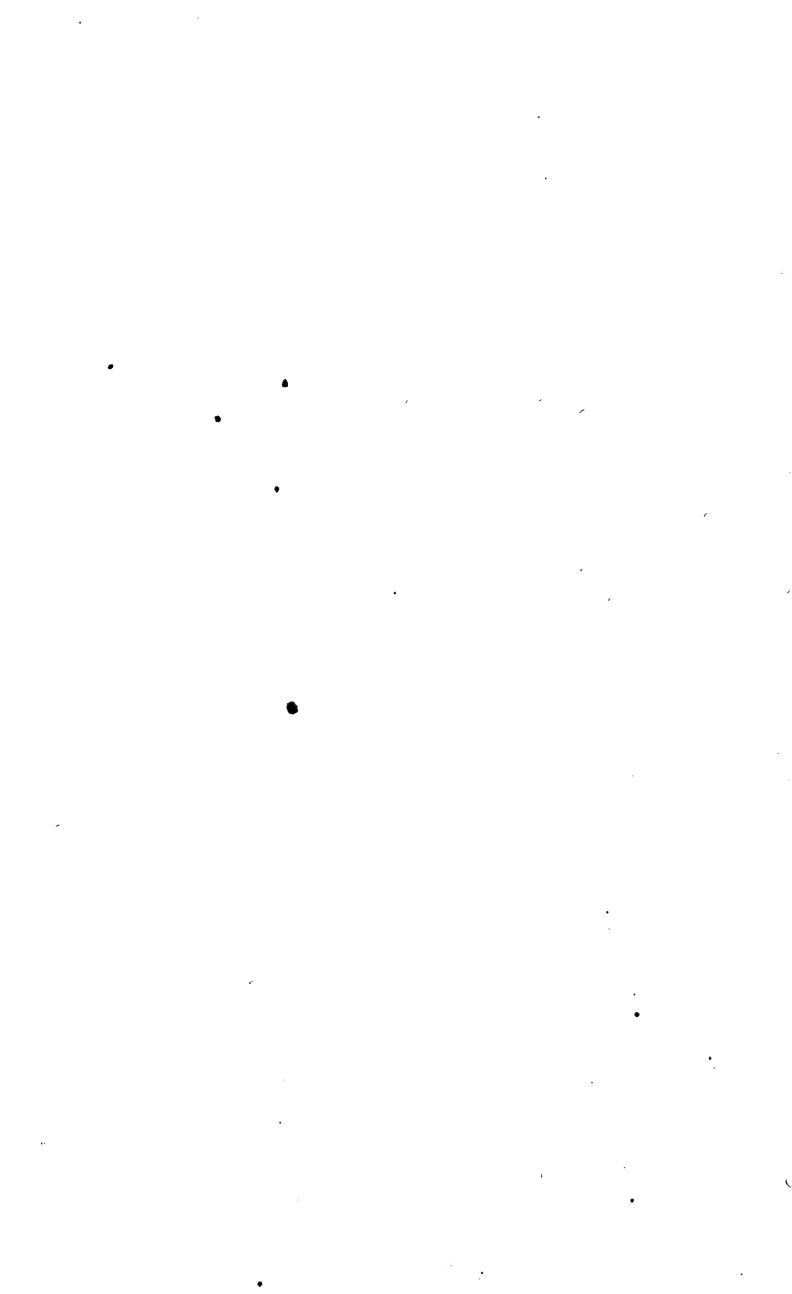
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MANUFACTURERS OF IRON
STEEL, COPPER, BRONZE AND ALUMINUM

Drop - Forgings

Business Established in Brooklyn, July 1,
1884. Incorporated, July 1, 1895



Tenth Edition — July, 1901


9 to 31 Richards St. and 1 to 29 Bowne St., near
Hamilton Ferry, Brooklyn, New York, U. S. A.

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WE are sole makers of the  and Vulcan brands of drop-forged specialties.

Our factory is equipped with the best appliances for the accurate and economical production of drop-forgings. The works are protected against fire, not only by automatic sprinklers but by the most approved fire extinguishing and preventive apparatus and an efficient, drilled fire department composed of our employees. We therefore offer customers the use of the best known machinery in producing drop-forgings and give them ample protection against delays and losses from fire.

As our working force is skilled and experienced and we carry a varied stock of materials, we serve customers promptly and well.

Estimates furnished on receipt of model or drawing and specifications stating quantity required.

Annealing, Tempering and Case-Hardening done to order

Pamphlet descriptive of our Annealing, Case-Hardening and Tempering facilities will be sent on application.



Cuts and tables showing our goods are furnished for customer's catalogues; if desired we will prepare such matter for printer and correct proof.



Terms Cash

Payable in New York City par funds, with no allowance for exchange. All goods delivered on cars or boat, New York, without charge for packing or cartage.



Cable Address—"Willrich, Brooklyn"

Codes used:—Western Union, Lieber's Standard and "A. B. C."—fourth edition.

Private code in back: see pages 62 to 65.

ADDITIONS AND CHANGES

Appearing for the First Time in this Catalogue

NEW GOODS

Air Valves
 Connecting Rods
 Eye Bolts, new designs
 Hammock Hooks
 Handles for Car Registers
 Igniter Levers
 Starting Levers
 Thumb Screws, new design
 Toggle Pins
 Wire Rope Sockets
 Wrenches, Check Nut
 Hexagon Cap Screw
 Socket, new design
 Spanners, Face
 Spanners, Hook
 Taper Handle

ADDITIONS

We have increased our established lines by adding sizes to

Ammonia Unions
 Crank Shafts
 Crank Handles
 Eye Bolts
 Hoist Hooks
 Lathe Dogs
 Rod Ends
 Valve Stems
 Wrenches, Double Head Tool Post
 Double Head Engineers'
 " S "
 Single Head Box
 Triple Head

CHANGES AFFECTING PRICES

Crank Shafts, new list prices
 Hoist Hooks, reduced list prices
 Rod Ends, new list prices
 Thumb Nuts, new list price $\frac{3}{4}$ inch.
 Valve Stems, new list prices
 Wrenches, " " " for 274 to 286 inclusive, " S "
 " " " " 20 & 20 $\frac{1}{2}$, Engineers'
 " " " " 56 to 58 inclusive, Engineers'

CHANGE AFFECTING DESCRIPTION

Wrench No. 57 $\frac{1}{2}$ (page 11, Catalogue 1900) is now No. 58 (see page 14): no change in size.

WRENCHES

WE were the first to establish a uniform line of drop-forged Wrenches and to make them with the fifteen degree angle since generally adopted. Others have appropriated the results of our costly experimenting but we do not approve of imitating the patterns or brands of other makers; the goods shown herein are not copies. We offer a larger number of Wrenches than are made by any other manufacturer and the widest range of sizes. Wrenches for every size bolt from $\frac{1}{8}$ inch to 5 inch, inclusive, are in stock.

All Wrenches are, unless otherwise specified, in stock in three conditions, viz.:

UNFINISHED WRENCHES, plain forgings, with openings milled to fit the nut or screw on which they are to be used;

SEMI-FINISHED WRENCHES, milled to fit the nut or screw on which they are to be used and case-hardened **all over**, otherwise plain;

FINISHED WRENCHES, milled to fit the nut or screw on which they are to be used; ground, polished, case-hardened **all over**, lacquered, heads bright, packed in separate envelopes.

Unfinished, plain forgings (not milled) are furnished on demand; these have openings from $\frac{1}{32}$ to $\frac{1}{8}$ inch smaller than the finished sizes.

Engineers' Wrenches, pages 10 to 14, **Taper-handle Wrenches**, page 16, **Check-nut Wrenches**, pages 17 and 61, **Construction Wrenches**, page 23, and **Car Wrenches**, page 35, are in stock milled to fit U. S. and Whitworth Standard finished nuts. **Hexagon Cap-screw Wrenches**, page 15, are in stock milled to fit standard hexagon cap-screws. **Set-screw Wrenches**, pages 18 and 19 and **Box Wrenches**, page 17, are in stock for standard sizes of set-screws. "**S**" **Wrenches**, pages 20 to 22 and **Socket Wrenches**, pages 28 to 34, are in stock for either U. S. or Whitworth Standard finished nuts, set-screws or cap-screws. **Triple-head Wrenches**, page 23, **Machine Wrenches**, page 27 and **Tool-post Wrenches**, page 36, are in stock for either U. S. or Whitworth Standard finished nuts and set-screws respectively.

Wrenches are milled to International Standard, Metric Measure or special sizes without extra charge in lots of 25 or more of a size at a time.

Please use numbers when ordering; an order for " $\frac{1}{2}$ inch and $\frac{5}{8}$ inch wrenches" may mean bolts or openings of these sizes and may be any of several lines; an order for " $\frac{1}{2}$ inch and $\frac{5}{8}$ inch openings" may also mean either of several styles. Numbers alone are sure.

ENGINEERS' WRENCHES

Single Head



These wrenches and those on pages 12 to 14 and 16 are adapted for machine tools, locomotives, pumps, engines and general shop use; they will be milled to Metric Measure, International Standard or to special sizes when required.

A sample nut or screw for use as gauge should accompany orders for specially milled wrenches.

Each opening is at an angle of fifteen degrees with the handle, which admits of turning a hexagon nut completely around where the swing of the handle is limited to thirty degrees.

The unfinished, plain forgings (not milled) have openings from $\frac{1}{2}$ to $\frac{3}{8}$ inch smaller than the finished sizes. See on page 9 the conditions in which they are furnished.

When ordering please use numbers, and state whether Unfinished, Semi-finished or Finished Wrenches are desired.

Prices given for special wrenches upon receipt of models or drawings and on learning quantity required.

The following Semi-finished and Finished Wrenches have hole drilled in end of handle:

Number	17	18	19	19 1/2	20	20 1/2
Diameter Hole, inches . .	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	$\frac{7}{8}$	1	1

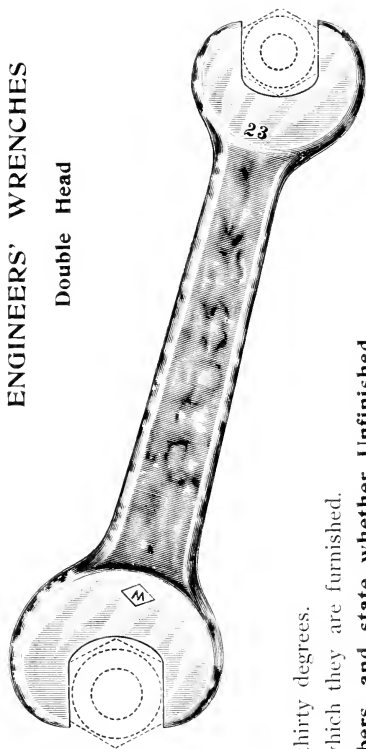
Unfinished Wrenches have Milled Openings

Number	For U. S. Standard Nut; Size Bolt	Opening Finished	Extreme Length	Thickness Head	Price, Unfinished	Price, Semi-finished	Price, Finished	Number
00	1/8	5/16	2 1/2	3/16	\$.08	\$.12	\$.16	00
0	3/16	1/2	2 7/8	7/32	.09	.13	.18	0
1	1/4	3/4	3 3/4	1/4	.10	.15	.20	1
2	5/16	1/2	4 3/4	9/32	.12	.18	.24	2
3	3/8	3/4	5 3/4	5/16	.14	.21	.28	3
4	7/16	1 1/4	6 1/2	11/32	.17	.25	.34	4
5	1/2	1 3/4	7 1/2	3/8	.20	.30	.40	5
6	9/16	2	8 3/4	7/16	.25	.38	.50	6
7	5/8	1 1/2	9 1/4	1/2	.32	.48	.64	7
8	3/4	1 3/4	11 1/8	9/16	.40	.60	.80	8
9	7/8	2	13	5/8	.50	.75	1.00	9
10	1	2 1/4	14 7/8	3/4	.65	.98	1.30	10
11	1 1/8	3	16 3/8	7/8	.85	1.28	1.70	11
12	1 1/4	2	18 1/2	1	1.10	1.65	2.20	12
13	1 3/8	2 3/4	20 1/4	1 1/8	1.40	2.10	2.80	13
14	1 1/2	3 1/4	22 1/4	1 1/4	1.75	2.63	3.50	14
15	1 5/8	4	24	1 1/2	2.10	3.15	4.20	15
16	1 3/4	4 1/4	25 3/8	1 3/4	2.50	3.75	5.00	16
16 ¹	1 7/8	5	26 3/8	1 7/8	2.50	3.75	5.00	16 ¹
16 ²	2	5 1/4	29 1/2	2	3.50	5.25	7.00	16 ²
17	2	6	30 1/2	2 1/8	4.75	7.13	9.50	17
18	2 1/4	6 1/4	33	2 1/4	6.50	9.75	13.00	18
19	2 1/2	7	37	2 1/2	6.50	9.75	13.00	19
19 ¹	2 3/4	8	37	2 3/4	6.50	9.75	13.00	19 ¹
19 ²	3	9	41	3	10.50	15.75	21.00	19 ²
20	3	10	44	3 1/8	10.50	15.75	21.00	20
20 ¹	3 1/2	11	44	3 1/2	10.50	15.75	21.00	20 ¹
20 ²	3 1/2	12	44	3 1/2	10.50	15.75	21.00	20 ²

For Wrenches for nuts on 4, 4 1/2 and 5 inch bolts see Nos. 521 and 521 1/2, page 16.
List prices are changed on numbers 20 and 20 1/2; ignore all previous lists.

ENGINEERS' WRENCHES

Double Head



These will be milled to Metric Measure, International Standard or to special sizes when required. A sample nut or screw for use as gauge should accompany orders for specially milled wrenches. Each opening is at an angle of fifteen degrees with the handle, which admits of turning a hexagon nut completely around where the swing of the handle is limited to thirty degrees.

See on page 9 the conditions in which they are furnished.

When ordering please use numbers, and state whether Unfinished, Semi-finished or Finished Wrenches are desired.

Unfinished Wrenches have Milled Openings

Number	For U. S. Standard Nuts; Size Bolts	Openings Finished	Extreme Length	Thickness Heads	Price, Unfinished	Price, Semi-finished	Price, Finished	Number
21	1/8 & 3/16	5/16 & 13/32	3 1/4	13/64 & 7/32	\$.12	\$.18	\$.24	21
22	1/8 & 1/4	5/16 & 1/2	4	13/64 & 1/4	.14	.21	.28	22
23	3/16 & 1/4	13/32 & 1/2	4	7/32 & 1/4	.15	.23	.30	23

24	3/16 & 5/16	13 & 13 32 & 32	47	7 & 9 32 & 32	\$.17	\$.25	8	.34	24
25	1/4 & 5/16	1 & 1 32 & 32	47	1 & 9 32 & 32	.18	.27		.36	25
26	1/4 & 3/8	1 & 1 32 & 16	57	1 & 5 32 & 16	.20	.30		.40	26
27	5/16 & 3/8	12 & 11 32 & 16	57	32 & 5 32 & 16	.21	.32		.42	27
28	5/16 & 7/16	12 & 32 32 & 32	67	32 & 11 32 & 32	.23	.35		.46	28
29	3/8 & 7/16	11 & 32 16 & 32	67	5 & 11 16 & 32	.25	.38		.50	29
30	3/8 & 1/2	11 & 7 16 & 8	73	5 & 25 16 & 64	.28	.42		.56	30
31	7/16 & 1/2	32 & 7 32 & 8	73	11 & 25 32 & 64	.30	.45		.60	31
32	7/16 & 9/16	32 & 32 32 & 32	83	11 & 7 32 & 16	.34	.51		.68	32
33	1/2 & 9/16	7 & 31 8 & 32	83	25 & 7 64 & 16	.36	.54		.72	33
34	1/2 & 5/8	7 & 16 8 & 16	93	25 & 31 64 & 64	.41	.61		.82	34
35	9/16 & 5/8	31 & 16 32 & 16	93	7 & 31 16 & 64	.43	.65		.86	35
36	9/16 & 3/4	31 & 11 32 & 14	115	7 & 9 16 & 16	.50	.75		1.00	36
37	5/8 & 3/4	11 & 11 16 & 11	115	31 & 9 64 & 16	.53	.80		1.06	37
38	5/8 & 7/8	11 & 17 16 & 16	132	31 & 32 64 & 32	.62	.93		1.24	38
39	3/4 & 7/8	11 & 16 11 & 16	132	9 & 32 16 & 32	.65	.98		1.30	39
40	3/4 & 1	11 & 15 11 & 18	152	9 & 3 16 & 3	.78	1.17		1.56	40
41	7/8 & 1	17 & 15 16 & 18	152	31 & 3 32 & 3	.82	1.23		1.64	41
42	7/8 & 1 1/8	17 & 18 16 & 18	178	31 & 53 32 & 64	1.00	1.50		2.00	42
43	1 & 1 1/8	15 & 18 16 & 18	178	3 & 53 3 & 64	1.08	1.62		2.16	43
44	1 & 1 1/4	15 & 2 16 & 2	193	3 & 32 3 & 32	1.27	1.91		2.54	44
45	1 1/8 & 1 1/4	113 & 2 116 & 2	193	53 & 32 64 & 32	1.35	2.03		2.70	45
46	1 1/8 & 1 3/8	113 & 2 1/2 116 & 2 1/2	214	53 & 63 64 & 64	1.65	2.48		3.30	46
47	1 1/4 & 1 3/8	2 & 2 1/2 2 & 2 1/2	214	32 & 63 32 & 64	1.75	2.63		3.50	47
48	1 1/4 & 1 1/2	2 & 2 1/2 2 & 2 1/2	234	32 & 1 1/2 32 & 1 1/2	2.10	3.15		4.20	48
49	1 3/8 & 1 1/2	2 1/2 & 2 1/2 2 1/2 & 2 1/2	234	63 & 1 1/2 64 & 1 1/2	2.25	3.38		4.50	49

For additional sizes see following page.

ENGINEERS' WRENCHES—Continued

Double Head

Unfinished Wrenches have Milled Openings

Number	For U. S. Standard Nuts; Size Bolts	Openings Finished	Extreme Length	Thickness Head	Price, Unfinished	Price, Semi-finished	Price, Finished	Number
50	1 3/8 & 1 5/8	2 3/16 & 2 9/16	25 1/8	63 & 1 1/8	\$ 2.65	\$ 3.98	\$ 5.30	50
51	1 1/2 & 1 5/8	2 3/8 & 2 9/16	25 1/8	1 1/16 & 1 1/8	2.85	4.28	5.70	51
52	1 1/2 & 1 3/4	2 3/8 & 2 3/4	27 1/8	1 1/16 & 1 7/32	3.30	4.95	6.60	52
53	1 5/8 & 1 3/4	2 9/8 & 2 3/4	27 1/8	1 1/8 & 1 7/32	3.55	5.33	7.10	53
53 1/2	1 5/8 & 1 7/8	2 9/8 & 2 15/16	27 1/8	1 1/8 & 1 7/32	3.55	5.33	7.10	53 1/2
54	1 5/8 & 2	2 9/8 & 3 1/8	30 7/8	1 1/8 & 1 3/8	4.15	6.23	8.30	54
55	1 3/4 & 2	2 3/4 & 3 1/8	30 7/8	1 3/2 & 1 3/8	4.55	6.83	9.10	55
55 1/2	1 7/8 & 2	2 13/16 & 3 1/8	30 7/8	1 7/32 & 1 3/8	4.55	6.83	9.10	55 1/2
56	1 3/4 & 2 1/4	2 3/4 & 3 1/2	34 5/8	1 7/32 & 1 17/32	5.45	8.18	10.90	56
56 1/2	1 7/8 & 2 1/4	2 15/16 & 3 1/2	34 5/8	1 7/32 & 1 17/32	5.45	8.18	10.90	56 1/2
57	2 & 2 1/4	3 1/8 & 3 1/2	34 5/8	1 3/8 & 1 17/32	6.15	9.23	12.30	57
57 1/2	2 & 2 1/2	3 1/8 & 3 7/8	34 5/8	1 3/8 & 1 17/32	6.15	9.23	12.30	57 1/2
58	2 1/4 & 2 1/2	3 1/2 & 3 7/8	34 5/8	1 3/8 & 1 17/32	6.15	9.23	12.30	58
59	2 1/4 & 2 3/4	3 1/2 & 4 1/4	39	1 17/32 & 1 5/8	8.45	12.68	16.90	59
60	2 1/2 & 2 3/4	3 7/8 & 4 1/4	39	1 5/8 & 1 5/8	9.75	14.63	19.50	60
61	2 1/2 & 3	3 7/8 & 4 5/8	46	1 5/8 & 1 7/8	13.25	19.88	26.50	61
62	2 3/4 & 3	4 1/4 & 4 5/8	46	1 5/8 & 1 7/8	13.25	19.88	26.50	62
63	2 3/4 & 3 1/2	4 1/4 & 5 3/8	46	1 5/8 & 1 7/8	13.25	19.88	26.50	63
64	3 & 3 1/2	4 5/8 & 5 3/8	46	1 7/8 & 1 7/8	15.75	23.63	31.50	64

List prices are changed on numbers 56 to 58, inclusive; ignore all previous lists.

HEXAGON CAP-SCREW WRENCHES

These are made from the Wrenches described on pages 11, 12 and 13 by milling the openings to the sizes shown on following table to fit the heads of standard hexagon-head cap-screws. All the sizes shown are kept in stock; see, on page 9, the conditions in which they are furnished. **When ordering, please use numbers and state whether Unfinished, Semi-finished or Finished Wrenches are desired.**

Unfinished Wrenches have Milled Openings

SINGLE HEAD

Number	For Hexagon Head Cap-screws; Diameter of Screws	Openings Finished	Extreme Length	Thickness of Head	Price Unfinished	Price Semi-Finished	Price Finished	Number
700	3/16	3/8	9 ⁷ / ₈	7 ³ / ₈	\$.09	\$.13	\$.18	700
701	1/4	7/16	3 ³ / ₄	1 ¹ / ₄	.10	.15	.20	701
701a	5/16	1/2	3 ³ / ₄	1 ¹ / ₄	.10	.15	.20	701a
702	3/8	9/16	4 ³ / ₄	1 ¹ / ₄	.12	.18	.24	702
703	7/16	5/8	5 ⁵ / ₈	1 ¹ / ₂	.14	.21	.28	703
704	1/2	3/4	6 ¹ / ₂	1 ³ / ₄	.17	.25	.34	704
705	9/16	13/16	7 ¹ / ₂	1 ³ / ₄	.20	.30	.40	705
705a	5/8	7/8	7 ¹ / ₂	1 ³ / ₄	.20	.30	.40	705a
706	3/4	1	8 ³ / ₄	1 ³ / ₄	.25	.38	.50	706
707	7/8	1 1/8	9 ¹ / ₄	1 ³ / ₄	.32	.48	.64	707
708	1	1 1/4	11 ¹ / ₈	1 ³ / ₄	.40	.60	.80	708

DOUBLE HEAD

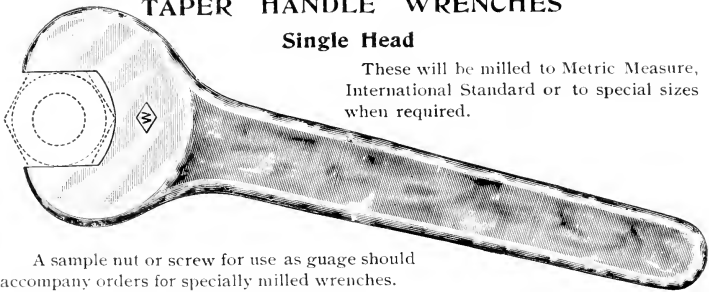
723	3/16 & 1/4	3/8 & 7/16	4	7 ² / ₈ & 1 ¹ / ₄	.15	.23	.30	723
723a	3/16 & 5/16	3/8 & 1/2	4	7 ² / ₈ & 1 ¹ / ₄	.15	.23	.30	723a
724	3/16 & 3/8	3/8 & 9/16	4 ⁷ / ₈	7 ² / ₈ & 1 ¹ / ₄	.17	.25	.34	724
725	1/4 & 5/16	7/16 & 1/2	4 ⁷ / ₈	7 ² / ₈ & 1 ¹ / ₄	.18	.27	.36	725
725a	1/4 & 3/8	7/16 & 9/16	4 ⁷ / ₈	7 ² / ₈ & 1 ¹ / ₄	.18	.27	.36	725a
725b	5/16 & 3/8	1/2 & 9/16	4 ⁷ / ₈	7 ² / ₈ & 1 ¹ / ₄	.18	.27	.36	725b
726	5/16 & 7/16	1/2 & 5/8	5 ⁷ / ₈	7 ² / ₈ & 1 ¹ / ₄	.20	.30	.40	726
727	3/8 & 7/16	9/16 & 5/8	5 ⁷ / ₈	7 ² / ₈ & 1 ¹ / ₄	.21	.32	.42	727
728	3/8 & 1/2	9/16 & 3/4	6 ⁷ / ₈	7 ² / ₈ & 1 ¹ / ₄	.23	.35	.46	728
729	7/16 & 1/2	5/8 & 3/4	6 ⁷ / ₈	7 ² / ₈ & 1 ¹ / ₄	.25	.38	.50	729
730	7/16 & 9/16	5/8 & 13/16	7 ³ / ₄	7 ² / ₈ & 1 ¹ / ₄	.28	.42	.56	730
731	1/2 & 9/16	3/4 & 13/16	7 ³ / ₄	7 ² / ₈ & 1 ¹ / ₄	.30	.45	.60	731
731a	1/2 & 5/8	3/4 & 7/8	7 ³ / ₄	7 ² / ₈ & 1 ¹ / ₄	.30	.45	.60	731a
731b	9/16 & 5/8	13/16 & 7/8	7 ³ / ₄	7 ² / ₈ & 1 ¹ / ₄	.30	.45	.60	731b
732	1/2 & 3/4	3/4 & 1	8 ³ / ₄	7 ² / ₈ & 1 ¹ / ₄	.34	.51	.68	732
732a	9/16 & 3/4	13/16 & 1	8 ³ / ₄	7 ² / ₈ & 1 ¹ / ₄	.34	.51	.68	732a
733	5/8 & 3/4	7/8 & 1	8 ³ / ₄	7 ² / ₈ & 1 ¹ / ₄	.36	.54	.72	733
734	5/8 & 7/8	7/8 & 1 1/8	9 ³ / ₄	7 ² / ₈ & 1 ¹ / ₄	.41	.61	.82	734
735	3/4 & 7/8	1 & 1 1/8	9 ³ / ₄	7 ² / ₈ & 1 ¹ / ₄	.43	.65	.86	735
736	3/4 & 1	1 & 1 1/4	11 ⁵ / ₈	7 ² / ₈ & 1 ¹ / ₄	.50	.75	1.00	736
737	7/8 & 1	1 1/8 & 1 1/4	11 ⁵ / ₈	7 ² / ₈ & 1 ¹ / ₄	.53	.80	1.06	737

Larger or special sizes, either single or double-head, to order.

TAPER HANDLE WRENCHES

Single Head

These will be milled to Metric Measure, International Standard or to special sizes when required.



A sample nut or screw for use as gauge should accompany orders for specially milled wrenches.

Each opening is at an angle of fifteen degrees with the handle, which admits of turning a hexagon nut completely around where the swing of the handle is limited to thirty degrees.

See on page 9 the conditions in which they are furnished.

When ordering please use numbers and state whether Unfinished, Semi-finished or Finished Wrenches are desired.

The following Semi-finished and Finished Wrenches have hole drilled in end of handle:

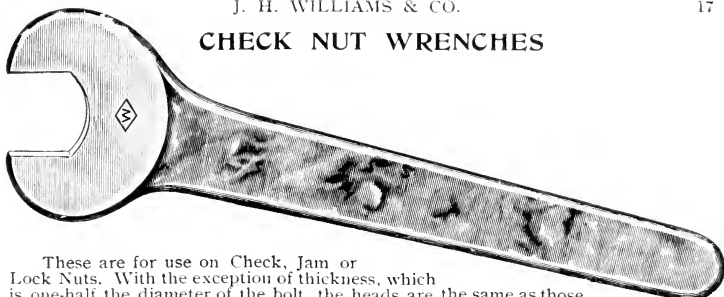
Number,	517	518	519	519½	520	520½	521	521½
Diameter Hole, inches,	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	$\frac{7}{8}$	1	1	1¼	1½

Unfinished Wrenches have Milled Openings.

Number	For U.S. Standard Nut; Size Bolt	Opening Finished	Extreme Length	Thickness Head	Price, Unfinished	Price, Semi-finished	Price, Finished	Number
501	1/4	$\frac{1}{2}$	3¾	1	\$.10	\$.15	\$.20	501
502	5/16	$\frac{19}{32}$	4¾	1	.12	.18	.24	502
503	3/8	$\frac{11}{16}$	5½	1½	.14	.21	.28	503
504	7/16	$\frac{25}{32}$	6½	1½	.17	.25	.34	504
505	1/2	$\frac{7}{8}$	7½	2	.20	.30	.40	505
506	9/16	$\frac{31}{32}$	8¾	2	.25	.38	.50	506
507	5/8	1	9¼	2½	.32	.48	.64	507
508	3/4	1½	11½	3	.40	.60	.80	508
509	7/8	1¾	13	3½	.50	.75	1.00	509
510	1	2	14¾	4	.65	.98	1.30	510
511	1 1/8	2½	16¾	5	.85	1.28	1.70	511
512	1 1/4	3	18½	6	1.10	1.65	2.20	512
513	1 3/8	3½	20½	7	1.40	2.10	2.80	513
514	1 1/2	4	22½	8	1.75	2.63	3.50	514
515	1 5/8	4½	24	9	2.10	3.15	4.20	515
516	1 3/4	5	25¾	10	2.50	3.75	5.00	516
516½	1 7/8	5½	25¾	11	2.50	3.75	5.00	516½
517	2	6	29	12	3.50	5.25	7.00	517
518	2 1/4	6½	33	14	4.75	7.13	9.50	518
519	2 1/2	7	37	16	6.50	9.75	13.00	519
519½	2 3/4	7½	37	17	6.50	9.75	13.00	519½
520	3	8	44	18	10.50	15.75	21.00	520
520½	3 1/2	8½	44	19	10.50	15.75	21.00	520½
521	4	9	59	22	27.50	41.25	55.00	521
521½	4 1/2	9½	59	23	27.50	41.25	55.00	521½

No. 521 milled to order for nuts on 5 inch bolts.

CHECK NUT WRENCHES



These are for use on Check, Jam or Lock Nuts. With the exception of thickness, which is one-half the diameter of the bolt, the heads are the same as those on our Engineers' Wrenches, pages 10, 11 and 16. They will be milled to Metric Measure, International Standard or to special sizes when required. A sample nut or screw for use as gauge should accompany orders for specially milled wrenches.

Each opening is at an angle of fifteen degrees with the handle, which admits of turning a hexagon nut completely around where the swing of the handle is limited to thirty degrees. Other sizes in preparation.

See on page 9 the conditions in which they are furnished.

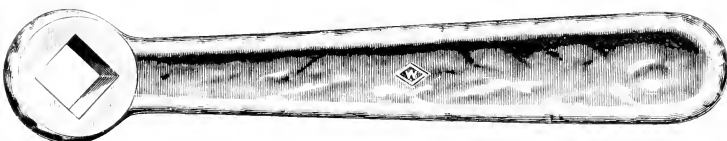
When ordering please use numbers and state whether Unfinished, Semi-finished or Finished Wrenches are desired.

Unfinished Wrenches have Milled Openings

Number	For U. S. Stand'rd Nut; Size Bolt	Opening, Finished	Extreme Length	Thickness Head	Price, Un-finished	Price, Semi-finished	Price, Finished	Number
602	5/16	1 1/16	4 1/2	1 1/4	\$.11	\$.17	\$.22	602
603	3/8	1 1/8	5 1/4	1 3/8	.13	.20	.26	603
604	7/16	1 3/8	5 3/4	1 5/8	.15	.23	.30	604
605	1/2	1 7/8	6 1/2	1 7/8	.18	.27	.36	605
607	5/8	1 11/16	8 1/4	1 11/16	.28	.42	.56	607
608	3/4	1 13/16	10	1 13/16	.36	.54	.72	608
609	7/8	1 7/8	11 1/2	1 7/8	.46	.69	.92	609
610	1	1 15/16	13 1/4	1 15/16	.59	.89	1.18	610

For Double Head Check-Nut Wrench No. 97₂, see page 61.

SINGLE HEAD BOX WRENCHES

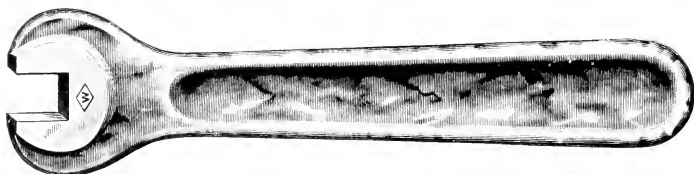


These can be broached to hexagonal openings if desired; sizes and prices on application. See on page 9 the conditions in which they are furnished.

When ordering, please use numbers and state whether Unfinished, Semi-finished or Finished Wrenches are desired.

Number	For Set-Screw; Size	Extreme Length	Thickness Head	Price, Un-finished	Price, Semi-finished	Price, Finished	Number
107	3/16	3	1 1/4	\$.09	\$.12	\$.18	107
108	1/4	3 3/8	1 3/8	.10	.15	.20	108
109	5/16	3 3/4	1 5/8	.11	.17	.22	109
110	3/8	4 1/4	1 7/8	.13	.20	.26	110
111	7/16	4 7/8	1 7/8	.16	.24	.32	111
112	1/2	5 1/2	1 11/16	.19	.28	.38	112
113	9/16	6 1/4	1 13/16	.22	.33	.44	113
114	5/8	7	1 15/16	.26	.39	.52	114
115	3/4	8	1 7/8	.30	.45	.60	115
116	7/8	9	1 11/16	.36	.54	.72	116
117	1	10	1 13/16	.44	.66	.88	117

SINGLE HEAD SET-SCREW WRENCHES



These can be milled one or two sizes larger than stated in table. See on page 9 the conditions in which they are furnished.

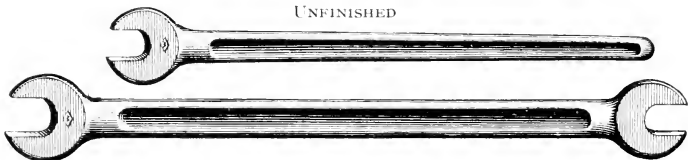
When ordering please use numbers and state whether Unfinished, Semi-finished or Finished Wrenches are desired.

Unfinished Wrenches have Milled Openings

Number	For Set-Screw; Size	Extreme Length	Thickness Head	Price, Un-finished	Price, Semi-finished.	Price, Fin-ished	Number
92	3/16	3	3/16	\$.08	\$.12	\$.16	92
93	1/4	3 5/8	1/4	.10	.15	.20	93
94	5/16	4 1/2	5/16	.12	.18	.24	94
95	3/8	5 3/8	3/8	.15	.23	.30	95
96	7/16	6 1/4	7/16	.20	.30	.40	96
97	1/2	7	1/2	.25	.38	.50	97
98	9/16	7 1/2	9/16	.27	.41	.54	98
99	5/8	8	5/8	.30	.45	.60	99
100	3/4	9 1/2	3/4	.35	.53	.70	100
101	7/8	10 1/2	7/8	.42	.63	.84	101
102	1	11 1/2	1	.50	.75	1.00	102
103	1 1/8	12	1 1/8	.60	.90	1.20	103

STRAIGHT CONCAVE HANDLE WRENCHES

UNFINISHED



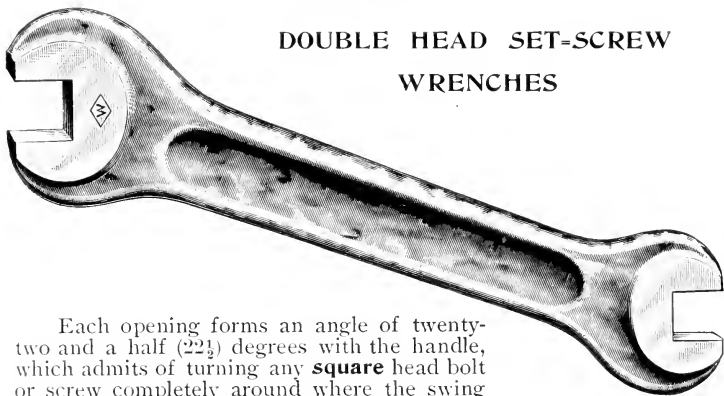
Openings milled to special sizes when required. Semi-finished and Finished to order. See on page 9 explanation of these conditions.

Please use numbers when ordering

Number	Kind	Outside Diameter of Nuts	Openings Un-finished	Extreme Length	Thickness Head	Price, Un-finished	Number
173	Single Head	1 3/16	1 1/4	23	3/4	\$.60	173
174	" "	1 1/4	1 5/8	23	3/4	.60	174
175	" "	1 3/8	1 7/8	23	3/4	.60	175
176	" "	1 1/2	1 9/8	23	3/4	.60	176
182	Double "	1 3/16 & 1 1/4	1 1/4 & 1 5/8	24	3/4	.90	182
184	" "	1 1/4 & 1 3/8	1 5/8 & 1 7/8	24	3/4	.90	184
186	" "	1 1/4 & 1 1/2	1 5/8 & 1 9/8	24	3/4	.90	186
188	" "	1 3/8 & 1 1/2	1 7/8 & 1 9/8	24	3/4	.90	188

Weight of Single Head, 3 3/4 lbs.; of Double Head, 5 lbs.

DOUBLE HEAD SET-SCREW WRENCHES



Each opening forms an angle of twenty-two and a half ($22\frac{1}{2}$) degrees with the handle, which admits of turning any **square** head bolt or screw completely around where the swing of the handle is limited to forty-five degrees.

These Wrench Forgings are made in **ten** sizes, as per **odd** numbers but **twenty** sizes **Unfinished, Semi-finished** and **Finished** wrenches are made (see list), as each forging is milled to two combinations.

These wrenches can be milled one or two sizes larger than stated in table.

When ordering please use numbers and state whether Unfinished, Semi-finished or Finished Wrenches are desired.

See on page 9 the conditions in which they are furnished.

Unfinished Wrenches have Milled Openings

Number	For Set-Screws; Size	Ex-treme Length	Thick-ness Heads	Price, Un-finished	Price, Semi-finished	Price, Fin-ished	Number
65	3/16 & 1/4	3 3/8	3/16 & 1/4	\$.13	\$.20	\$.26	65
66	3/16 & 5/16	3 3/8		.13	.20	.26	66
67	1/4 & 5/16	4	1/4 & 5/16	.15	.23	.30	67
68	1/4 & 3/8	4		.15	.23	.30	68
69	5/16 & 3/8	5	5/16 & 3/8	.18	.27	.36	69
70	5/16 & 7/16	5		.18	.27	.36	70
71	3/8 & 7/16	5 7/8	11/32 & 3/8	.22	.33	.44	71
72	3/8 & 1/2	5 7/8		.22	.33	.44	72
73	7/16 & 1/2	6 5/8	3/8 & 7/16	.27	.41	.54	73
74	7/16 & 9/16	6 5/8		.27	.41	.54	74
75	1/2 & 9/16	7 1/2	7/16 & 1/2	.33	.50	.66	75
76	1/2 & 5/8	7 1/2		.33	.50	.66	76
77	9/16 & 5/8	8 3/8	1/2 & 9/16	.40	.60	.80	77
78	9/16 & 3/4	8 3/8		.40	.60	.80	78
79	5/8 & 3/4	10	9/16 & 5/8	.48	.72	.96	79
80	5/8 & 7/8	10		.48	.72	.96	80
81	3/4 & 7/8	11 3/8	5/8 & 11/16	.58	.87	1.16	81
82	3/4 & 1	11 3/8		.58	.87	1.16	82
83	7/8 & 1	12 5/8	11/16 & 3/4	.68	1.02	1.36	83
84	7/8 & 1 1/8	12 5/8		.68	1.02	1.36	84

S WRENCHES

For Nuts, Set-Screws
and Cap-Screws

These Wrench Forgings are made in nine (9) sizes; viz.: Numbers 235, 240, 246, 251, 255, 263, 274, 281 and 288 but each is milled and finished to several combinations. (See list.) They will be milled to Metric Measure, International Standard or to special sizes when required. A sample nut or screw for use as gauge should accompany orders for specially milled wrenches.

The unfinished, plain forgings (not milled) have openings from $\frac{3}{32}$ to $\frac{1}{8}$ inch smaller than the finished sizes.

See on page 9 the conditions in which they are furnished.

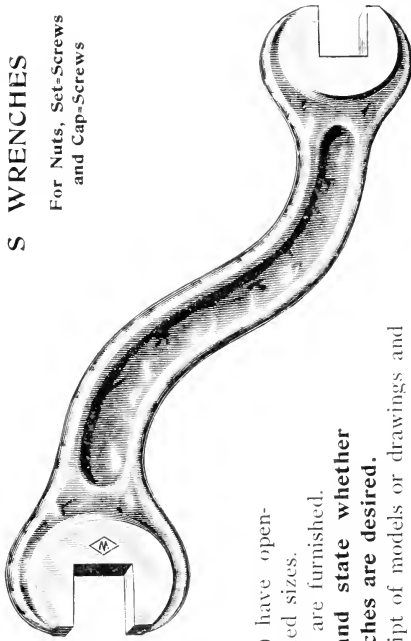
When ordering please use numbers and state whether Unfinished, Semi-finished or Finished Wrenches are desired.

Prices given for special wrenches upon receipt of models or drawings and on learning quantity required.

For other S Wrenches, see page 35.

Unfinished Wrenches have Milled Openings

Number	For U. S. Standard Nuts ; Size Bolts	For Set-Screws ; Sizes	For Square Hd. Cap-Screws ; Diam. Screws	For Hex. Hd. Cap-Screws ; Diam. Screws	Openings Finished	Ex-treme Lgth.	Thick-ness Heads	Price, Unfin-ished	Price, Semi-fin-ished	Price, Fin-ished	Num-ber
235		1/4 & 5/16			1 & 5/8	3 5/8	1 & 3/32	\$.10	\$.15	\$.20	235
236		1/4 & 3/8			1 & 3/4			.10	.15	.20	236
237		1/4 & 7/16			1 & 7/8			.10	.15	.20	237
238		5/16 & 3/8			5/8 & 3/4			.10	.15	.20	238
239	1/8 & 3/16				5/8 & 1/2			.10	.15	.20	239



240	1/8 & 1/4	5/16 & 7/16	3/8 & 7/16	1/4 & 5/16	3/16 & 1/4	5/16 & 7/16	24
241	3/16 & 1/4	3/8 & 9/16	1/4 & 7/16	3/16 & 5/16	3/16 & 5/16	5/16 & 7/16	24
242	3/16 & 5/16	7/16 & 1/2	5/16 & 3/8	1/4 & 5/16	3/16 & 3/8	5/16 & 7/16	24
243	1/4 & 5/16	7/16 & 9/16	5/16 & 7/16	5/16 & 7/16	1/4 & 3/8	5/16 & 7/16	24
244							24
245							24
246							24
247							24
248							24
249							24
250	1/4 & 3/8	1/2 & 9/16	3/8 & 7/16	3/8 & 7/16	5/16 & 3/8	5/16 & 7/16	24
251		1/2 & 5/8	3/8 & 1/2	3/8 & 1/2	5/16 & 7/16	5/16 & 7/16	24
252	5/16 & 3/8						24
253	5/16 & 7/16						24
254							24
255							24
256							24
257		1/2 & 3/4	9/16 & 5/8	7/16 & 1/2	3/8 & 7/16	5/16 & 7/16	24
258				7/16 & 9/16	3/8 & 1/2	5/16 & 7/16	24
259				7/16 & 5/8			24
260				1/2 & 9/16			24
261	3/8 & 7/16						24
262	3/8 & 1/2						24
263		5/8 & 3/4	5/8 & 5/8	1/2 & 5/8	7/16 & 1/2	7/16 & 9/16	24
264							24
265		5/8 & 7/8	5/8 & 3/4	1/2 & 3/4	9/16 & 5/8	9/16 & 3/4	24
266				9/16 & 5/8			24
267				9/16 & 3/4			24
268							24
269		3/4 & 7/8	3/4 & 3/4	5/8 & 3/4	1/2 & 9/16	1/2 & 5/8	24
270	7/16 & 1/2						24
271	7/16 & 9/16						24

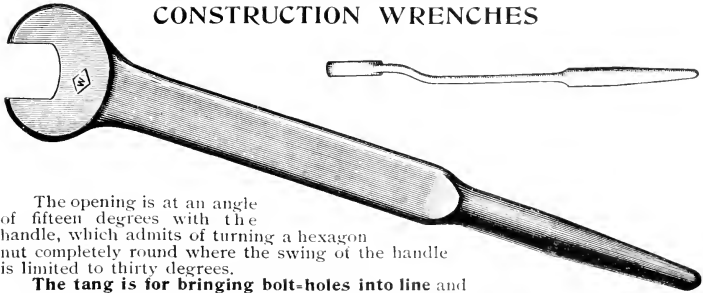
For additional sizes see following page.

S WRENCHES—Continued
Please use numbers when ordering
Unfinished Wrenches have Filled Openings

Number	For U. S. Standard Nuts; Size Bolts	For Set Screws; Sizes	For Square Hd. Cap. Screws; Diam. Screws	For Hex. Hd. Cap. Screws; Diam. Screws	Openings Finished	Extreme Length	Thickness Heads	Price, Unfinished	Price, Semi-finished	Price, Finished	Number
272	1/2 & 9/16				7/8 & 3/4			.30	.45	.60	272
273	1/2 & 5/8				7/8 & 1 1/16			.30	.45	.60	273
274		3/4 & 1		1/2 & 3/4	3/8 & 1/2	10	17 & 9/32	.38	.57	.76	274
275				9/16 & 5/8	1/2 & 7/8			.38	.57	.76	275
276				9/16 & 3/4	1/2 & 1			.38	.57	.76	276
277		7/8 & 1		5/8 & 3/4	7/8 & 1			.38	.57	.76	277
278	9/16 & 5/8				3/4 & 1 1/16			.38	.57	.76	278
279	9/16 & 3/4				3/4 & 1 1/16			.38	.57	.76	279
280	5/8 & 3/4				1 1/16 & 1 1/8			.38	.57	.76	280
281		7/8 & 1 1/8		5/8 & 7/8	7/8 & 1 1/8	11 1/2	5 & 1/8	.49	.74	.98	281
282		1 & 1 1/8		3/4 & 7/8	1 & 1 1/8			.49	.74	.98	282
283		1 & 1 1/4		3/4 & 1	1 & 1 1/4			.49	.74	.98	283
284		1 1/8 & 1 1/4		7/8 & 1	1 1/8 & 1 1/4			.49	.74	.98	284
285	5/8 & 7/8				1 1/8 & 1 1/2			.49	.74	.98	285
286	3/4 & 7/8				1 1/8 & 1 1/2			.49	.74	.98	286
288					1 1/8 & 1 1/2			.65	.98	1.30	288
289			7/8 & 1 1/8	7/8 & 1 1/8	1 1/8 & 1 1/2	14 1/2	3 & 7/8	.65	.98	1.30	289
290			7/8 & 1 1/4	7/8 & 1 1/4	1 1/8 & 1 1/2			.65	.98	1.30	290
291			1 & 1 1/8	1 & 1 1/8	1 1/8 & 1 1/4			.65	.98	1.30	291
292			1 & 1 1/4	1 & 1 1/4	1 1/8 & 1 1/2			.65	.98	1.30	292
293	3/4 & 1		1 1/8 & 1 1/4	1 1/8 & 1 1/4	1 1/8 & 1 1/2			.65	.98	1.30	293
294	7/8 & 1				1 1/8 & 1 1/4			.65	.98	1.30	294
295	7/8 & 1 1/8				1 1/8 & 1 1/4			.65	.98	1.30	295

List prices are changed on numbers 274 to 286, inclusive; ignore all previous lists

CONSTRUCTION WRENCHES



The opening is at an angle of fifteen degrees with the handle, which admits of turning a hexagon nut completely round where the swing of the handle is limited to thirty degrees.

The tang is for bringing bolt-holes into line and for insertion into convenient openings when wrench is not in use, preventing loss and keeping tool in sight. Handles will be offset, (see small cut) if desired, at an additional charge.

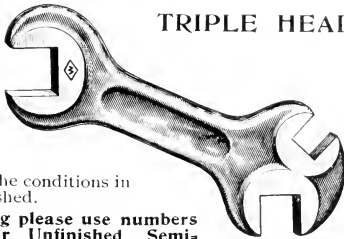
See on page 9 the conditions in which they are furnished.

Milled to special sizes when required.

When ordering please use numbers and state whether Unfinished, Semi-finished or Finished Wrenches are desired

Unfinished Wrenches have Milled Openings

Number	For U. S. Standard Nut; Size Bolt	Opening Finished	Ex-treme Length	Thick-ness Head	Price, Un-finished	Price, Semi-finished	Price, Fin-ished	Num-ber
223	3/8	1 1/16	9	1 1/32	\$.20	\$.30	\$.40	223
225	1/2	7/8	11 1/2	7/16	.32	.48	.64	225
226	9/16	3 1/32	12 1/2	1/2	.40	.60	.80	226
227	5/8	1 1/8	14	9/16	.50	.75	1.00	227
228	3/4	1 1/4	16	5/8	.65	.97	1.30	228
229	7/8	1 7/16	17 1/2	1 1/16	.85	1.28	1.70	229
230	1	1 5/8	19	3/4	1.10	1.65	2.20	230



TRIPLE HEAD WRENCHES

See on page 9 the conditions in which they are furnished.

When ordering please use numbers and state whether Unfinished, Semi-finished or Finished Wrenches are desired.

Unfinished Wrenches have Milled Openings

Number	For U. S. Standard Nuts; Size Bolts	For Set-Screws; Sizes	Ex-treme Length	Thick-ness Heads	Price, Un-finished	Price, Semi-finished	Price, Fin-ished
464A	5/16, 3/8, 1/2		5 1/2	3/8	\$.28	\$.42	\$.56
B	5/16, 7/16, 1/2				.28	.42	.56
C	3/8, 7/16, 1/2				.28	.42	.56
D		1/2, 5/8, 3/4			.28	.42	.56
E		9/16, 5/8, 3/4			.28	.42	.56
465A	7/16, 9/16, 1 1/8		6 1/2	7/8	.45	.68	.90

PIN SPANNERS

UNFINISHED



Please use numbers when ordering

Number	For Circle; Size	Extreme Length	Pin will finish : Size	Price	Number
204	1	4	$\frac{3}{16}$	\$.18	204
205	1 1/4	$4\frac{1}{2}$	$\frac{13}{64}$	.19	205
206	1 1/2	5	$\frac{7}{32}$	.20	206
207	1 3/4	$5\frac{1}{2}$	$\frac{15}{64}$	.21	207
208	2	6	$\frac{1}{4}$	.22	208
209	2 1/4	$6\frac{1}{2}$	$\frac{17}{64}$	.23	209
210	2 1/2	7	$\frac{9}{32}$	.24	210
211	2 3/4	$7\frac{1}{2}$	$\frac{19}{64}$	.26	211
212	3	8	$\frac{5}{16}$	.28	212
213	3 1/4	$8\frac{1}{2}$	$\frac{21}{64}$	.30	213
214	3 1/2	9	$\frac{11}{32}$	.32	214
215	3 3/4	$9\frac{1}{2}$	$\frac{23}{64}$	.34	215
216	4	10	$\frac{3}{8}$	.36	216
218	5	12	$\frac{7}{16}$	.48	218
220	6	14	$\frac{1}{2}$	.65	220

LIGHT HOOK SPANNERS

UNFINISHED



Please use numbers when ordering

Number	For Circle; Size	Extreme length	Price, Each	Number
310	1 3/4	7 1/2	\$.14	310
311	2 1/8	8	.15	311
312	2 1/2	8 1/4	.16	312
313	2 3/4	8 1/2	.18	313
314	3	8 3/4	.20	314
315	3 1/2	9	.22	315

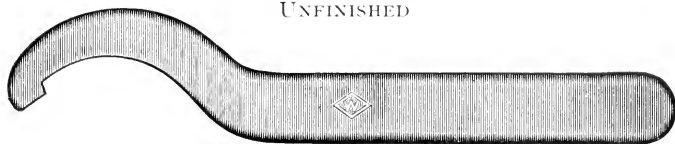
Width of hook, $\frac{3}{16}$ in. Hook projects $\frac{1}{8}$ in.

Diameter of handle, all sizes, $\frac{3}{8}$ in. Width, face of curve, $\frac{3}{8}$ in.

Length of handle can be varied, if desired.

HOOK SPANNERS

UNFINISHED

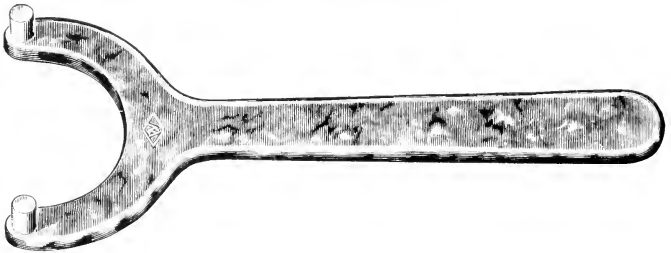


The diameter of circle which the unfinished forgings fit is given in second column of table but wrenches will finish to sizes stated in third column.

Please use numbers when ordering

Number	For Circle; Size	Forgings will finish for Circles; Size	Extreme length	Thick- ness	Price, Each	Number
403	1 1/4	1 to 1 1/4	4 3/4	7/32	\$.20	403
404	1 1/2	1 3/8 to 1 5/8	6	1/4	.23	404
405	2	1 3/4 to 2	7 1/8	1/4	.26	405
406	2 1/4	2 1/8 to 2 3/8	8 7/16	1/4	.30	406
407	2 5/8	2 1/2 to 2 3/4	9 3/4	1/4	.34	407
408	3 1/8	2 7/8 to 3 1/8	10 7/8	5/16	.40	408
409	3 3/4	3 3/8 to 3 7/8	12	5/16	.48	409
410	4 3/8	4 to 4 1/2	13	5/16	.58	410

FACE SPANNERS



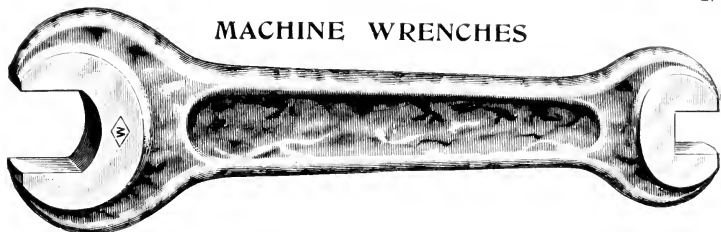
The Pins on these Spanners are forged integral with the Wrench, thus making the tools stronger and more durable than those of the ordinary type with inserted pins. They are regularly furnished with Pins milled to sizes given below, but will be supplied with Pins unfinished (not milled) if desired. Pins will be milled to special sizes at an extra charge. See on page 9 the conditions in which they are furnished.

When ordering please use numbers and state whether Unfinished (Pins Milled), Semi-finished or Finished are desired.

Number	Pins.			Span of jaws in Clear	L'gth from C. of Pins	Thick-ness	Price, Unfin-ished, (Pins Milled)	Price, Semi-fin-ished	Price, Fin-ished	Num-ber
	Dis-tance C to C	Fin-ished Diam.	Length							
418	1	3/16	3/16	1 1/2	4 1/2	3/16	\$.15	\$.22	\$.33	418
420	1 1/4	7/32	7/32	1 5/8	5	3/16	.17	.24	.36	420
422	1 1/2	7/32	7/32	1 7/8	5 1/2	3/16	.19	.27	.39	422
424	1 3/4	7/32	7/32	1 7/8	6	7/32	.22	.30	.43	424
426	2	1/4	1/4	1 5/8	6 1/2	7/32	.25	.34	.47	426
428	2 1/4	1/4	1/4	1 7/8	7	7/32	.29	.38	.52	428
430	2 1/2	9/32	9/32	2 3/32	7 1/2	1/4	.33	.43	.57	430
432	2 3/4	9/32	9/32	2 11/32	8	1/4	.38	.48	.63	432
434	3	5/16	5/16	2 19/32	8 1/2	1/4	.43	.54	.70	434
436	3 1/4	5/16	5/16	2 13/32	9 1/8	1/4	.49	.60	.77	436
438	3 1/2	5/16	5/16	2 1/8	9 3/8	1/4	.55	.67	.85	438
440	3 3/4	5/16	5/16	3 1/32	10 3/8	1/4	.62	.75	.94	440
442	4	3/8	3/8	3 7/16	11	1/4	.70	.85	1.05	442

Larger sizes in preparation.

MACHINE WRENCHES



These are unusually heavy, being designed for use on Planers, Milling Machines, Lathes, Drill Presses, etc.

The Unfinished are sold in four (4) sizes; viz.: Numbers 395, 396, 397 and 398 but each can be milled to several combinations; see list.

Table gives sizes of openings for U. S. Standard Nuts and Set-screws only but each wrench admits of milling to several combinations of Hexagon and Square Head Cap-screws.

See on page 9 the conditions in which they are furnished.

Please use numbers when ordering, and state whether Unfinished, Semi-finished or Finished Wrenches are desired. Unfinished Wrenches have Milled Openings.

Number	Large Head for U. S. Standard Nuts; Size Bolt	Small Head for Set-screws; Size	Extreme Length	Price, Unfinished	Price, Semi-finished	Price, Finished	Number
395 A	3/8	3/8	6½	\$.20	\$.30	\$.40	395
B	3/8	7/16		.20	.30	.40	
C	3/8	1/2		.20	.30	.40	
D	7/16	3/8		.20	.30	.40	
E	7/16	7/16		.20	.30	.40	
F	7/16	1/2		.20	.30	.40	
396 A	1/2	7/16	7½	.25	.38	.50	396
B	1/2	1/2		.25	.38	.50	
C	1/2	9/16		.25	.38	.50	
D	1/2	5/8		.25	.38	.50	
E	9/16	7/16		.25	.38	.50	
F	9/16	1/2		.25	.38	.50	
G	9/16	9/16		.25	.38	.50	
H	9/16	5/8		.25	.38	.50	
397 A	5/8	9/16	8½	.30	.45	.60	397
B	5/8	5/8		.30	.45	.60	
C	5/8	3/4		.30	.45	.60	
398 A	3/4	3/4	10	.40	.60	.80	398
B	3/4	7/8		.40	.60	.80	
C	3/4	1		.40	.60	.80	
D	7/8	3/4		.40	.60	.80	
E	7/8	7/8		.40	.60	.80	
F	7/8	1		.40	.60	.80	

SINGLE HEAD SOCKET WRENCHES

With or Without Handle



These are adapted for Nuts, Set-Screws and Cap-Screws. They are designed for use either with another wrench which may be adjusted to the hexagon end of shank as a handle or with a Pin-handle (see table) which will be fitted to hexagon end of wrench at extra cost (see list).

The Openings are broached to U. S. Standard dimensions; Metric Measure, Whitworth or International Standard and special sizes furnished to order. In stock Unfinished only but with **openings broached**. Semi-finished and Finished to order when required.

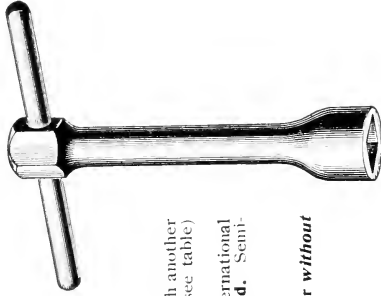
The Handles are made of stiff, cold-rolled steel with ends nicely rounded.

When ordering please use numbers and state whether Wrenches are desired with or without handles; if not specified, they will be sent without.

See on page 9 the conditions in which they are furnished.

Special sizes and designs to order.

For other Single Head Socket Wrenches see page 61.



SQUARE OPENINGS

HEXAGON OPENINGS

Number	HEXAGON OPENINGS			SQUARE OPENINGS			Extreme Length	Diameter of Head	Diameter of Shank	Hex End; same size as U. S. Nut; for Size Bolt	Size of Pin-Handle		Price with Opening Broached		
	For U. S. Standard Nuts; Size Bolts	For Cap-Screws; Diam. Screws	Short Diam. Finished Openings	For U. S. Standard Nuts; Size Bolts	For Cap-Screws; Diam. Screws	For Set-Screws; Size					Short Diam. Finished Openings	Diameter	Length	Without Pin-Handle or Hole for same	With Pin-Handle and Hole for same
321 A	1/8		21 61			1 4	1	2	1 6	3 1 6	3 1 6	1 20	1 20	\$ 20	\$ 20
B															

322	A	3/16	3/16	3/16	25 64					45	11 16	3 8	1 4	1 4	45	23 31	31
	B	3/16	1/4	1/4	27 64										23	31	31
	C				29 64										23	31	31
	D				61										23	31	31
323	A	1/4	5/16	1/4	33 64		5/16			53	3	7 16	5 16	5 16	52	26	36
	B				64		3/8			16	1	1	5 16	5 16	26	36	36
324	A	5/16	3/8	1/4	37 64					53	7 8	1	3 8	3 8	31	41	41
	B				64										31	41	41
	C				61		5/16			63	1 16	9 16	3 8	3 8	31	41	41
325	A	7/16	1/2	1/4	41 64					63	1 16	9 16	3 8	3 8	36	48	48
	B				64		3/8								36	48	48
	C				45 64		7/16			71	1 32	5 8	1 16	7 16	36	48	48
	D				61		1/2								36	48	48
326	A	7/16	9/16	1/4	51 64					71	1 32	5 8	1 16	7 16	43	57	57
	B				64		5/16								43	57	57
	C				64		3/8								43	57	57
	D				64		5/16								43	57	57
327	A	9/16	3/4	5/8	63 64					75	11 16	11 16	1 2	1 2	52	68	68
	B				64		3/4								52	68	68
	C				161		7/16								52	68	68
328	A	5/8	7/8	1/2	15 64					81	13 32	3 8	1 2	1 2	64	80	80
	B				64		3/4								64	80	80
	C				132		1/2								64	80	80
329	A	3/4	1	9/16	19 64					87	17 32	7 8	3 8	5 8	78	100	100
	B				64		5/8								78	100	100
	C				161		1								78	100	100
	D				164		5/8								78	100	100

For additional sizes see following page.

SINGLE HEAD SOCKET WRENCHES—Continued

When ordering please use numbers and state whether Wrenches are desired *with* or *without* handles; if not specified they will be sent *without*.

Number	HEXAGON OPENINGS				SQUARE OPENINGS				Extreme Length	Diameter of Head	Diameter of Shank	Hex. End; same size as U. S. Nut; for Size Profit	Size of Pin-Handle		Price with Opening Broached	
	For U. S. Stand'rd Nuts; Size Bolts	For Cap-Screws; Diam. Screws	Short Diam. Finished Openings		For U. S. Stand'rd Nuts; Size Bolts	For Cap-Screws; Diam. Screws	For Set-Screws; Size	Short Diam. Finished Openings					Diameter	Length	Without Pin-Handle or Hole for same	With Pin-Handle and Hole for same
330 A		1 1/8	1 3/8						9 1/4	2 3/16	1	7 8	1 1/16	10	\$ 1.27	\$1.27
B	7/8		1 1/2												.98	1.27
C		1 1/4	1 3/2												.98	1.27
D			1 3/2												.98	1.27
E			1 3/2												.98	1.27
331 A	1		1 1/2		3/4	7/8	1 1/8	1 3/2	10 5/8	2 1/2	1 1/8	1	3 1	11	1.28	1.64
B	1 1/8		1 3/2					1 1/2							1.28	1.64
C		1 1/4	1 3/2		7 8	1 1/8		1 3/2							1.28	1.64
D			1 3/2					1 3/2							1.28	1.64
332 A	1 1/4		2 1/2					1 1/2	11 1/2	2 1/8	1 1/4	1 1/4	7 8	12	1.96	2.46
B		1 1/4	2 1/2					1 1/2							1.96	2.46
C		1 3/8	2 1/2		1	1 1/4	1 3/8	1 3/2							1.96	2.46
333 A	1 1/2		2 3/2					1 3/2	12 1/2	3 3/8	1 3/8	1 1/2	1	13	2.80	3.44
B		1 1/2	2 3/2					1 3/2							2.80	3.44
C			2 3/2		1 1/8			1 3/2							2.80	3.44
D			2 3/2		1 1/4			1 3/2							2.80	3.44

For other Single Head Socket Wrenches see page 61.

DOUBLE HEAD SOCKET WRENCHES

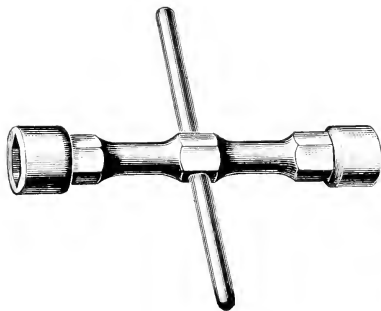
With or Without Handle



These are designed for use either with another wrench which may be adjusted to the hexagon parts of shank as a handle or with a Pin-handle (see table), which will be fitted to central or end hexagon at extra cost (see list).

If desired, holes for Pin-handles will be drilled in the other hexagons at an additional charge. Only openings of same shape are combined in list but one end can be broached hexagon and the other square if desired. Openings are broached to U. S. Standard dimensions; Metric Measure, Whitworth or International Standard and special sizes furnished to order. In stock **Unfinished** only but with openings broached. Semi-finished and Finished to order when required.

The Handles are made of stiff, cold-rolled steel with ends nicely rounded.
When ordering, please use numbers and state whether wrenches are desired with or without handles. If not specified, they will be sent without.
 See on page 9 the conditions in which they are furnished.
 Special sizes and designs to order.



Number	HEXAGON OPENINGS			SQUARE OPENINGS			Extreme Length	Diam. of Head.	Diam. of Shank	Hex. Parts of Shank; same size as U. S. Nut;	Size of Pin-Diam.	Length of HANDLE.	Price Without Pin-Handle or Hole	Price With Pin-Handle and Hole
	For U. S. Standard Nuts; Size Bolts	For Cap-Screws; Diam. Screws	Short Diam. Finished Openings	For U. S. Standard Nuts; Size Bolts	For Cap-Screws; Diam. Screws	For Set-Screws; Sizes									Short Diam. Finished Openings
340A	1 8 & 3 16		31 & 35				47	16 & 18	3	4	1 12	\$32	\$40	
B			31 & 35											
342A	1 8 & 1 4		31 & 35			1 4 & 5 16	61	1 8 & 1	3	5	1 5 16	\$32	\$41	

For additional sizes see following page.

DOUBLE HEAD SOCKET WRENCHES—Continued

When ordering please use numbers and state whether wrenches are desired *with* or *without* handles. If not specified they will be sent *without*

Number	HEXAGON OPENINGS				SQUARE OPENINGS				Extreme Length.	Diam. of Head	Diam. of Shank	Hex. Parts of Shank; same size as U. S. Nut;	Size of Pin-Handle	Without Pin-Handle or Hole	With Pin-Handle and Hole	OPENINGS BROACHED
	For U. S. Standard Nuts; Size Bolts	For Cap-Screws; Diam. Screws	Short Diam. Finished Openings	For U. S. Standard Nuts; Size Bolts	For Cap-Screws; Diam. Screws	For Set-Screws; Sizes	Short Diam. Finished Openings	Diam.									Length
342B	3/16 & 1/4	3/16 & 1/4	27 28 29													34
C		3/16 & 5/16	30 31 32													34
D		1/4 & 5/16	33 34 35													34
E			36 37 38													34
F		1/4 & 3/8	39 40 41													34
G		5/16 & 3/8	42 43 44													34
H	3/16 & 5/16		45 46 47													34
I	1/4 & 5/16		48 49 50													34
J			51 52 53													34
K			54 55 56													34
L			57 58 59													34
M	1/4 & 3/8		60 61 62													34
344A	5/16 & 3/8		63 64 65													34
B	5/16 & 7/16		66 67 68													34
C		5/16 & 7/16	69 70 71													34
D			72 73 74													34
E			75 76 77													34
F			78 79 80													34
G			81 82 83													34
H			84 85 86													34
I	3/8 & 7/16		87 88 89													34
J	3/8 & 1/2		90 91 92													34
K			93 94 95													34
L			96 97 98													34
M			99 100 101													34

344N	1 2 9 10	1 4 5 10	3 8 7 16	1 2 9 10	9 1	1 2 9 10	1 11	78
P	1 2 5 8	1 4 3 8	3 8 1 2	1 2 5 8			64	78
Q			3 8 9 16				64	78
R			7 16 1 2				64	78
S			7 16 9 16	9 16 5 8			64	78
T							64	78
U							64	78
346A	7 16 1 2	5 16 3 8	3 8 7 16	1 2 9 10	9 1	1 2 9 10	95	1 11
B	7 16 9 16	5 16 7 16	3 8 1 2	1 2 5 8			95	1 11
C	1 2 9 16	3 8 7 16	7 16 5 8	1 2 5 8			95	1 11
D			1 2 5 8	9 16 3 4			95	1 11
E	9 16 5 8		7 16 5 8				95	1 11
F	9 16 3 4		1 2 5 8				95	1 11
G	5 8 3 4		9 16 5 8				95	1 11
H							95	1 11
I							95	1 11
J							95	1 11
K							95	1 11
L	1 2 5 8		7 16 5 8	9 16 3 4			95	1 11
M	9 16 5 8		1 2 5 8	5 8 3 4			95	1 11
N			9 16 3 4				95	1 11
O	5 8 7 8						95	1 11
P	3 4 7 8						95	1 11
Q							95	1 11
R							95	1 11
S							95	1 11
T							95	1 11
U							95	1 11
348A	9 16 3 4	3 8 1 2	1 2 3 4	5 8 7 8	11	1 2 3 4	1 60	1 89
B	5 8 3 4	7 16 1 2	9 16 3 4	3 4 7 8			1 60	1 89
C			5 8 3 4				1 60	1 89
D							1 60	1 89
E							1 60	1 89
F							1 60	1 89
G							1 60	1 89
H							1 60	1 89
I							1 60	1 89
J							1 60	1 89
K							1 60	1 89
L							1 60	1 89
M							1 60	1 89
N							1 60	1 89
O							1 60	1 89

For additional sizes see following page

DOUBLE HEAD SOCKET WRENCHES—Continued

When ordering please use numbers and state whether wrenches are desired *with* or *without* handles. If not specified they will be sent *without*

J. H. WILLIAMS & CO.

Number	HEXAGON OPENINGS			SQUARE OPENINGS			Extreme Length	Diam. of Head	Diam. of Shank	Hex. Parts of Shank: same Size as U. S. Nut	Plate Size or Pin	Length	Without Pin-Handle or Price	With Pin-Handle and Hole	(OPENINGS)	
	For U. S. Standard Nuts; Size Bolts	For Cap-Screws; Diam. Screws	Short Diam. Finished Openings	For U. S. Standard Nuts; Size Bolts	For Cap-Screws; Diam. Screws	For Set-Screws; Sizes										Short Diam. Finished Openings
348P																
O																
R																
S																
T																
U																
350A	3 4 & 1												1 60	1 60	1 60	1 60
B	7 8 & 1												1 60	1 60	1 60	1 60
C													1 60	1 60	1 60	1 60
D													1 60	1 60	1 60	1 60
E													1 60	1 60	1 60	1 60
F													1 60	1 60	1 60	1 60
G													1 60	1 60	1 60	1 60
H													1 60	1 60	1 60	1 60
I													1 60	1 60	1 60	1 60
J													1 60	1 60	1 60	1 60
K	7/8 & 1 1/8												1 60	1 60	1 60	1 60
L	1 1/8 & 1 3/8												1 60	1 60	1 60	1 60
M	1 3/8 & 1 1/2												1 60	1 60	1 60	1 60
N	1 1/2 & 1 3/4												1 60	1 60	1 60	1 60
O	1 3/4 & 2												1 60	1 60	1 60	1 60
P													1 60	1 60	1 60	1 60
Q													1 60	1 60	1 60	1 60
R													1 60	1 60	1 60	1 60
S													1 60	1 60	1 60	1 60

TRACK WRENCHES



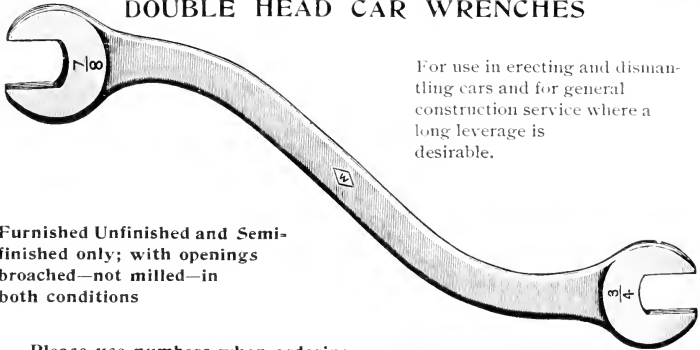
These are forged with round handles from stiff, strong steel that will not bend in use and are made any length down to 24 inches over all.

Furnished Unfinished and Semi-finished only; with openings broached—not milled—in both conditions

Please use numbers when ordering

Number	Outside Diameter of Nuts	Openings	Extreme Length	Thickness Head	Weight, Each	Price, Un-finished	Price, Semi-finished	Number
194	1 1/4	1 5/16	30	25/32	5 lbs. 5 oz.	\$.60	\$.90	194
195	1 3/8	1 7/16	30	13/16	5 lbs. 7 oz.	.60	.90	195
196	1 1/2	1 9/16	30	13/16	5 lbs. 9 oz.	.60	.90	196

DOUBLE HEAD CAR WRENCHES



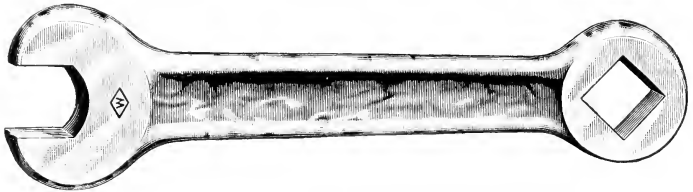
For use in erecting and dismantling cars and for general construction service where a long leverage is desirable.

Furnished Unfinished and Semi-finished only; with openings broached—not milled—in both conditions

Please use numbers when ordering

Number	For U. S. Standard Nuts; Size Bolts	Openings	Extreme Length	Thickness Heads	Price, Un-finished	Price, Semi-finished	Number
370	1/2 & 5/8	15/16 & 11/8	19	1/2	\$.85	\$1.28	370
371	1/2 & 3/4	15/16 & 1 1/16	19	1/2	.85	1.28	371
372	1/2 & 7/8	15/16 & 1 1/8	20	1/2	.92	1.38	372
373	5/8 & 3/4	1 1/8 & 1 1/16	20	1/2	.92	1.38	373
374	5/8 & 7/8	1 1/8 & 1 1/2	21	1/2	1.00	1.50	374
375	5/8 & 1	1 1/8 & 1 1/16	21	1/2	1.00	1.50	375
376	3/4 & 7/8	1 5/16 & 1 1/2	21	1/2	1.00	1.50	376
377	3/4 & 1	1 5/16 & 1 1/16	22	1/2	1.10	1.65	377
378	3/4 & 1 1/8	1 5/16 & 1 7/8	22	1/2	1.10	1.65	378
379	7/8 & 1	1 1/2 & 1 1/16	22	1/2	1.10	1.65	379
380	7/8 & 1 1/8	1 1/2 & 1 7/8	23	1/2	1.25	1.88	380
382	1 & 1 1/8	1 1/16 & 1 7/8	23	1/2	1.25	1.88	382

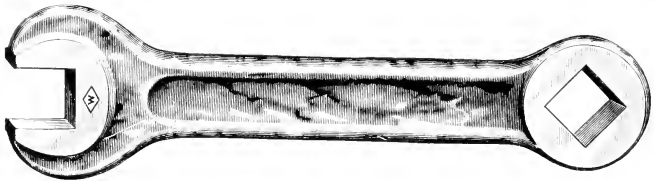
For other "S" Wrenches see pages 20 to 22.

DOUBLE HEAD TOOL POST WRENCHES

These can be milled a size larger than stated in table.
See on page 9 the conditions in which they are furnished.

Please use numbers when ordering.
Unfinished Wrenches have openings milled and holes broached.

Number	Open End for U. S. Standard Nuts; Size Bolt	Closed End for Set-Screws; Size	Extreme Length	Price, Unfinished	Price, Semi-finished	Price, Finished	Number
124	3/8	9/16	6½	\$.30	\$.45	\$.60	124
129	1/2	7/16	7	.35	.52	.70	129
131	1/2	9/16	7	.35	.52	.70	131
132	1/2	5/8	7	.35	.52	.70	132
139	5/8	5/8	7½	.40	.60	.80	139
140	5/8	3/4	8	.45	.68	.90	140
143	3/4	3/4	9	.55	.82	1.10	143



These can be milled a size larger than stated in table. The forgings for Nos. 154 and 158 are furnished in four other milled or finished combinations (Nos. 156, 157, 160 and 161) as stated in table.

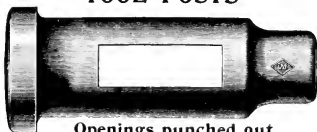
See on page 9 the conditions in which they are furnished.

Please use numbers when ordering.
Unfinished Wrenches have openings milled and holes broached.

Number	Open End for Set-Screws; Size	Closed End for Set-Screws; Size	Extreme Length	Price, Unfinished	Price, Semi-finished	Price, Finished	Number
152	7/16	7/16	5½	\$.25	\$.37	\$.50	152
154	1/2	1/2	6	.27	.40	.54	154
156	9/16	1/2		.27	.40	.54	156
157	9/16	9/16		.27	.40	.54	157
158	5/8	5/8	6¾	.32	.48	.64	158
160	11/16	5/8		.32	.48	.64	160
161	11/16	11/16		.32	.48	.64	161
162	3/4	3/4	7½	.40	.60	.80	162

TOOL POST FITTINGS—Unfinished

TOOL POSTS



Openings punched out

Number	0	2	3	4	5	7
Extreme Length	4 ¹ / ₁₆	4 ⁹ / ₁₆	5 ¹ / ₁₆	6 ⁵ / ₁₆	7 ³ / ₁₆	8 ³ / ₁₆
Diameter of Body	1 ¹ / ₁₆	1 ⁵ / ₈	1 ¹³ / ₁₆	2 ¹ / ₁₆	2 ⁴ / ₁₆	2 ³ / ₁₆
Length of Body	2 ⁷ / ₈	3 ¹ / ₄	3 ³ / ₄	4 ³ / ₈	5	6
Diameter of Base	1 ⁵ / ₈	2 ¹ / ₈	2 ⁵ / ₈	2 ⁵ / ₈	2 ¹⁵ / ₁₆	3 ¹ / ₁₆
Thickness of Base	1 ¹ / ₁₆	1 ⁷ / ₁₆	2 ² / ₁₆	2 ⁹ / ₁₆	3 ⁵ / ₁₆	3 ³ / ₁₆
Distance Base to Opening	1 ² / ₁₆	1 ¹³ / ₁₆	1 ¹⁵ / ₁₆	1 ¹³ / ₁₆	1 ¹³ / ₁₆	1 ¹² / ₁₆
Size of Opening	1 ¹⁵ / ₁₆ x 1 ¹⁹ / ₃₂	1 ⁷ / ₈ x 1 ¹¹ / ₁₆	2 ¹ / ₈ x 3 ³ / ₁₆	2 ¹ / ₂ x 7 ⁷ / ₈	3 x 1 ¹⁵ / ₁₆	3 ⁹ / ₁₆ x 1
Price, each	\$.30	.45	.60	.80	1.00	2.00

TOOL POST WEDGES



For Changing Angles of Lathe Tools

Number	0	1	1 1/2	2	3	4	6
Length	3	3 ³ / ₈	3 ³ / ₈	3 ⁷ / ₈	4 ³ / ₈	4 ⁷ / ₈	5 ¹ / ₄
Width	9 ⁹ / ₁₆	1 ² / ₈	1 ⁵ / ₈	1 ¹¹ / ₁₆	1 ³ / ₄	1 ³ / ₄	1 ¹⁵ / ₁₆
Radius	2 ⁷ / ₈	4 ⁵ / ₈	4 ⁵ / ₈	4 ³ / ₄	5 ¹ / ₂	5 ³ / ₄	6
Price, each	\$.07	.09	.09	.10	.12	.14	.18

TOOL POST RINGS



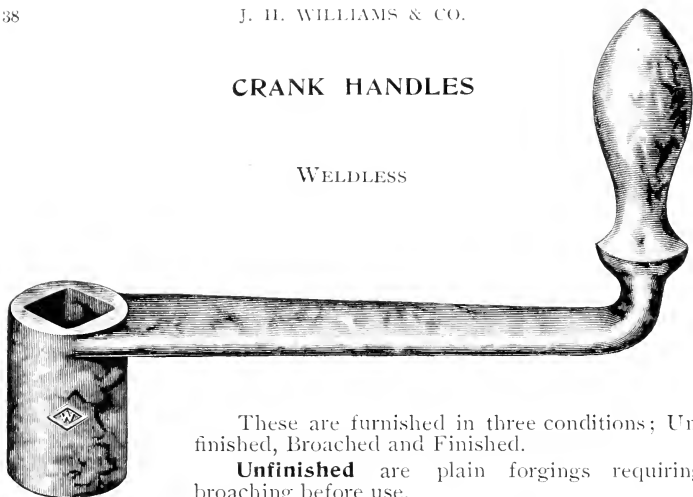
For Changing Angles of Lathe Tools

Number	0	1	2	3	4	6
Diameter, Outside	2 ¹⁵ / ₁₆	3	3 ¹ / ₂	3 ¹ / ₂	4	4 ¹ / ₂
Diameter, Hole	1 ⁵ / ₁₆	1 ⁵ / ₈	1 ³ / ₄	2	2	2 ³ / ₁₆
Thickness, Outside Edge	1 ⁷ / ₁₆	1 ⁷ / ₁₆	1 ⁹ / ₁₆	1 ³ / ₄	1 ³ / ₄	1 ³ / ₄
Radius of Concave	2 ⁷ / ₈	4 ⁵ / ₈	4 ³ / ₄	5 ¹ / ₂	5 ³ / ₄	6
Price, each	\$.14	.15	.20	.22	.27	.33

Please use numbers when ordering

CRANK HANDLES

WELDLESS



These are furnished in three conditions; Unfinished, Broached and Finished.

Unfinished are plain forgings requiring broaching before use.

Broached have hubs broached but are otherwise plain forgings.

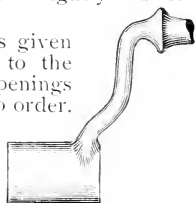
Finished are broached, ground, polished, case-hardened all over and lacquered to prevent rusting.

The broached openings are made with corners slightly rounded to prevent breakage.

Holes are regularly finished to standard sizes given below but each forging admits of broaching to the maximum dimensions stated in table. Smaller openings than standard and special sizes will be broached to order.

Hubs of Broached or Finished will be cut to shorter lengths and Handles will be offset (see cut) if desired, at an additional charge.

When ordering please use numbers and state whether Unfinished, Broached or Finished are desired.



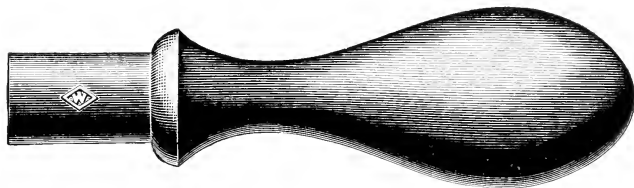
Number	Length over all	Length Center to Center	Length Handle above Arm	Length, Hub	Diameter Hub	Size Hole Broached		Price, Unfinished	Price, Broached	Price, Finished	Number
						Standard in Stock	Maximum to Order				
2	4 $\frac{1}{2}$	3 $\frac{1}{2}$	2 $\frac{7}{8}$	1 $\frac{5}{16}$	1	1 $\frac{2}{16}$	9 $\frac{16}{16}$	\$.50	\$.75	\$1.00	2
4	5 $\frac{1}{8}$	4	3 $\frac{1}{8}$	1 $\frac{5}{16}$	1 $\frac{1}{4}$	1 $\frac{5}{16}$	9 $\frac{3}{16}$	.60	.85	1.20	4
6	6 $\frac{1}{8}$	5	3 $\frac{3}{8}$	1 $\frac{13}{16}$	1 $\frac{1}{4}$	1 $\frac{5}{16}$	9 $\frac{3}{16}$	.75	1.00	1.50	6
8	7 $\frac{1}{8}$	6	3 $\frac{1}{4}$	1 $\frac{13}{16}$	1 $\frac{1}{4}$	1 $\frac{1}{4}$	9 $\frac{3}{16}$	.95	1.25	1.90	8
10	8 $\frac{1}{4}$	7	3 $\frac{7}{16}$	2	1 $\frac{3}{8}$	1 $\frac{3}{4}$	9 $\frac{3}{16}$	1.20	1.50	2.40	10
12	9 $\frac{3}{8}$	8	3 $\frac{5}{8}$	2 $\frac{7}{16}$	1 $\frac{1}{2}$	1 $\frac{7}{8}$	9 $\frac{3}{16}$	1.50	1.80	3.00	12
14	10 $\frac{1}{2}$	9 $\frac{1}{8}$	3 $\frac{5}{8}$	2 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{7}{8}$	9 $\frac{3}{16}$	1.70	2.00	3.40	14
16	11 $\frac{1}{2}$	10	4	3	1 $\frac{3}{4}$	1	9 $\frac{3}{16}$	2.25	2.60	4.50	16

Smaller sizes in preparation.

MACHINE HANDLE FORGINGS

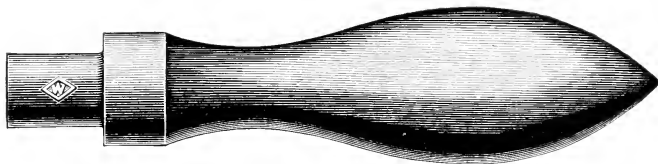
UNFINISHED

Ball Pattern



Number	00	0	1	2	3	4	5	6	7
Length, over all	2	2 ¹ / ₈	2 ⁵ / ₈	3 ¹ / ₄	3 ⁷ / ₈	4 ¹ / ₂	5 ¹ / ₈	5 ³ / ₄	6 ⁵ / ₈
Standard L'th, Shank	1 ² / ₈	1 ² / ₈	1 ⁵ / ₈	1 ³ / ₄	1 ⁷ / ₈	1	1 ¹ / ₈	1 ¹ / ₄	1 ² / ₈
Maximum L'th, Shank	1 ¹ / ₆	1 ³ / ₄	1	1 ¹ / ₈	1 ¹ / ₂	1 ¹ / ₂	1 ⁷ / ₈	2	2 ¹ / ₈
Diam. Shank	5 ¹ / ₁₆	1 ¹ / ₂	1 ³ / ₈	1 ⁵ / ₈	1 ⁵ / ₈	1 ⁷ / ₈	1 ⁹ / ₈	1 ¹ / ₂	1 ³ / ₄
Price, each	$\frac{5}{8}$.04	.05	.06	.08	.10	.12	.14	.16	.22

Cone Pattern

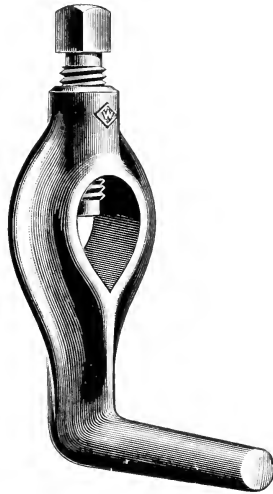


Number	11	13	15	16
Length, over all	3 ³ / ₈	4 ¹ / ₂	5 ¹ / ₂	6
Standard L'th, Shank	1 ² / ₈	1 ³ / ₄	1 ⁷ / ₈	1 ¹ / ₈
Maximum L'th, Shank	1 ¹ / ₆	1 ¹ / ₈	1 ³ / ₈	1 ¹ / ₂
Diam. Shank	3 ⁸ / ₈	1 ⁷ / ₈	1 ¹ / ₂	1 ⁹ / ₈
Price, each	\$.06	.10	.14	.16

Please use numbers when ordering

DROP-FORGED LATHE DOGS

With Bent Tail



These are superior to any in the market, for the following reasons :
 They are drop-forged from steel, which gives the greatest strength and toughness of material for the least weight, while they are also heavier than dogs of corresponding sizes made elsewhere.

The cross section is shaped similarly to an ogee, forming a rib on the edge, by which the metal is utilized to its greatest advantage at the point of severest strain.

The steel screws have U. S. Standard threads, the points are hardened and they are from one-sixteenth to one-eighth of an inch larger in diameter than those generally used in Lathe Dogs.

Please use numbers when ordering

Number	1	2	3	4	5	6	7	8	9	10	11	12	13
Size Dog . . .	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	5
Price, each . .	\$.50	.60	.70	.80	.95	1.10	1.25	1.40	1.60	1.80	2.00	2.30	4.00
Diam. Screw	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{11}{16}$	$\frac{3}{4}$	$\frac{7}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{7}{8}$	1
Length Screw	$1\frac{1}{4}$	1 $\frac{1}{2}$	$1\frac{3}{4}$	2	$2\frac{1}{4}$	$2\frac{1}{2}$	$2\frac{3}{4}$	3	$3\frac{1}{4}$	$3\frac{1}{2}$	$3\frac{3}{4}$	$4\frac{1}{4}$	$4\frac{1}{2}$
Extra Screws, each	\$.05	.06	.07	.08	.09	.10	.12	.18	.20	.22	.33	.35	.50

DROP-FORGED LATHE DOGS With Straight Tail



These are similar in design but are heavier than those with Bent Tail shown on previous page.

The cross section of the body is shaped similar to an ogee, forming a rib on the edge; that of the tail is an oval with the long axis in the direction of the thrust, thus utilizing the metal to the greatest advantage at the point of severest stress.

The heads are made of sufficient size to permit re-tapping for one or two larger sizes of screws as the threads wear.

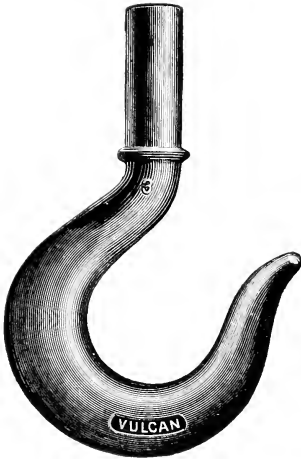
The screws are the same as furnished with Bent Tail Dogs (see page 40), but have hole drilled in heads.

Please use numbers when ordering

Number	21	22	32	24	25	26	27	28	29	30	31	32	33
Size Dog .	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	5
Price, each .	\$.30	.35	.40	.45	.55	.65	.80	1.05	1.30	1.65	2.00	2.30	4.00
Diam. Screw	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{11}{16}$	$\frac{11}{16}$	$\frac{3}{4}$	$\frac{7}{8}$	$\frac{7}{8}$	1
Length Screw	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{3}{8}$	2	$2\frac{1}{4}$	$2\frac{3}{8}$	$2\frac{1}{2}$	$2\frac{3}{4}$	3	$3\frac{1}{4}$	$3\frac{1}{2}$	$3\frac{3}{4}$	$4\frac{1}{2}$
Size Hole in Head of Screw	$\frac{6}{32}$	$\frac{7}{16}$	$\frac{7}{32}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{5}{16}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{7}{16}$	$\frac{1}{2}$
Extra Screws, each .	\$.05	.06	.07	.08	.09	.10	.12	.18	.20	.22	.33	.35	.50

VULCAN HOIST HOOKS

With Shank



These have the greatest strength and stiffness with the least weight; their dimensions and form are the results of long and careful experimenting. They are forged from a fine steel, which is utilized to greatest advantage at the point of severest stress. The shanks are designed to sustain a far heavier load than is required to straighten the hooks and the strength of the hooks throughout is much greater than the stated safe capacity: see table of tests on following page.

Full size drawings will be sent on request.

Tobin Bronze Hooks, from standard or special dies, to order in quantities; prices on application.

List prices are reduced on numbers 7 to 13 inclusive; ignore all previous lists.

Please use numbers when ordering

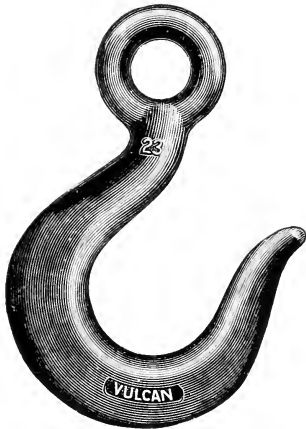
Number	For Size Hoist; Tons	Shank		Extreme Dimensions		Safe Capacity; Tons	Price, each	Number
		Diam.	Length	Length	Width			
2	1/8	1/2	1 1/4	4 1/4	2 7/8	1	8.15	2
3	1/4	9/16	1 1/2	4 3/4	3 1/8	1 1/2	.18	3
4	1/2	5/8	1 3/4	5 1/4	3 1/2	2	.21	4
5	3/4	3/4	2	6	3 7/8	3	.27	5
6	1	7/8	2 1/4	6 3/4	4 3/8	4	.36	6
7	1 1/2	1	2 1/2	7 1/2	4 7/8	5	.50	7
8	1 3/4	1 1/8	2 3/4	8 1/2	5 5/8	6	.70	8
9	2	1 1/4	3	9 1/2	6 3/8	7	.95	9
10	2 1/2	1 3/8	3 1/4	10 1/4	6 7/8	8	1.25	10
11	3	1 1/2	3 1/2	11 1/8	7 1/2	10	1.65	11
12	4	1 5/8	4	12 1/2	8 1/4	12	2.15	12
13	5	1 3/4	4 1/2	13 7/8	9 1/4	15	2.90	13
14	6	2	5 1/8	15 5/8	10 7/8	18		14
15	8	2 3/8	5 7/8	17 1/4	13	22		15

Shanks of Nos. 14 and 15 can be made longer if desired.

VULCAN HOIST HOOKS

With Eye

Weldless



These are the same, in all respects, as those with shank on opposite page, except that the bead is omitted and an eye substituted for the shank. The eye is designed to stand a much greater strain than is required to straighten the hook. See table of tests on following page.

Full size drawings will be sent on request.

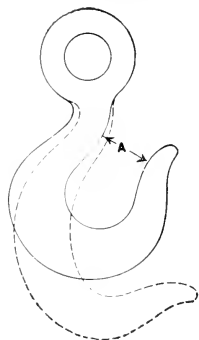
Tobin Bronze Hooks, from standard or special dies, to order in quantities; prices on application.

List prices are reduced on numbers 27 to 33, inclusive; ignore all previous lists.

Please use numbers when ordering

Number	For Size Hoist; Tons	Inside Diameter of Eye	Outside Diameter of Eye	Extreme Dimensions		Safe Capacity; Tons	Price, Each	Number
				Length	Width			
22	1/8	3/4	1 1/2	4 3/8	2 7/8	1	\$.15	22
23	1/4	7/8	1 3/4	4 7/8	3 1/8	1 1/2	.18	23
24	1/2	1	2	5 3/8	3 1/2	2	.21	24
25	3/4	1 1/8	2 1/4	6 1/8	3 7/8	3	.27	25
26	1	1 1/2	2 1/2	6 3/4	4 3/8	4	.36	26
27	1 1/2	1 3/8	2 3/4	7 5/8	4 7/8	5	.50	27
28	1 3/4	1 1/2	3	8 1/2	5 3/8	6	.70	28
29	2	1 5/8	3 1/4	9 1/2	6 3/8	7	.95	29
30	2 1/2	1 3/4	3 1/2	10 1/4	6 7/8	8	1.25	30
31	3	2	4	11 1/2	7 1/2	10	1.65	31
32	4	2 3/8	4 5/8	12 3/8	8 1/4	12	2.15	32
33	5	2 3/4	5 1/4	14 1/2	9 1/4	15	2.90	33
34	6	3 1/8	6 1/8	16 1/2	10 7/8	18		34
35	8	3 1/2	7	19	13	22		35

TESTS OF VULCAN HOIST HOOKS.



While we cannot guarantee the exact strength of any particular hook these goods have been often carefully tested by various parties to determine their strength. From the records kept of all these tests the **weakest** hook found of each size has been selected as the basis of the following table. The **average** strength is much greater than that stated. The cut shows at A the point at which the straightening was measured and the form of the hook when straightened out is indicated by dotted lines; none of the hooks broke under tests.

Number of Hook	Strain Required to Stretch $\frac{1}{8}$ inch; lbs.	Strain Required to Stretch $\frac{1}{4}$ inch; lbs.	Strain Required to Stretch $\frac{3}{8}$ inch; lbs.	Strain Required to Straighten out; lbs.	Number of Hook	
With Shank	2	2,800	3,000	3,100	3,600	2
	3	3,200	3,500	3,700	4,300	3
	4	3,900	4,300	4,600	5,500	4
	5	6,500	7,900	9,100	13,800	5
	6	8,200	9,100	9,900	12,300	6
	7	9,800	11,600	13,100	19,100	7
	8	12,300	13,560	14,550	18,950	8
	9	15,850	17,830	19,200	27,060	9
	10	20,750	22,000	23,460	38,630	10
	11	20,700	23,550	29,440	42,800	11
	12	26,950	30,800	34,700	54,540	12
	13	28,140	32,650	36,600	67,900	13
	14					14
	15	In Preparation.				15
	With Eye	22	2,700	3,100	3,500	4,050	22
23		3,200	3,900	4,300	5,800	23
24		4,000	4,900	5,600	7,600	24
25		6,500	7,900	9,100	13,800	25
26		9,400	10,800	11,600	13,100	26
27		12,200	14,000	15,800	24,000	27
28		12,300	13,560	14,550	18,950	28
29		16,520	18,500	20,820	32,440	29
30		20,750	22,000	23,460	38,630	30
31		18,950	21,240	23,850	40,200	31
32	26,900	30,700	33,500	53,950	32	
33	31,870	35,060	38,160	64,100	33	
34					34	
35	In Preparation.				35	

EYE-BOLTS

Weldless

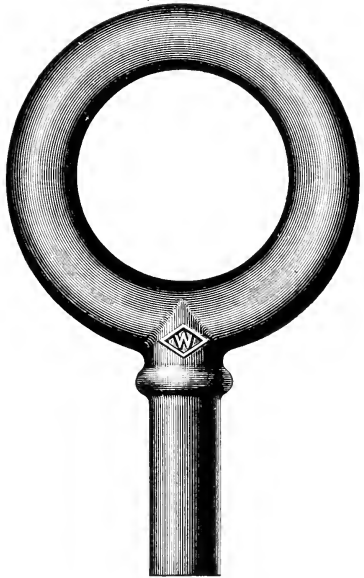
These are drop-forged from a stiff, strong steel, which careful tests have proved to be the best for the purpose. The metal in the heads is so distributed as to utilize it to the greatest advantage at the point of severest stress.

Prices given for special Eye-bolts on receipt of drawings or models and specifications.

Furnished without bead shown in cut, if preferred.

When ordering please state whether Blank or Threaded are desired. If not specified, Blank (shank not threaded) will be sent.

Threaded Eye-bolts of standard length are in stock; prices for these are for either



U. S. or Whitworth Standard

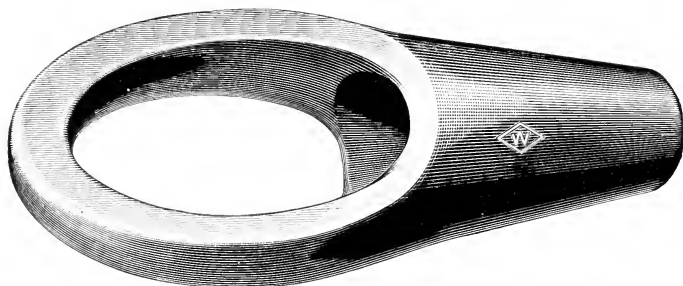
threads; special threads extra. Tobin Bronze Eye-bolts for marine work from Standard or special dies to order in quantities. Prices on application.

Diam. Shank	Standard Length of Shank from Bead	Diam. Eye, Inside	Safe Capacity: Tons	Breaking Strain: Tons	Price, Each, Blank	Price, Each, Threaded	Price for Extra Length, per Inch or Fraction Thereof on Blanks	Diam. Shank
3/8	1	1 1/8	3/4	2 1/2	\$.11	\$.16	\$.02	3/8
7/16	1 1/8	1 3/16	1	3	.12	.17	.02	7/16
1/2	1 1/4	1 9/16	1 1/2	5	.14	.20	.03	1/2
9/16	1 1/2	1 3/8	2	6	.17	.24	.03	9/16
5/8	1 3/4	1 1/2	2 1/2	6	.22	.30	.04	5/8
3/4	2	1 11/16	3	8	.30	.40	.04	3/4
7/8	2 1/4	1 7/8	4	17	.40	.52	.05	7/8
1	2 1/2	2 1/16	5	22	.55	.69	.06	1
1 1/8	2 3/4	2 1/4	6	27	.80	.96	.07	1 1/8
1 1/4	3	2 7/16	7	33	1.10	1.29	.08	1 1/4
1 1/2	3 1/2	2 13/16	10	40	1.55	1.80	.10	1 1/2
1 3/4	3 3/4	3 1/8	15	47	2.15	2.50	.14	1 3/4
2	4	3 1/2	20	over 50	2.90	3.40	.18	2

For other Eye-bolts see page 53.

CLOSED WIRE-ROPE SOCKETS

Weldless



These are drop-forged from a fine grade of **steel** and are made **without welds**; they are, therefore, very much stronger, though lighter, than corresponding sizes of hand-forged, welded iron sockets.

Their design and proportions have been carefully studied to obtain the greatest possible strength with the least weight.

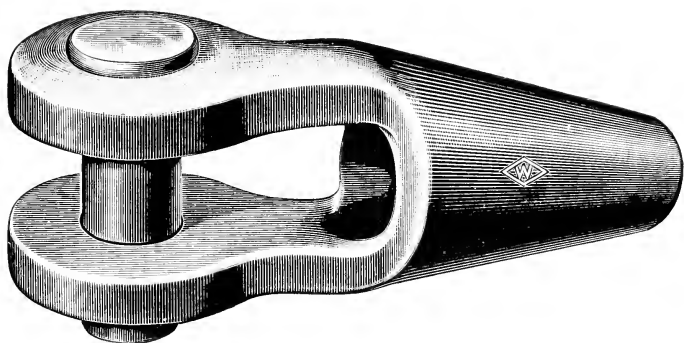
Furnished, regularly, with interior of the basket for holding rope serrated: smooth finish inside supplied to order.

When ordering, please use numbers and state whether serrated or smooth are desired. If not specified, serrated will be sent.

Number	4	5	6	7	8	9	10	11
Size Rope . . .	3/8	7/16	1/2	9/16	5/8	3/4	7/8	1
Extreme Length	4 ¹³ / ₁₆	4 ¹³ / ₁₆	5 ¹ / ₄	5 ¹ / ₄	6 ³ / ₄	7 ⁷ / ₈	9 ¹ / ₈	10 ¹ / ₄
Length Basket .	2 ¹ / ₄	2 ¹ / ₄	2 ¹ / ₂	2 ¹ / ₂	3	3 ¹ / ₂	4	4 ¹ / ₂
Large Diameter Basket, Outside	1 ¹ / ₂	1 ¹ / ₂	1 ³ / ₄	1 ³ / ₄	2 ¹ / ₄	2 ³ / ₄	3 ¹ / ₈	3 ¹ / ₂
Small Diameter Basket, Outside	3/4	3/4	1 ⁵ / ₁₆	1 ⁵ / ₁₆	1 ¹ / ₁₆	1 ⁵ / ₁₆	1 ⁷ / ₁₆	1 ¹¹ / ₁₆
Price, each . .	\$.65	.65	.80	.80	1.00	1.25	1.55	1.95

OPEN WIRE-ROPE SOCKETS

Weldless



These are similar in design and proportions to the Closed Sockets shown on opposite page and are drop-forged, **without welds**, from a fine grade of **steel**, making them far superior in strength and finish to hand-forged, welded iron sockets.

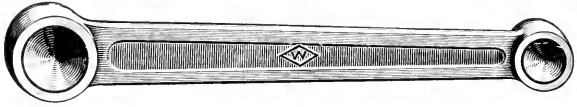
The Pins are made of a superior grade of steel to obtain high shearing strength.

Furnished, regularly, complete with split-pin and with interior of basket for holding rope serrated; smooth finish inside supplied to order.

When ordering, please use numbers and state whether serrated or smooth are desired. If not specified, serrated will be sent.

Number	24	25	26	27	28	29	30	31
Size Rope . . .	3/8	7/16	1/2	9/16	5/8	3/4	7/8	1
Extreme Length	4 ¹³ / ₁₆	4 ¹³ / ₁₆	5 ⁷ / ₁₆	5 ⁷ / ₁₆	6 ⁵ / ₈	7 ⁷ / ₈	9 ¹ / ₈	10 ¹ / ₈
Length Basket	2 ¹ / ₁	2 ¹ / ₁	2 ² / ₂	2 ² / ₂	3	3 ¹ / ₂	4	4 ¹ / ₂
Large Diameter Basket, Outside	1 ¹ / ₂	1 ¹ / ₂	1 ³ / ₁	1 ³ / ₁	2 ¹ / ₁	2 ³ / ₁	3 ¹ / ₈	3 ¹ / ₂
Small Diameter Basket, Outside	3 ₁	3 ₁	1 ⁵ / ₁₆	1 ⁵ / ₁₆	1 ¹ / ₁₆	1 ⁵ / ₁₆	1 ⁷ / ₁₆	1 ¹¹ / ₁₆
Diameter Pin .	5 ₈	5 ₈	3 ₁	3 ₁	1	1 ¹ / ₁	1 ¹ / ₂	1 ⁵ / ₈
Price, each . .	\$.80	.80	1.00	1.00	1.25	1.60	2.05	2.60

J. H. WILLIAMS & CO.
CONNECTING RODS
 UNFINISHED



For Gas Engines, Etc.

Full size drawings will be sent on request.

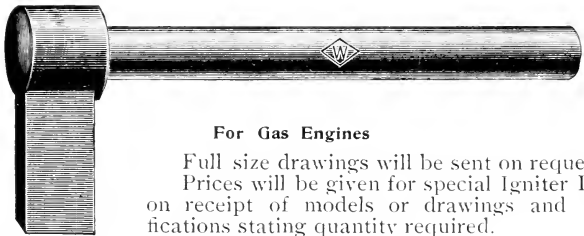
Prices will be given for Special Connecting Rods on receipt of models or drawings and specifications stating quantity required. Dimensions show sizes of unfinished forgings.

Please use numbers when ordering

Number	Length C to C	BOSSES OR HEADS				Thickness of Shank	Price	Number
		SMALL		LARGE				
		Diam.	Thick.	Diam.	Thick.			
* 14A	5 1/2	1 1/8	1 1/8	1 1/8	1 3/8	3/16	.29	14A
21A	7 1/2	1 1/8	1 1/8	1 1/8	1 3/8	3/16	.32	21A
24A	7 1/2	1 1/8	1 1/8	1 1/8	1 3/8	3/16	.34	24A
35A	8 1/2	1 1/8	1 1/8	1 1/8	1 3/8	3/16	.60	35A

*Round shank ; heads flush with shank on one side, projecting 1/4 in. from shank on other side

IGNITER LEVERS
 UNFINISHED



For Gas Engines

Full size drawings will be sent on request.

Prices will be given for special Igniter Levers on receipt of models or drawings and specifications stating quantity required.

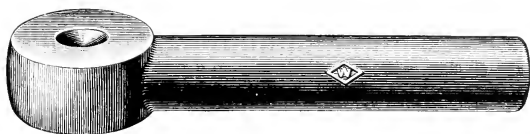
Dimensions show sizes of unfinished forgings.

Please use numbers when ordering

Number	STEM		ARM OR LEVER		ARM BOSS.		Price	Number
	Diam.	Length under Shoulder	Length from C. of Stem	Width	Thick.	Diam.			Length
6A	3/8	3 3/4	1 1/8	1 1/8	1 1/8	1 1/8	.12	6A
6B-Right	3/8	4	1 1/8	1 1/8	1 1/8	1 1/8	.12	6B-Right
6C-Left	3/8	4	1 1/8	1 1/8	1 1/8	1 1/8	.12	6C-Left
6D	3/8	4 1/2	1 1/8	1 1/8	1 1/8	1 1/8	.14	6D
8A	1/2	2 1/2	1	1 1/8	1 1/8	1 1/8	.12	8A
* 10A	1/2	1 1/2	1 1/8	1 1/8	1 1/8	1 1/8	.31	10A
10B	3/8	5 3/8	1 1/8	1 1/8	1 1/8	1 1/8	.22	10B
12A-Right	3/8	3 1/8	1 1/8	1 1/8	1 1/8	1 1/8	.18	12A-Right
12B-Left	3/8	3 1/8	1 1/8	1 1/8	1 1/8	1 1/8	.18	12B-Left

*Double arms projecting both sides of stem in form of T.

ROD ENDS



UNFINISHED

These Rod or Stub Ends are drop-forged from mild steel that welds easily. They are of service in general shop use or machine manufacture as ends of Connecting Rods, Oscillating Bars, Shifting Levers, Eccentric Connections, Yoke Heads, etc., etc.

Prices will be given for special forms on receipt of models or drawings and specifications stating quantity required.

Dimensions show sizes of unfinished forgings.

List prices are changed; ignore all previous lists.

Please use numbers when ordering

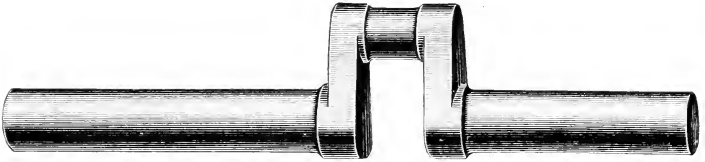
Number	SHANK		HEAD		Price, Each	Number
	Diameter	Length under Head	Diameter	Thickness		
2-A	5/16	$3\frac{3}{4}$	$\frac{3}{4}$	$\frac{7}{16}$	\$.06	2-A
* 3-A	3/8	2	1	$\frac{3}{8}$	.06	* 3-A
5-A	1/2	$4\frac{3}{8}$	1	$\frac{1}{2}$	.11	5-A
† 5-B	1/2	$2\frac{3}{8}$	$\frac{3}{4}$	$\frac{3}{4}$	.08	† 5-B
6-A	9/16	2	$1\frac{1}{16}$	$\frac{7}{16}$	.08	6-A
7-A	5/8	$2\frac{3}{8}$	$1\frac{1}{8}$	$\frac{15}{32}$	.09	7-A
7-B	5/8	$4\frac{7}{8}$	$1\frac{1}{4}$	$\frac{19}{32}$	.14	7-B
7-C	5/8	$1\frac{1}{2}$	$1\frac{3}{4}$	$\frac{5}{8}$	.14	7-C
* 7-D	5/8	$7\frac{1}{2}$	$1\frac{5}{32}$	$\frac{21}{32}$	.18	* 7-D
* 9-A	3/4	$3\frac{7}{8}$	$1\frac{3}{4}$	$\frac{5}{8}$	.20	* 9-A
* 14-A	1 1/16	$5\frac{3}{4}$	$2\frac{1}{16}$	$1\frac{1}{8}$	.40	* 14-A

* Can be furnished longer if desired.

† Head off-set from center of shank $\frac{3}{16}$ inch.

CRANK SHAFTS

Unfinished and Weldless



Cut shows form of Nos. 25 and 40

These are drop-forged from stiff, strong steel and are made close to size, leaving a minimum amount of stock for finishing. Ends marked * on Nos. 10, 20 and 40 cannot be made longer than shown by table; all others can be drawn out to extra length at additional charge; see list.

Full size drawings sent on request.

Prices will be given for special Crank Shafts upon receipt of drawings and specifications.

Dimensions show sizes of unfinished forgings.

Single Throw Cranks

Number	Size of Shafts		Stroke of Piston	Diam. Wrist Pin	Distance Between Arms	Price, Each	Price for Extra Length, per inch or fraction thereof	Number
	Diam.	Lengths from Arm						
10	1 1/16	*2 1/8 & 8	2	1 1/16	1 7/16	\$.90	.06	10
20	1 3/16	*2 3/8 & 8 1/2	3	1 3/16	2 1/4	1.30	.07	20
25	1 1/4	8 1/2 & 8 1/2	3 1/2	1 1/8	1 1/2	1.75	.08	25
40	1 5/8	*8 1/2 & 10 1/2	4 1/2	1 3/8	1 3/4	2.90	.12	40
45	1 11/16	11 & 11	6	1 3/4	1 3/8	5.90	.13	45
46	1 3/4	11 1/2 & 11 1/2	6	1 5/8	2 7/16	4.75	.14	46
48	1 3/4	11 1/2 & 11 1/2	6 1/2	1 7/8	2 3/4	4.75	.14	48

Double Throw Cranks

30	1 3/8	9 & 9	4	1 1/2	1 7/16	4.00	.09	30
50	1 7/8	12 1/2 & 12 1/2	5	1 3/4	2 1/2	9.20	.16	50

See cut No. 30, page 67

List prices are changed; ignore all previous lists.

Please use numbers when ordering

PARTS FOR AUTOMOBILE STEERING GEAR

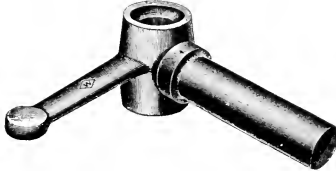
UNFINISHED

Suitable for carriages weighing from 600 to 1,500 pounds.

These parts are drop-forged from stiff, strong steel and are designed for use with ball bearings in pivot hub; they can be furnished for plain bearings in quantities to order.

Full size drawings sent on request.

Estimates given for special parts on receipt of models or drawings and specifications stating quantity required.



Steering Knuckle

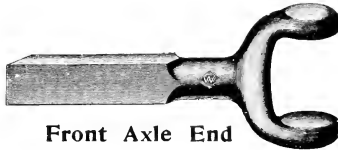
Price \$2.00 each

Inches		Inches	
Length Axle from Shoulder	47/8	Length Lever C. to C.	6 1/2
Diameter of Axle	1 1/4	Length of Hub	3
Diameter of Shoulder	1 3/4	Diameter of Hub	1 3/4

Two other larger sizes Steering Knuckles furnished to order, viz:

Inches		Inches	
No. 5249, Length Axle from Shoulder, 10 1/2		No. 5850, Same general style as cut.	
Diameter of Axle,	2 1/4	Length Axle from Shoulder	9 1/2
		Diameter of Axle	2

No Axle Ends in Stock for Nos. 5249 and 5850; would be made to order in quantities.

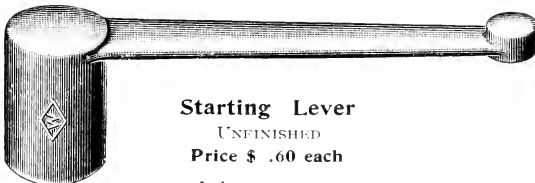


Front Axle End

Price \$2.00 each

Inches		Inches	
Extreme Length	11 3/4	Distance between Arms	2 1/8
Length Round part of Axle	2 1/4	Length Square Part Axle	6
Diameter Round Part of Axle	1 5/16	Size Square Part Axle	1 5/16

If desired in quantities two Axle Ends will be furnished in one forging of any desired length, making a solid axle bed complete without welds.



Starting Lever

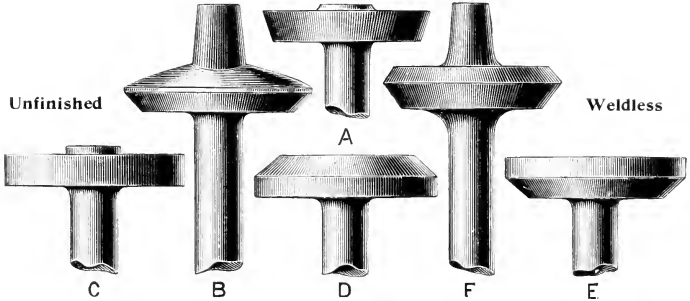
UNFINISHED

Price \$.60 each

Inches		Inches	
Extreme Length	9 1/16	Length C. to C.	7 7/8
Large Hub, Diam.	1 3/4	Small Hub, Diam.	1 1/2
" " Length	2 1/2	" " Length	1 3/8

See Crank Handles, page 38

VALVE-STEM FORGINGS



For Gas Engines, Etc. Dimensions show sizes of unfinished forgings.
List prices are changed; ignore all previous lists.

Please use numbers when ordering

Type	Number	HEAD			STEM		LUG ON HEAD		Price, Each	Price for Extra Length, per Inch or Fraction Thereof	Type	Number		
		Large Diam.	Small Diam.	Thickness	Diam.	Length	Diam.	Length						
A	2	1 1/4	1 1/8	5/16	5/16	6 1/2	5/16	5/16	\$.25	\$.01	A	2		
	4	2 5/16	1 3/4	3/8	5/16	8 1/2	3/4	3/8	.40	.02		4		
	6	2 5/16	1 3/4	7/16	5/16	8 1/2	3/4	3/8	.40	.03		6		
	8	2 3/4	2 1/16	7/16	5/16	9	3/4	3/8	.45	.03		8		
	9	3 1/4	2 1/16	7/16	5/16	9 1/2	1 1/16	3/8	.55	.04		9		
	10	3 7/8	3 5/16	7/16	5/16	10 1/2	1 1/16	3/8	.65	.04		10		
	B	1	1 1/4	1 1/8	3/8	1 1/16	6 1/2	1 1/16	5/16	.25		.01	B	1
		2	2 3/16	1 3/8	3/8	1 1/16	8 1/2	1 1/16	5/16	.40		.02		2
		4	2 3/16	1 3/8	7/16	5/16	9	1 1/16	5/16	.50		.03		4
		6	2 1/16	2 1/16	3/8	5/16	9 1/2	1 1/16	5/16	.50		.03		6
8		3 1/16	2 1/16	3/8	5/16	9 1/2	1 1/16	5/16	.50	.03	8			
10		3 5/8	3 1/16	3/8	5/16	10 1/2	1 1/16	5/16	.65	.04	10			
12		4 3/16	4 1/16	7/16	7/16	13	1 3/16	5/16	1.00	.05	12			
14		6 1/2	4 5/8	5/8	1 1/16	16	1 1/16	5/16	2.60	.09	14			
C		0	1 1/2	1 1/8	1/8	1/4	5 1/2	1	1	.20	.01	C		0
		2	1 1/2	1 1/8	1/8	1/4	6 1/2	1	3/16	.25	.01			2
	4	1 1/2	1 1/8	3/8	3/8	7 1/2	1 5/16	5/16	.25	.01	4			
	5	2 3/4	2 3/8	3/8	3/8	9	1 3/4	3/8	.50	.04	5			
	6	2 3/4	2 3/8	7/16	3/8	9	1 3/4	3/8	.55	.05	6			
	8	3 9/16	3 1/16	7/16	3/8	10 1/2	1 1/4	1/4	.80	.07	8			
	10	4 1/16	4 1/16	1 1/2	1 1/2	10 1/2	1 1/2	1 1/2	.75	.05	10			
	12	4 9/16	4 1/16	1 1/2	1 1/2	13	1 1/2	1 1/2	1.40	.07	12			
	13	4 7/8	4 5/8	5/8	1 3/8	13	1 7/8	7/8	1.70	.09	13			
	14	5 5/16	5 1/16	1 1/2	1 1/2	16	1 7/8	1 1/2	2.20	.10	14			
D	2	2 1/4	1 1/16	1/16	1 1/16	8 1/2	1	1	.45	.03	D	2		
	3	2 1/4	1 1/16	1/16	1 1/16	9	1	1	.55	.05		3		
	4	2 1/4	1 1/16	1/16	1 1/16	9	1	1	.65	.06		4		
	6	3 1/4	2 3/16	5/8	1 1/16	9 1/2	1 1/16	1 1/16	.75	.06		6		

*Head slightly recessed on Stem side.
Continued following page. For other valves, see page 61.

VALVE-STEM FORGINGS

UNFINISHED AND WELDLESS

See cuts on previous page.

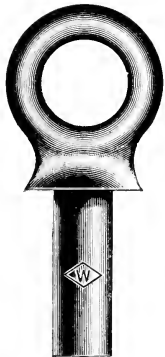
Dimensions show sizes of unfinished forgings.

For other valves see page 61.

List prices are changed ; ignore all previous lists.

Please use numbers when ordering

Type	Number	HEAD			STEM		LUG ON HEAD		Price, Each	Price for Extra Length per Inch or Fraction Thereof	Type	Number
		Large Diam.	Small Diam.	Thickness	Diam.	Length	Diam.	Length				
E	2	1 8/8	1 1/8	7/32	3/8	6 1/2			\$.25	¢ .01	E	2
	3	1 3/8	1 3/8	1/4	7/8	7 1/8	7/16	3/16	.25	.02		3
	4	2 1/16	2 1/8	1/4	1 1/8	9			.50	.04		4
	6	3 9/16	3 3/8	5/16	1 1/8	10 1/2			.75	.06		6
F	10	5 7/16	4 1/8	1/4	1 5/16	13			1.70	.08	10	
	2	1 1/16	1 3/8	3/32	1/16	7 1/2	7/16	7/8	.35	.02	F	2
	6	2 7/8	2 5/16	1/16	9/16	9	9/16	7/8	.45	.02		6
	7	2 7/8	2 1/8	1/16	1 1/16	9	1 1/16	1 5/16	.50	.03		7
12	4 1/16	3 5/8	1/16	1	13	1	1 1/4	1.20	.06	12		



A

MISCELLANEOUS EYE-BOLTS

WELDLESS

These are furnished in two styles or types, A and B. They are carried in stock with Shanks blank (not threaded), but will be supplied threaded to order. Full size drawings will be sent on request.



B

Please use numbers when ordering

Type	Number	SHANK		DIAM. EYE		Price, Each, Blank	Type	Number
		Diam.	Length	Inside	Outside			
A	15	1 1/2	2	9/16	1 1/4	\$.11	A	15
	25	5/8	1 3/4	7/8	1 5/8	.14		25
B	1	1 1/4	1 1/2	3/8	3/4	.05	B	1
	10	1 7/16	1 1/8	1/2	1 3/4	.11		10
	15	1 1/2	1 9/16	1/2	1 1/2	.12		15
	16	1 1/2	1 1/16	1/2	1 1/4	.12		16
	16	1 1/2	3/8	7/8	1 7/8	.12		16
	45	1 1/2	4 1/8	1 1/8	2 3/8	.35		45

For other Eye Bolts see page 45.



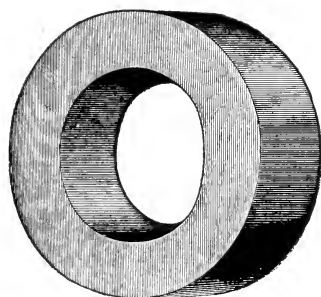
KEY FORGINGS

UNFINISHED

These are made from $\frac{1}{32}$ to $\frac{1}{16}$ inch wider than finished size, to allow for machining and are square without taper or draft on edges.

Cut to special length if desired. Taper $\frac{3}{16}$ inch to 1 foot.

Width, Finished Size	Standard Length under Head	Maximum Length under Head	Thickness under Head; Size Forgings	Price, per 100	Price per Extra Inch or Fraction Thereof, per 100	Width, Finished Size
3/16	1 $\frac{1}{2}$	3 $\frac{1}{2}$	$\frac{3}{16}$	\$ 3.50	\$.90	3/16
1/4	2	4 $\frac{1}{2}$	$\frac{1}{4}$	4.25	1.00	1/4
5/16	2 $\frac{1}{2}$	5 $\frac{1}{2}$	$\frac{5}{16}$	5.25	1.10	5/16
3/8	3	6 $\frac{1}{2}$	$\frac{3}{8}$	6.50	1.25	3/8
7/16	3 $\frac{1}{2}$	7 $\frac{1}{2}$	$\frac{7}{16}$	7.75	1.40	7/16
1/2	4	8 $\frac{1}{2}$	$\frac{1}{2}$	9.00	1.60	1/2
9/16	4 $\frac{1}{2}$	9	$\frac{9}{16}$	10.50	1.80	9/16
5/8	5	9	$\frac{5}{8}$	12.00	2.05	5/8
11/16	5 $\frac{1}{2}$	10	$\frac{11}{16}$	13.50	2.20	11/16
3/4	6	12	$\frac{3}{4}$	15.00	2.30	3/4
7/8	7	13	$\frac{7}{8}$	19.00	2.60	7/8
1	8	14	1	25.00	2.90	1
1 1/8	9	15	$\frac{13}{16}$	35.00	3.40	1 1/8
1 1/4	10	16	$\frac{7}{8}$	50.00	4.00	1 1/4



SHAFTING COLLARS OR BUSHINGS

UNFINISHED

Drop-forged from Steel

Weldless

Hole forged scant to allow for finishing

Size Shaft . .	15/16	1 $\frac{3}{16}$	1 $\frac{7}{16}$	1 $\frac{11}{16}$	1 $\frac{15}{16}$	2 $\frac{3}{16}$	2 $\frac{7}{16}$	2 $\frac{11}{16}$	2 $\frac{15}{16}$
Outside Diam.	$\frac{113}{16}$	$\frac{213}{16}$	$\frac{277}{16}$	$\frac{213}{16}$	$\frac{333}{16}$	$\frac{397}{16}$	$\frac{313}{16}$	$\frac{437}{16}$	$\frac{497}{16}$
Width Face . .	$\frac{13}{16}$	$\frac{7}{8}$	1	$\frac{11}{16}$	$\frac{13}{16}$	$\frac{15}{16}$	$\frac{13}{8}$	$\frac{17}{16}$	$\frac{19}{16}$
Price, each . .	\$.09	.11	.14	.20	.26	.35	.44	.56	.70

For other rings see Ferrules, page 59

THUMB NUTS



Blank or Threaded
Threaded have base
faced at right angle
to hole
**Tobin Bronze Thumb
Nuts to order**

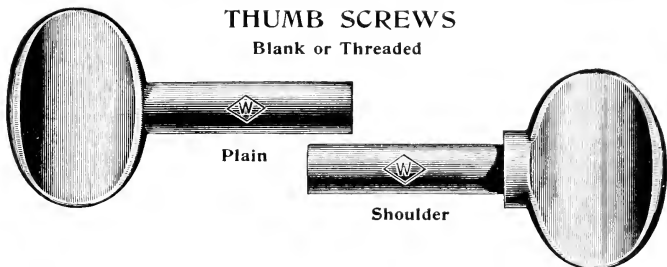
**Threaded Thumb
Nuts double
following List Prices**

List price is changed on $\frac{3}{4}$ inch; ignore all previous lists.

For Bolt; Size	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	3/4
Diam. Top	1	5	3	7	1	9	5	11	3	7
Price, Bl'ks per 100	\$3.00	3.50	4.00	4.50	5.00	6.00	8.00	10.00	12.00	16.00

THUMB SCREWS

Blank or Threaded



Drop-forged from steel which will harden slightly in water. Plain and shoulder are sold from same list. Please state when ordering which are desired; if not specified, plain will be sent. Special sizes and shapes and Tobin Bronze Thumb Screws to order. The threaded prices are for either U. S. or Whitworth Standard threads; special threads extra.

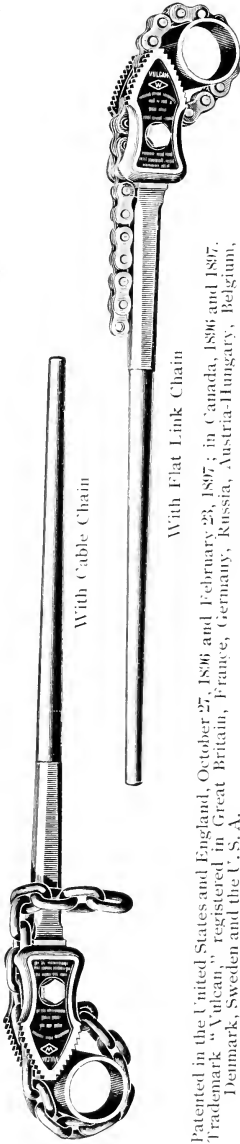
Price of Blanks per 100

Length under Head	Diameter									
	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	3/4
1/4	\$1.40	\$2.00	\$2.50	\$2.75	\$3.00					
1/2	1.50	2.10	2.60	2.90	3.25	\$4.25	\$5.25	\$6.25		
3/4	1.60	2.20	2.70	3.05	3.50	4.50	5.50	6.50		
1	1.70	2.30	2.80	3.20	3.75	4.75	5.75	6.75	\$7.75	\$10.00
1 1/4	1.80	2.40	2.90	3.35	4.00	5.00	6.00	7.00	8.00	10.25
1 1/2	1.90	2.50	3.00	3.50	4.25	5.25	6.25	7.25	8.25	10.50
1 3/4		2.60	3.10	3.65	4.50	5.50	6.50	7.50	8.50	10.75
2		2.70	3.20	3.80	4.75	5.75	6.75	7.75	8.75	11.00
2 1/4			3.30	3.95	5.00	6.00	7.00	8.00	9.00	11.50
2 1/2			3.40	4.10	5.25	6.25	7.25	8.25	9.50	12.00
2 3/4			3.50	4.25	5.50	6.50	7.50	8.50	9.75	12.25
3			3.60	4.40	5.75	6.75	7.75	8.75	10.00	12.50
3 1/2				4.70	6.25	7.25	8.25	9.25	10.50	13.00
4				5.00	6.75	7.75	8.75	9.75	11.00	13.50
4 1/2					7.25	8.25	9.25	10.25	11.50	14.00
5					7.75	8.75	9.75	10.75	12.00	14.50
5 1/2					8.25	9.25	10.25	11.25	12.50	15.00
6							10.75	11.75	13.00	15.50

Threaded Thumb Screws at double above List
For other Thumb Screws see page 61.

THE VULCAN PATENT DROP-FORGED CHAIN PIPE WRENCH

For Turning or Holding Pipe, Pipe-fittings, Bolts, Bars, Shafts, Etc., from 1/8 to 18 inches Diameter




Patented in the United States and England, October 27, 1896 and February 23, 1897; in Canada, 1896 and 1897. Trademark "Vulcan," registered in Great Britain, France, Germany, Russia, Austria-Hungary, Belgium, Denmark, Sweden and the U. S. A.

These wrenches combine the merits of all other chain pipe wrenches with special advantages of their own; they are strong and durable, being wholly from wrought steel. The drop-forged jaws are of saw temper; the teeth can be sharpened by filing only. The pressure of the teeth is in a line tangent to the circumference of the pipe, which, combined with the encircling grip of the chain, prevents crushing.

The Vulcan Wrench is sold with either cable or flat link chain, and is the only wrench adapted for both.

When ordering, say which chain is desired; flat link chain will be sent unless otherwise specified.

To change the chain, unscrew one cap-screw but remove neither jaw; slip out the internal pin on which the chain swings, thus releasing the chain; insert new chain, replace pin and cap-screw, screwing the latter **firmly** into place. Always keep the jaws screwed **tightly** to the handle.

The cable chains are of the finest quality; only the "D. B. G. Special Crane Chain" is used; each chain is hand formed and tested, link by link; each bears the trade mark . The flat link chains are hand made from steel made expressly for them and carefully tested in an Olsen testing machine.

The chain swings from the center and can be used on either side of the jaws, reducing the wear of the teeth to the minimum. Extra chains are supplied with swinging link and pin; extra jaws are supplied with one pair cap-screws. The handles are made from stiff, strong steel.

This wrench is equally efficient on fittings and straight pipe, in corners, against walls, between floors, in ditches or for overhead work. Each fits a range of sizes equal to six pairs of common tongs, and will outwear several pairs of any kind.

These tools are fully guaranteed and are recommended as the most efficient and economical chain pipe wrenches made. Nothing is spared in their manufacture that adds to their working and wearing qualities. All parts are interchangeable; repairs can always be had.

We shall be glad to send the wrenches for trial.

No. 16 has eye on the end of handle for use with tackle.

For Standard Packages, with Weights and Measurements, see page 58

Size	No. 10	No. 11	No. 12.	No. 13	No. 13 1/2	No. 14.	No. 15.	No. 16.
Price, with flat link chain, each	\$2.50	\$3.50	\$5.00	\$7.00	\$9.00	\$11.00	\$18.00	\$40.00
Price, with cable chain, each	2.25	3.25	4.50	6.25	7.75	9.50	16.00	40.00
Capacity, size pipe	1 to 3 in.	1 to 1 1/2 in.	1 to 2 1/2 in.	3 to 4 in.	1 to 6 in.	1 1/2 to 8 in.	2 to 12 in.	4 to 18 in.
Length, over all	13 1/2 in.	20 in.	27 in.	37 in.	44 1/2 in.	50 1/2 in.	64 1/2 in.	87 in.
Weight	13 lbs.	13 lbs.	8 1/2 lbs.	16 lbs.	21 lbs.	29 lbs.	49 lbs.	137 lbs.
Extra flat link chain, each	\$.75	\$1.00	\$1.50	\$2.50	\$3.25	\$4.00	\$6.00	\$13.00
Extra cable chain, each	.50	.75	1.00	1.75	2.00	2.50	4.00	13.00
Extra jaws, pair	1.00	1.75	2.75	4.00	4.75	5.50	7.50	16.00
Length, flat link chain	9 1/2 in.	13 1/2 in.	17 1/2 in.	22 1/2 in.	31 in.	39 in.	54 1/2 in.	74 1/2 in.
Length, cable chain	9 3/4 in.	14 1/2 in.	18 in.	27 in.	33 1/2 in.	42 in.	57 in.	76 in.
Breaking strain, flat link chain	3,600 lbs.	6,700 lbs.	9,800 lbs.	12,500 lbs.	14,300 lbs.	15,700 lbs.	21,800 lbs.	40,000 lbs.
Breaking strain, cable chain	1,200 lbs.	4,000 lbs.	6,000 lbs.	10,500 lbs.	12,500 lbs.	15,000 lbs.	19,000 lbs.	40,000 lbs.
Size iron in cable chain	3 in.	3 1/2 in.	4 1/2 in.	7 in.	1 1/2 in.	3 1/2 in.	3 1/2 in.	1 1/2 in.

See Cable Code on page 64.

Same prices for parts of Brock Chain Pipe Wrench of corresponding numbers.

VULCAN CHAIN PIPE WRENCHES

Standard Packages

With Shipping Weights and Measurements

We give below average net and gross weights and measurements of Vulcan Chain Pipe Wrenches when packed in the respective standard quantities of sizes stated. The No. 10 wrench is not included in the following table, because its small size permits packing with other wrenches without enlarging the case. Whenever No. 10 are ordered, their weight, as given on page 43, should be added to obtain total weight of shipment.

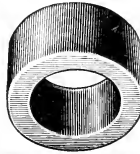
These tools are kept in stock packed ready for shipment in the quantities given below for each size. They are, however, furnished in any desired assortment.

All cases are securely nailed and carefully strapped with wire to ensure safe transit.

Size	No. 11	No. 12	No. 13	No. 13 1/2	No. 14	No. 15	No. 16
Quantity in case	24	24	24	12	12	6	2
Extreme exterior size of cases, in inches	47x12x7	46x12x10	59x14x14	59x14x10	59x14x10	70x14x7	90x12x8
Gross weight, lbs.	154	235	425	317	390	344	306
Net weight, lbs.	132	215	376	277	351	300	260

**PARTS FOR AMMONIA UNIONS—Unfinished
Drop-forged from Steel**

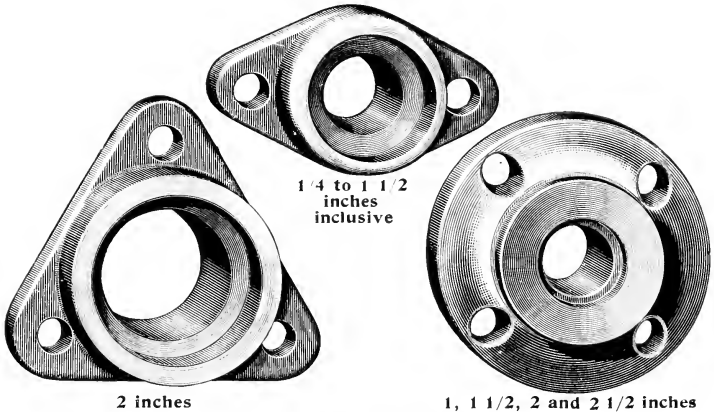
FERRULES



Size, for pipe	1/4	1/2	3/4	1	1 1/4	1 1/2	2
Diameter outside	1 3/8	1 3/8	1 9/16	1 7/8	2 5/16	2 9/16	3 1/8
Diameter inside	1 3/2	1 3/8	1 1/16	1 1/4	1 9/16	1 15/16	2 3/16
Length	3/2	7/8	7/8	1	1	1 1/8	1 3/4
Price, each	\$.05	.06	.07	.09	.11	.14	.26

For other rings see Shafting Collars, page 54.

FLANGES



2 inches

1/4 to 1 1/2
inches
inclusive

1, 1 1/2, 2 and 2 1/2 inches

Oval and Triangular

Size, for pipe	1/4	1/2	3/4	1	1 1/4	1 1/2	2
Length over all	3 1/8	3 1/2	4	4 1/2	5	5 5/8	5
Width over all	1 11/16	2 1/16	2 1/16	2 9/16	2 7/8	3 1/16	3 1/4
Thickness at centre	1	1	1	1 1/4	1 3/8	1 3/8	1 3/8
Thickness at bolt-holes	7/16	7/16	7/16	1 1/2	9/16	9/16	9/16
Distance bet. bolt-holes (C to C)	2 1/16	2 1/16	2 7/8	3 1/4	3 5/8	4 1/8	4 1/16
Diameter of bolt-holes	7/16	1 1/2	1 1/2	9/16	9/16	9/16	9/16
Diameter of recess (for packing)	1 3/2	1 3/8	1 9/16	1 7/8	2 5/16	2 9/16	3 1/8
Depth of recess (for packing)	7/16	1/4	1/16	3/8	3/8	3/8	3/8
Price, each	\$.11	.12	.14	.17	.24	.30	.44

Round Flanges, like cut, for 1, 1 1/4, 2 and 2 1/2 inch pipe and **Oval Flange** with center hole solid to be drilled for 3/4 to 3/4 inch pipe to order in quantities.
Full size drawings sent on request.

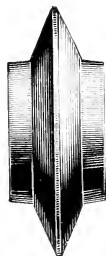
STANWOOD CUTTER WHEEL FORGINGS

No. 2, Exact Size

UNFINISHED



Drop-forged from tool steel and carefully annealed and pickled. They are centered on both sides and are forged accurately so that the expense of finishing is reduced to a minimum. Cutter wheels made from these forgings are better and cheaper than those cut from the solid bar.



Other designs are also kept in stock; details on application

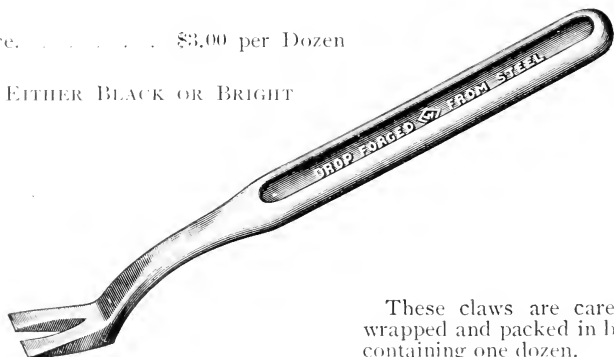
Number	Diameter, Unfinished	Thickness Hub, Unfinished	Width Hub, Unfinished	Price, per 100
1	1 $\frac{1}{16}$	15	5	\$5.00
2	1 $\frac{13}{32}$	9	3	7.00
3	2 $\frac{1}{16}$	11	1 $\frac{1}{32}$	16.00

DROP-FORGED STEEL TACK CLAWS

Tempered and Warranted

Price. \$3.00 per Dozen

EITHER BLACK OR BRIGHT



These claws are carefully wrapped and packed in boxes containing one dozen.

MISCELLANEOUS SPECIALTIES

Full size drawings or samples will be sent on request. Prices on application.



Style No. 3.



Style No. 4.

Thumb Screws—Diam. Shanks $\frac{1}{2}$ in. Any length, blank or threaded, in quantities. For other Thumb Screws, see page 55.



Air Valves—2 sizes.

Number	Length	Diam. Head	Spread of Wings	Diam. Stem
5656	$3\frac{1}{2}$	2	2 $\frac{3}{4}$	$\frac{7}{8}$
5657	5	$3\frac{3}{16}$	4	$1\frac{1}{8}$

Furnished to order in quantities, unfinished. For other Valves, see pages 52, 53.



Hammock Hooks—U. S. Government pattern.

Extreme Length $4\frac{1}{2}$ in. Drilled for $\frac{1}{2}$ in. bolt; special sizes to order in quantities.



Car Register Handles—2 sizes.

Number	Maximum Square	Openings Round	Extreme Length	Outside Diam. Head
4529	$\frac{1}{2}$	$\frac{11}{16}$	$5\frac{1}{2}$	$1\frac{1}{4}$
5252	$\frac{3}{8}$	$\frac{11}{16}$	$5\frac{1}{4}$	$1\frac{1}{4}$



Toggle Pins—5 sizes.

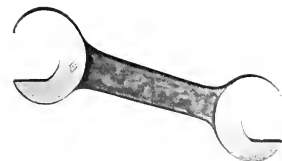
Diam. Shanks $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$, 1, 1 1/8
Length " 5, 5 1/2, 4 1/2, 4 3/4, 5 1/8
Furnished to order in quantities, unfinished.



Single Head Socket Wrenches—2 sizes.

Number	Extreme Length	Diam. Head	MAXIMUM OPENINGS	
			Square	Hex. across Flats
5676	6 1/4	2 5/8	1 7/8	1 7/8
5677	6 1/2	1 7/8	3 1/2	3 1/2

Furnished in quantities with openings in head broached square or hexagon; details on application. For other Socket Wrenches see page 28 to 31.



Double Head Check-Nut Wrench, No. 97 1/2.

Extreme Length 8 in. Thickness Heads $\frac{1}{2}$ in. Openings milled $1\frac{1}{4}$ and $1\frac{7}{16}$ in. for $\frac{3}{4}$ and $\frac{7}{8}$ in. U. S. Standard Nuts.

Milled to special sizes when required. See on page 9 the conditions in which they are furnished. For Single Head Check-Nut Wrenches see page 17.

A full line of Caliper or Snap Gauge Forgings for $\frac{1}{4}$ to 4 inches inclusive, in preparation.

Special Code for Wrenches, Lathe Dogs and Hoist Hooks with Quantities

Supplemental to Codes used as per Page 7.

Cable Address—"Willrich, Brooklyn"

When using this code, add the number showing sizes desired; for example: a dispatch reading "Isolation fifteen" would order 10 unfinished wrenches No. 15; reading "Muster four ten twelve" it would order 5 each Nos. 4, 10, 12 Semi-finished wrenches. A dispatch reading "Islet six Mustiness eight Zinepro eight" would order 4 unfinished wrenches No. 6, 10 semi-finished wrenches No. 8 and 15 lathe dogs No. 8; a dispatch reading "Putamen two Zodiac twenty-six Hydropic seven" would order 2 finished wrenches No. 2, 25 lathe dogs No. 26 and 10 Vulcan hoist hooks No. 7.

A further saving may be made by using in connection with this code, the "Table of Numerals," pages 749-757 Lieber's Standard Code (1898), or the "Serial Numbers," pages 632-641 Western Union Code (1900). Thus a dispatch reading "Isolation Sabientes" (W. U. Code) would mean 10 unfinished wrenches each, Nos. 10, 11, 12, 13, 14, 15, 17 and 18. and a dispatch reading "Hylobate Sibmah" (W. U. Code) would mean 20 Vulcan hoist hooks each, Nos. 2, 3, 4, 5.

Table Combining Quantities and Goods

Quantities	Unfinished Wrenches	Semi-finished Wrenches	Finished Wrenches	Lathe Dogs	Vulcan Hoist Hooks	Quantities
1	Islam	Muslin	Pustular	Zealless	Hybrid	1
2	Islamitic	Musquash	Putamen	Zealot	Hyalite	2
3	Islander	Musrol	Putative	Zedoary	Hydra	3
4	Islet	Mussel	Putrid	Zeolite	Hydrant	4
5	Isolate	Muster	Putty	Zibilina	Hydrogen	5
6	Ironed	Musician	Putrescent	Zarathan	Hurler	6
10	Isolation	Mustiness	Puzzle	Zimborio	Hydropic	10
12	Irongate	Musket	Pirate	Zeladora	Hurrah	12
15	Isosceles	Mutable	Pigmy	Zinepro	Hygeian	15
20	Issuing	Mutage	Pyramid	Zinkenite	Hylobate	20
25	Isthmian	Mutation	Pyrite	Zodiac	Hymn	25
30	Italics	Mutely	Pyrology	Zolfatea	Hyphen	30
40	Iterate	Mutilate	Pyroscope	Zoneless	Hyssop	40
50	Ivory	Mutineer	Putridness	Zufolare	Hyperbola	50
100	Ivy	Mutton	Pyritical	Zumology	Hypericon	100
150	Itching	Mutual	Pyrotechny	Zozymus	Hypnology	150
200	Isthmus	Muzzle	Putridity	Zumbayar	Hymeneal	200

CODE FOR VULCAN CHAIN PIPE WRENCHES

Cable address, "WILLRICH, BROOKLYN"

Table Combining Sizes and Quantities With Flat Link Chains

Quantity Wanted	No. 10	No. 11	No. 12	No. 13	No. 13 1/2	No. 14	No. 15	No. 16	Quantity Wanted
1	Vacca	Valerus	Vasatal	Velinum	Vennones	Vergilia	Vertumnus	Viadrus	1
2	Vadavero	Valgato	Vasarhely	Veliocassi	Venidius	Verginius	Verulanus	Vialis	2
3	Vadimonis	Valgdai	Vascones	Veliturna	Veuleters	Vergium	Vesagus	Viasma	3
4	Vaga	Valgius	Vasilipot	Velites	Venusium	Vergobret	Vesbius	Vibidia	4
5	Vagedrusa	Vallebana	Vaticanus	Velitrac	Vepicus	Vermiejo	Vescianus	Vibiones	5
6	Vagevano	Villia	Vindex	Virbus	Viridom	Viselus	Visurgis	Vipsani	6
10	Vagellius	Valombro	Vatinus	Vellari	Virdunia	Verodocti	Vescular	Vibius	10
12	Vittellia	Viterbon	Vitator	Vitricus	Vogesus	Voconitia	Vogheral	Volagin	12
15	Vageni	Vaniah	Vatronus	Velletri	Veragri	Veromanda	Veseris	Vibo	15
20	Vagesus	Vaudalia	Vaucluse	Venatrum	Verabia	Veronesum	Vesevas	Vibuleus	20
25	Vahalis	Vaugiones	Vauconicus	Venaisin	Verbigenus	Veronica	Vesontis	Vibullius	25
30	Vaicus	Vannius	Velabrum	Venango	Vercelac	Verrugo	Vesoul	Vicapota	30
35	Vajetha	Varanes	Velanus	Venedae	Vereginum	Versetz	Vestales	Vicellus	35
40	Valamirus	Vardaei	Veleda	Venilia	Veretum	Vertagus	Vesticus	Vicintia	40
45	Valentia	Variabra	Veia	Venilia	Vergasil	Vertisium	Vestilium	Victorina	45
50	Valerianus	Vashti	Velbrijo	Venloo	Vergellus	Vertisens	Vestini	Victumvia	50
100	Votienus	Vulcovan	Vulcanadia	Vulcatius	Vulsinum	Vultura	Vulturum	Vulturius	100

A despatch reading "Valgius" would order four No. 11 with Flat Link Chains; a despatch reading "Vepicus Verrugo" would order five No. 13½ and thirty No. 14 with Flat Link Chains.

If wrenches are wanted with Cable Chain, add the code word "Vophsif"; a despatch reading "Veleda Vophsif Velinum" would order forty No. 12 with Cable Chain and one No 13 with Flat Link Chain.

PARTS: { One pair of Jaws for Vulcan Chain Pipe Wrench Code word, "Vesulusia."
 { One-half pair Jaws for Vulcan Chain Pipe Wrench Code word, "Vettius."
 { Flat Link Chain for Vulcan Chain Pipe Wrench Code word, "Veturia."
 { Cable Chain for Vulcan Chain Pipe Wrench Code word, "Vetlonia."

For details of Vulcan Wrenches see page 57.

CODE FOR STANDARD SPECIALTIES

Supplemental to Codes used as per page 7

Cable Address—"Willrich, Brooklyn"

Koppelaars	Air Valves.	Koppelbord	Toggle Pins.
Kopglas	Automobile Axle End.	Kopfhalter	Tool Posts.
Kopfwurm	Automobile Steering Gear Parts.	Kopfhaaren	Tool Post Rings.
Kopfzeug	Automobile Steering Knuckle.	Kopfhaar	Tool Post Wedges.
Kopfwunde	Crank Shafts.	Kopierbuch	Valve Stems.
Kopfunter	Connecting Rods.	Kopfueber	Wire Rope Sockets, closed.
Kopflaenge	Eye Bolts—forgings.	Kopituches	Wire Rope Sockets, open.
Kopflauch	Eye Bolts—threaded.		
Kopfringes	Ferrule Forgings for Ammonia Unions.	Wrenches	
Kopfriemen	Flange Forgings for Ammonia Unions.	Kopfarbeit	Box Wrenches, single-head.
Koppelbalk	Hammock Hooks.	Kopftoenen	Car Wrenches.
Koppelband	Handles—Car Register.	Kopfskegel	Check-nut Wrenches.
Kopfkissen	Handles—Crank, broached.	Kopfgicht	Construction Wrenches.
Kopfkierer	Handles—Crank, finished.	Koperkies	Engineers' Wrenches, double-head.
Kopfkohl	Handles—Crank, forgings.	Koperig	Engineers' Wrenches, single-head.
Kopflös	Handles—Machine, ball pattern.	Kopfschild	Hexagon Cap-Screw Wrenches.
Kopflöser	Handles—Machine, cone pattern.	Kopfstimme	Machine Wrenches.
Kopftuch	Hoist Hooks, Eye.	Kopfende	"S" Wrenches.
Kopftön	Hoist Hooks, Shank.	Koperwerk	Set-Screw Wrenches, double-head.
Kopfuebung	Igniter Levers.	Kopersteen	Set-Screw Wrenches, single-head.
Kopfhaut	Key Forgings	Koperzout	Set-Screw Wrenches, triple-head.
Kopflerche	Lathe Dogs—Bent Tail.	Kopfstueck	Socket Wrenches, double-head.
Kopflinie	Lathe Dogs—Straight Tail.	Kopfstoss	Socket Wrenches, single-head.
Kopfputz	Pipe Cutter Wheel Forgings.	Kopfsohle	Straight Concave Handle Wrenches.
Kopfwasser	Rod Ends.	Kopfseite	Taper-Handle Wrenches.
Kopfputzes	Shafting Collars.	Kopfbandes	Tool Post Wrenches.
Kopfsteuer	Spanners—Face.	Kopfartig	Track Wrenches.
Kopfsprung	Spanners—Hook.	Koperzout	Triple-Head Wrenches.
Kopfgelder	Spanners—Light Hook.	Kopialien	Vulcan Chain Pipe Wrenches.
Kopfgeld	Spanners—Pin.		
Kophamers	Starting Lever.	Koperslak	Openings to be Milled.
Kopmessen	Tack Claws, Black.	Koppelbout	Openings to be U. S. Standard.
Kopfschatz	Tack Claws, Bright.	Koperslaan	Openings to be Whitworth Standard.
Kopfmohr	Thumb Nuts, Blank.		
Kopfmuskel	Thumb Nuts, threaded.	Kopernikus	Wrenches are wanted Finished.
Kopfnicken	Thumb-Screw Blanks, plain.	Koperoker	Wrenches are wanted Semi-finished.
Kopfpain	Thumb-Screw Blanks, shoulder.	Kopperoest	Wrenches are wanted Un-finished.
Kopfpuehl	Thumb-Screws threaded, plain.		
Kopfplatte	Thumb-Screws threaded, shoulder.		

Code for Phrases Relating to Orders for Special Forgings

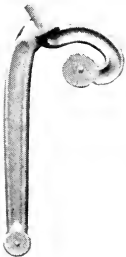
Supplemental to Codes used as per page 7

Cable Address—"Willrich, Brooklyn"

SUBJECT	CODE WORD	PHRASE
Allowance	Kourgan	We will add usual allowance for machining (1/32 in. or .9 m/m) on surfaces marked.
	Kourilien	We will add usual allowance for machining (1/32 in. or .9 m/m) on each surface.
	Kourakin	We will add usual allowance for machining (1/32 in. or .9 m/m) plus draft.
	Kourkho	What allowance shall we make for machining or grinding?
	Kouseband	Add your usual allowance (1/32 in. or .9 m/m) for machining.
	Kouso	Allow for finishing
Annealing	Krachneu	Forgings would be annealed.
	Krachsauer	We require forgings annealed.
	Krachtiger	We think annealing unnecessary.
Dies	Kraftgeist	Alter dies to
	Kraftmalz	New dies necessary.
	Kraftlehre	Dies broke while forging.
Draft	Kommiss	Add the necessary draft.
	Koukleum	Draft, if any, should be added.
	Koulbac	Draft, if needed, may be taken off.
	Kouler	Shall we allow usual draft—7 degrees?
	Koukarien	.....degrees draft necessary around edges, where dies part.
	Koudzweet	Draft is necessary inside and outside.
Koudvuur	Make as little draft as possible.	
Koudsmeden	Usual draft (7 degrees) on forgings will be satisfactory.	
Holes	Kraalboom	Forgings would be solid, without holes.
	Kraaidoorn	Holes would be centred for drilling.
	Kraakwater	Holes would be punched, leaving draft on edges.
Iron	Kraempeln	Drop-forgings from iron.
Lead-Proofs	Kraftreich	Lead-proof(s) is (are) satisfactory.
	Kraftquell	Lead-proof(s) is (are) not correct.
	Kraftstuhl	Is (are) lead-proof(s) correct?
	Kraftvoll	Lead-proof(s) not required.
	Kraitnuss	Is lead-proof required?
	Kragenent	Shall we send lead-proof, showing change?
	Kraftmehl	Lead-proof(s) has (have) been sent (by
Kraftmilch	Lead-proof(s) will be sent (by	
Pickled	Krachtvol	Forgings would be pickled.
	Kraechzen	We require forgings pickled.
	Kraechzet	We think pickling unnecessary.
	Krachten	Forgings would be annealed and pickled.
Sample	Kraamwaren	Sample(s)—or drawing(s)—is (are) forging size(s).
	Kraanbalk	Sample(s)—or drawing(s)—is (are) finished size(s).
	Kraanbek	Sample(s)—or drawing(s)—is (are) finished size(s) allow for machining on surfaces marked
	Kraanvogel	Is (are) sample(s)—or drawing(s)—forging or finished size(s)?
Steel	Kraenker	Drop-forgings from.....
	Kraemerin	Drop-forgings from soft steel.
	Kraenzen	Drop-forgings from open-hearth (Siemens-Martin) steel.

SPECIAL DROP-FORGINGS

THE art of forging with drop-hammers, which may be designated as "machine blacksmithing" developed about 1853 when Colonel Samuel Colt adopted these machines to make parts for fire-arms. They have since been greatly improved and the products of the drop-forging industry are now used in a great variety of mechanical arts, some of which we outline on page 70.



Drop-forgings are made in dies which are in two parts. One part is fastened in the ram or hammer itself, which moves vertically between two uprights or guides and is raised by means of friction rolls controlled by the operator: the other part is fixed in the anvil or base of the hammer. The ram rises until released, when it falls instantly, striking with the upper die the heated bar of metal placed on the bottom die and forcing it into impressions in both dies. By a series of such blows the completed article is formed. Since 1884 we have devoted ourselves exclusively to making the best quality of this work known generally as "Machine Forging". Our original forging plant was three drop-hammers: it now consists of forty-three drop-hammers with trip-hammers, steam hammers, upsetting machines and other apparatus, forming a complete plant.

The necessary dies are made from a drawing or model, preferably the latter, as it facilitates designing the dies and frequently permits our quoting lower prices than could be given from a drawing. We must know whether drawing or model shows finished or forging size: if finished size we need also to know the allowance desired in machining. It is usual to add $\frac{3}{32}$ inch on each surface to be machined unless the piece is to be finished by grinding or polishing only, in which case $\frac{1}{100}$ inch is allowed; surfaces not

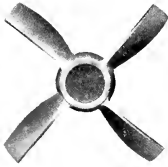
to be machined or ground are made close to size. Forgings vary slightly in thickness—say from $\frac{1}{100}$ inch to $\frac{1}{32}$ inch—depending on their shape and the material used. They can, however, be made to gauge by a re-striking operation; this often requires separate dies and entails additional expense. In addition to forging dies, the cost and endurance of which vary with the work required of them, trimming dies are necessary to remove the surplus metal thrown out between the forging dies in working.

We include but a portion of the cost of tools in our estimates and **cannot sell them at the price given in our quotations.** We prefer not to sell dies at all because designing them involves our best skill which we do not care to make generally available. Nor is it advantageous to the customer to **own** the dies for if made to suit our methods they are unlikely to work well elsewhere and alterations would be required before they would fit the machines in other shops. We assume all expense of breakage and maintenance of dies, keeping them ready for



our customer's service but should he own them, he would naturally take these risks. We charge practically only for the **exclusive use of dies**; this the customer controls, for we will not make forgings from them for others without his written consent.

The lead proof which we submit from each die to our customer often varies from the model or drawings by what is called "draft". This is the taper necessary on the forgings to permit drawing them from the dies while working and averages seven degrees. It can be obtained by adding to or taking from the forging; unless instructed to the contrary, we **add** the necessary draft



We carry a large and assorted stock of material but with new dies, where the size of metal required to make the forgings cannot be determined until they are tried in the hammer, delays in obtaining the right sizes sometimes occur. We cannot use poor material and drop-forgings are, therefore, not only superior to hand-forgings or castings, because the metal is improved by the forging operation but also because the nature of the process requires a good quality of material.

We are daily machining many varieties of the products of our own forge and can often determine from this experience what material is best for a customer's use and furnish it in proper condition for his processes.

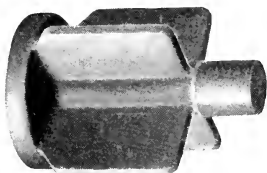
Forgings from steel of high carbon usually require annealing before they

can be machined; we have a large and modern equipment both for this work and for case-hardening. While making forgings we carefully brush them with steel wire brushes to remove the scale but if they are to be machined we pickle them in diluted sulphuric acid to ensure the complete removal of this hard outer surface. We sometimes tumble small pieces instead of pickling them.

We can often save customers expense if informed of the use for which the forgings are intended. The price is largely affected by the quantity made with one setting of the tools. It costs as much to set dies for 100 as for 1000 pieces and the forging work is also more costly in small lots. Prices for special drop-forgings are made per piece, not per pound and vary with the nature of the work, the material used and the quantity taken.

We guarantee quality of both workmanship and material and replace without charge forgings that are imperfect or defective but **we cannot be responsible for the cost of labor put on them after they have left our hands.**

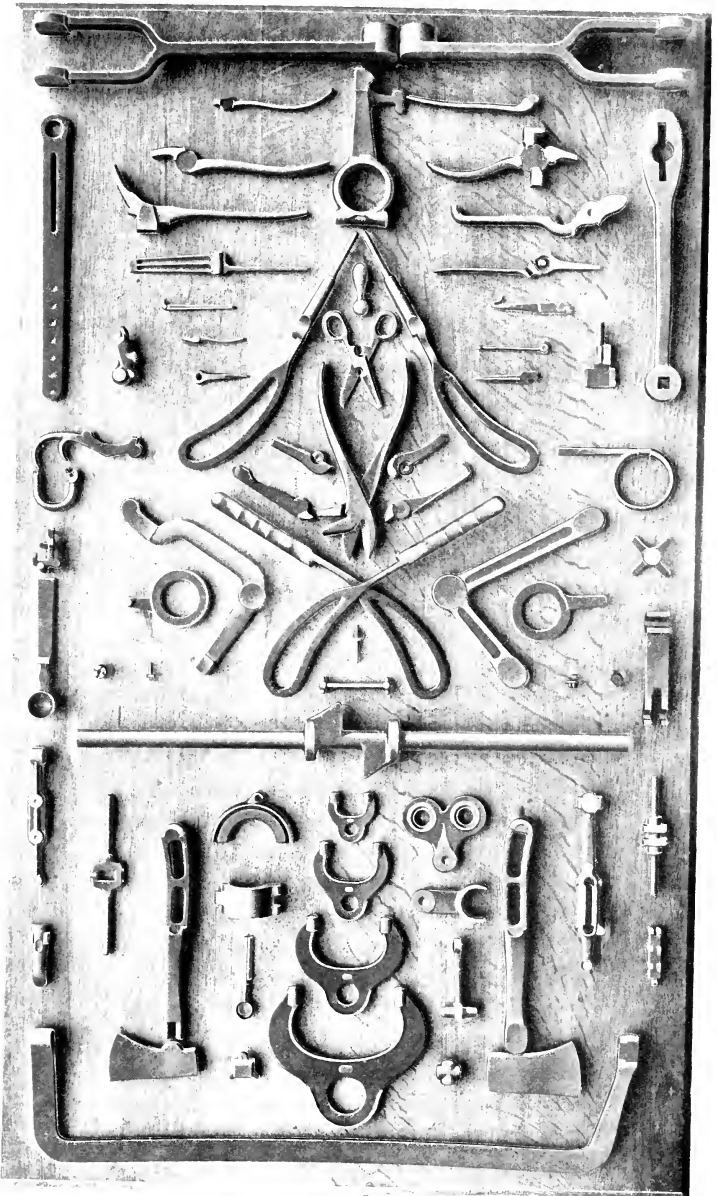
The cheapest forgings in the long run are those made uniform in size and quality and close to finished dimensions, thus saving labor, time, tools and money.



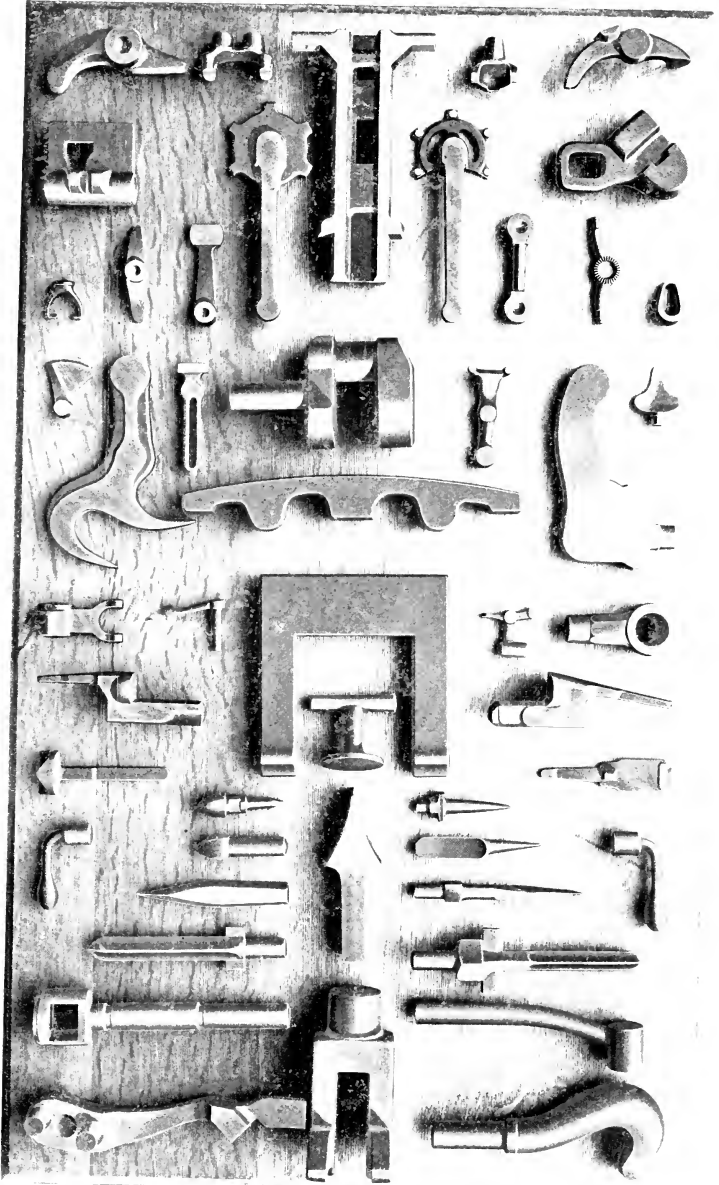
SPECIAL DROP-FORGINGS MADE FOR

Automobiles,	Adjustable and Solid Wrenches,
Bicycles,	Agricultural Machinery,
Bolt Cutters,	Air Compressors,
Carpenters' Tools,	Automatic Sprinklers,
Chucks,	Boilermakers' and Blacksmiths' Tools.
Conductors' Punches,	Bookbinders' Machinery,
Cooking Ranges,	Bottling and Wiring Machinery,
Dairy Machinery,	Cable Transmission Machinery,
Elevators,	Chain Links and Hooks,
Fire Arms,	Cotton, Flax, Jute and Wool Machinery,
Golf Irons,	Dynamos, Electric Motors and Apparatus,
Gymnasium Apparatus,	Harness and Saddlery,
Hydrants,	Hemp and Wire Rope Machinery
Injectors,	and Appliances.
Jewelers' Tools,	Hydraulic and Lever Jacks.
Knitting Machinery,	Ice Cutting Machinery.
Laundry Machinery	Lumbermen's Tools and Appliances.
Lawn Mowers,	Marine Specialties.
Locomotives,	Pipe Cutting and Threading Machinery.
Lubricators,	Pipe Wrenches, Cutters and Vises,
Machine Tools,	Printing Presses and Printers' Tools,
Machinists' Tools	Railway Brakes, Tools and Appliances.
Nail Pullers,	Refrigerating Machinery,
Oil Well Apparatus,	Rock Drills and Mining Machinery,
Ordnance,	Saw Mill Machinery,
Projectiles,	Steam, Gas and Hot Air Engines,
Ratchet Drills,	Stonecutters' Machinery and Tools.
Sewing Machines,	Store Service and Cash Registry
Shoe Machinery,	Machinery.
Special Nuts,	Surgical Instruments,
Steam Pumps,	Tap Wrenches and Dies,
Sugar Machinery.	Telephone and Telegraph Appliances.
Tobacco Machinery.	Trolley and Cable Railway Fittings.
Typewriters,	Weighing Machines.
Water Motors,	Wood-Working Machinery, etc.

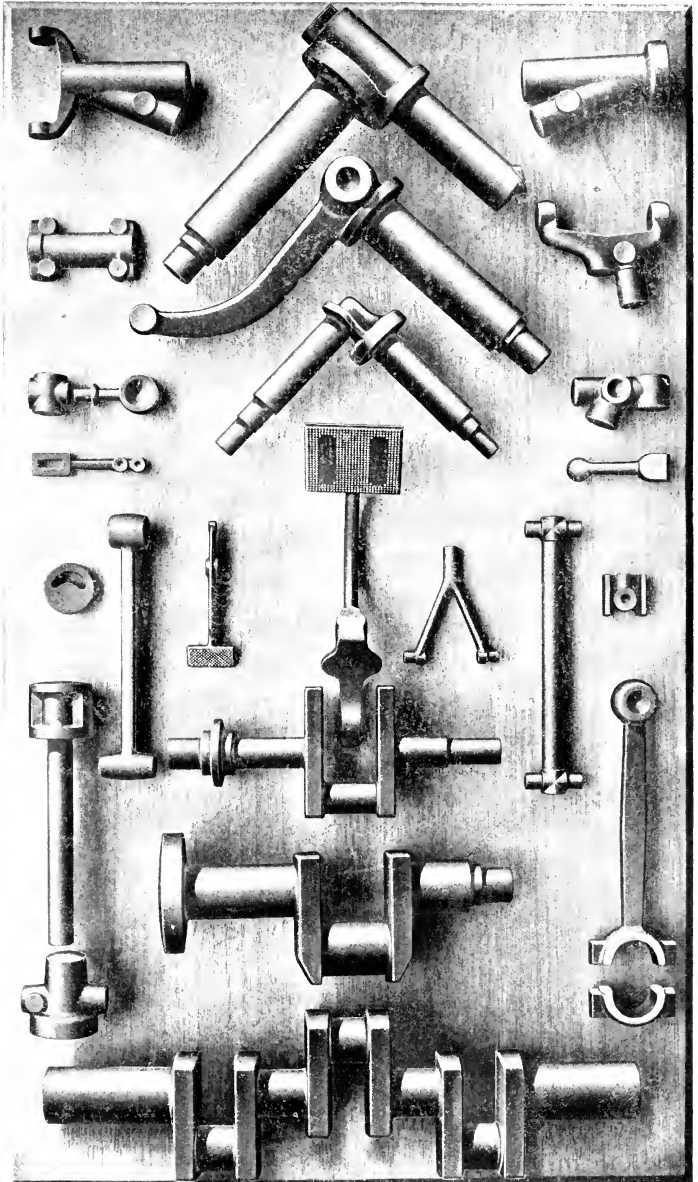
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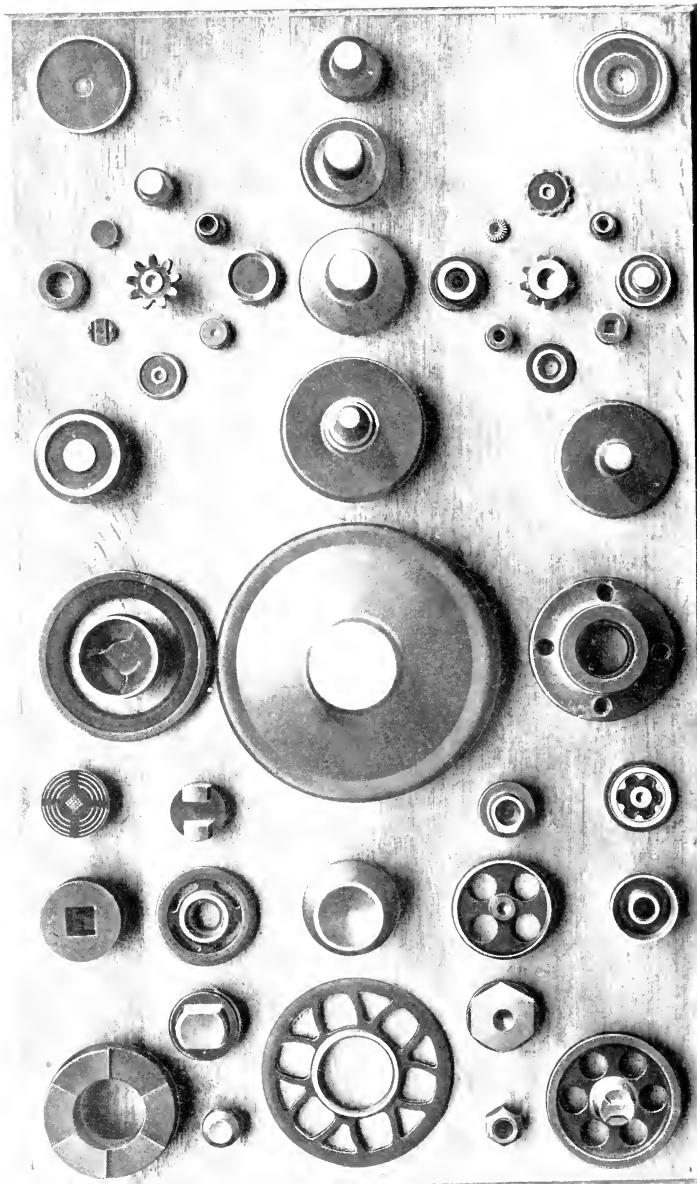
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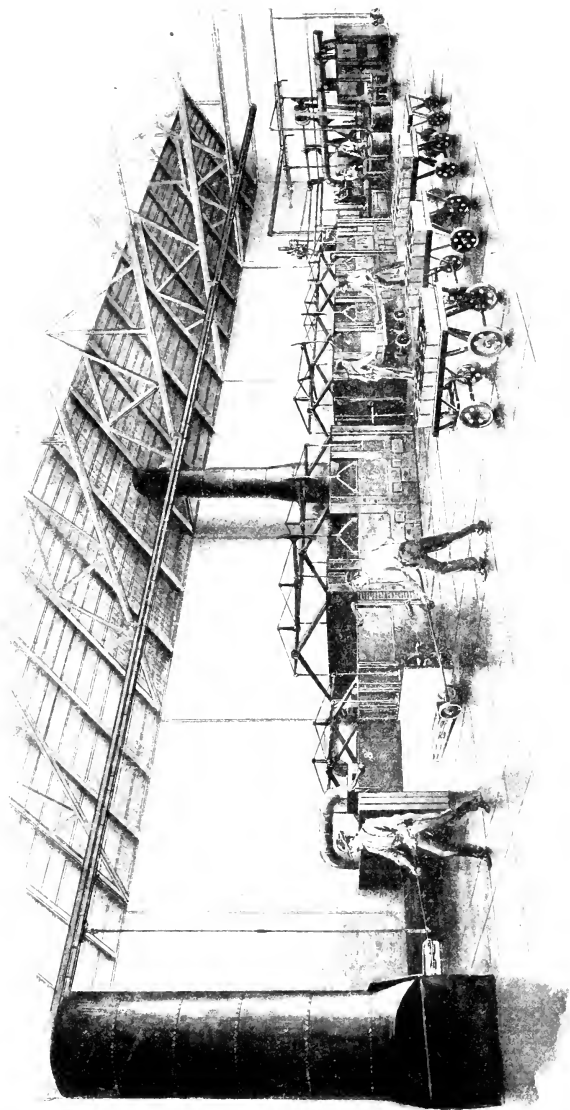


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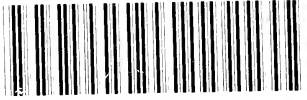


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