

APPLICATION FILED DEC. 1, 1911.

4 SHEETS-SHEET 1.

COMPUTING TABLE FOR N^o 23 as MULTIPLIER OR DIVISOR

DIVISION A										DIVISION B									
SECTION 1					SECTION 2					SECTION 3					SECTION 4				
a		b		c		d		e		a		b		c		d		e	
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
-a-	-a-	-a-	-a-	-a-	-a-	-a-	-a-	-a-	-a-	000	023	046	069	092	115	138	161	184	207
0	23	46	69	92	115	138	161	184	207	01	230	253	276	299	322	345	368	391	414
c	c	c	c	c	c	c	c	c	c	02	460	483	506	529	552	575	598	621	644
d	d	d	d	d	d	d	d	d	d	03	690	713	736	759	782	805	828	851	874
										04	920	943	966	989					
										04					012	035	058	081	104
1	24	47	70	93	116	139	162	185	208	05	150	173	196	219	242	265	288	311	334
										06	380	403	426	449	472	495	518	541	564
d	d	d	d	d	d	d	d	d	d	07	610	633	656	679	702	725	748	771	794
										08	840	863	886	909	932	955	978		
										08								001	024
2	25	48	71	94	117	140	163	186	209	09	070	093	116	139	162	185	208	231	254
										10	300	323	346	369	392	415	438	461	484
										11	530	553	576	599	622	645	668	691	714
d	d	d	d	d	d	d	d	d	d	12	760	783	806	829	852	875	898	921	944
										13	990								
										13		013	036	059	082	105	128	151	174
3	26	49	72	95	118	141	164	187	210	14	220	243	266	289	312	335	358	381	404
										15	450	473	496	519	542	565	588	611	634
d	d	d	d	d	d	d	d	d	d	16	680	703	726	749	772	795	818	841	864
										17	910	933	956	979					
										17					002	025	048	071	094

Fig. 1.

Witnesses
R. Kohl

Ruth C. Miller

John Knause

264

Harry Freese

Attorney

J. KNAUSE.
COMPUTING TABLE.

APPLICATION FILED DEC. 1, 1911

1,037,640.

Patented Sept. 3, 1912.

4 SHEETS—SHEET 2.

Fig. 2.

COMPUTING TABLE
For No 89 as Multiplier or Divisor

PART 1

DIVISION A										DIVISION B									
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
0	89	178	267	356	445	534	623	712	801	00	000	089	178	267	356	445	534	623	712
1	90	179	268	357	446	535	624	713	802	01	890	979							
2	91	180	269	358	447	536	625	714	803	02	780	869	958						
3	92	181	270	359	448	537	626	715	804	03	670	759	848	937					
4	93	182	271	360	449	538	627	716	805	04	560	649	738	827	916				
5	94	183	272	361	450	539	628	717	806	05	450	539	628	717	806	895	984		
6	95	184	273	362	451	540	629	718	807	06	340	429	518	607	696	785	874	963	
7	96	185	274	363	452	541	630	719	808	07	230	319	408	497	586	675	764	853	942
8	97	186	275	364	453	542	631	720	809	08	120	209	298	387	476	565	654	743	832
9	98	187	276	365	454	543	632	721	810	09	010	099	188	277	366	455	544	633	722
10	99	188	277	366	455	544	633	722	811	10	900	989							
11	100	189	278	367	456	545	634	723	812	11	790	879	968						
12	101	190	279	368	457	546	635	724	813	12	680	769	858	947					
13	102	191	280	369	458	547	636	725	814	13	570	659	748	837	926				
14	103	192	281	370	459	548	637	726	815	14	460	549	638	727	816	905	994		
15	104	193	282	371	460	549	638	727	816	15	350	439	528	617	706	795	884	973	
16	105	194	283	372	461	550	639	728	817	16	240	329	418	507	596	685	774	863	952
17	106	195	284	373	462	551	640	729	818	17	130	219	308	397	486	575	664	753	842
18	107	196	285	374	463	552	641	730	819	18	020	109	198	287	376	465	554	643	732
19	108	197	286	375	464	553	642	731	820	19	910	999							
20	109	198	287	376	465	554	643	732	821	20	800	889	978						
21	110	199	288	377	466	555	644	733	822	21	690	779	868	957					
22	111	200	289	378	467	556	645	734	823	22	580	669	758	847	936				
23	112	201	290	379	468	557	646	735	824	23	470	559	648	737	826	915			
24	113	202	291	380	469	558	647	736	825	24	360	449	538	627	716	805	894	983	
25	114	203	292	381	470	559	648	737	826	25	250	339	428	517	606	695	784	873	962
26	115	204	293	382	471	560	649	738	827	26	140	229	318	407	496	585	674	763	852
27	116	205	294	383	472	561	650	739	828	27	030	119	208	297	386	475	564	653	742
28	117	206	295	384	473	562	651	740	829	28	920								
29	118	207	296	385	474	563	652	741	830	29	810	899	988						
30	119	208	297	386	475	564	653	742	831	30	700	789	878	967					
31	120	209	298	387	476	565	654	743	832	31	590	679	768	857	946				
32	121	210	299	388	477	566	655	744	833	32	480	569	658	747	836	925			
33	122	211	300	389	478	567	656	745	834	33	370	459	548	637	726	815	904	993	
34	123	212	301	390	479	568	657	746	835	34	260	349	438	527	616	705	794	883	972
35	124	213	302	391	480	569	658	747	836	35	150	239	328	417	506	595	684	773	862
36	125	214	303	392	481	570	659	748	837	36	040	129	218	307	396	485	574	663	752
37	126	215	304	393	482	571	660	749	838	37	930								
38	127	216	305	394	483	572	661	750	839	38	820	909	998						
39	128	217	306	395	484	573	662	751	840	39	710	799	888	977					
40	129	218	307	396	485	574	663	752	841	40	600	689	778	867	956				
41	130	219	308	397	486	575	664	753	842	41	490	579	668	757	846	935			
42	131	300	398	487	576	665	754	843		42	380	469	558	647	736	825	914		
43	132	301	310	399	488	577	666	755	844	43	270	359	448	537	626	715	804	893	982
44	133	312	311	400	489	578	667	756	845	44	160	249	338	427	516	605	694	783	872
										45	050	139	228	317	406	495	584	673	762
										46	940								
										47	830	919							
										48	720	809	898	987					
										49	610	699	788	877	966				
										50	500	589	678	767	856	945			

Witnesses:
Arthur C. Miller

Inventor:
John Knause
By *Harry H. Knause* Attorney

J. KNAUSE.

COMPUTING TABLE.

APPLICATION FILED DEC. 1, 1911.

Patented Sept. 3, 1912.

4 SHEETS—SHEET 3.

1,037,640.

Fig. 3.

COMPUTING TABLE
For N° 89 as MULTIPLIER OR DIVISOR.

PART 2																			
a DIVISION A										b DIVISION B									
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
15	134	223	312	401	490	579	668	757	846	50	390	479	568	657	746	835	924	1013	1102
46	137	224	313	402	491	580	669	758	847	51	391	480	569	658	747	836	925	1014	1103
47	138	225	314	403	492	581	670	759	848	52	392	481	570	659	748	837	926	1015	1104
48	139	226	315	404	493	582	671	760	849	53	393	482	571	660	749	838	927	1016	1105
49	140	227	316	405	494	583	672	761	850	54	394	483	572	661	750	839	928	1017	1106
50	141	228	317	406	495	584	673	762	851	55	395	484	573	662	751	840	929	1018	1107
51	142	229	318	407	496	585	674	763	852	56	396	485	574	663	752	841	930	1019	1108
52	143	230	319	408	497	586	675	764	853	57	397	486	575	664	753	842	931	1020	1109
53	144	231	320	409	498	587	676	765	854	58	398	487	576	665	754	843	932	1021	1110
54	145	232	321	410	499	588	677	766	855	59	399	488	577	666	755	844	933	1022	1111
55	146	233	322	411	500	589	678	767	856	60	400	489	578	667	756	845	934	1023	1112
56	147	234	323	412	501	590	679	768	857	61	401	490	579	668	757	846	935	1024	1113
57	148	235	324	413	502	591	680	769	858	62	402	491	580	669	758	847	936	1025	1114
58	149	236	325	414	503	592	681	770	859	63	403	492	581	670	759	848	937	1026	1115
59	150	237	326	415	504	593	682	771	860	64	404	493	582	671	760	849	938	1027	1116
60	151	238	327	416	505	594	683	772	861	65	405	494	583	672	761	850	939	1028	1117
61	152	239	328	417	506	595	684	773	862	66	406	495	584	673	762	851	940	1029	1118
62	153	240	329	418	507	596	685	774	863	67	407	496	585	674	763	852	941	1030	1119
63	154	241	330	419	508	597	686	775	864	68	408	497	586	675	764	853	942	1031	1120
64	155	242	331	420	509	598	687	776	865	69	409	498	587	676	765	854	943	1032	1121
65	156	243	332	421	510	599	688	777	866	70	410	499	588	677	766	855	944	1033	1122
66	157	244	333	422	511	600	689	778	867	71	411	500	589	678	767	856	945	1034	1123
67	158	245	334	423	512	601	690	779	868	72	412	501	590	679	768	857	946	1035	1124
68	159	246	335	424	513	602	691	780	869	73	413	502	591	680	769	858	947	1036	1125
69	160	247	336	425	514	603	692	781	870	74	414	503	592	681	770	859	948	1037	1126
70	161	248	337	426	515	604	693	782	871	75	415	504	593	682	771	860	949	1038	1127
71	162	249	338	427	516	605	694	783	872	76	416	505	594	683	772	861	950	1039	1128
72	163	250	339	428	517	606	695	784	873	77	417	506	595	684	773	862	951	1040	1129
73	164	251	340	429	518	607	696	785	874	78	418	507	596	685	774	863	952	1041	1130
74	165	252	341	430	519	608	697	786	875	79	419	508	597	686	775	864	953	1042	1131
75	166	253	342	431	520	609	698	787	876	80	420	509	598	687	776	865	954	1043	1132
76	167	254	343	432	521	610	699	788	877	81	421	510	599	688	777	866	955	1044	1133
77	168	255	344	433	522	611	700	789	878	82	422	511	600	689	778	867	956	1045	1134
78	169	256	345	434	523	612	701	790	879	83	423	512	601	690	779	868	957	1046	1135
79	170	257	346	435	524	613	702	791	880	84	424	513	602	691	780	869	958	1047	1136
80	171	258	347	436	525	614	703	792	881	85	425	514	603	692	781	870	959	1048	1137
81	172	259	348	437	526	615	704	793	882	86	426	515	604	693	782	871	960	1049	1138
82	173	260	349	438	527	616	705	794	883	87	427	516	605	694	783	872	961	1050	1139
83	174	261	350	439	528	617	706	795	884	88	428	517	606	695	784	873	962	1051	1140
84	175	262	351	440	529	618	707	796	885	89	429	518	607	696	785	874	963	1052	1141
85	176	263	352	441	530	619	708	797	886	90	430	519	608	697	786	875	964	1053	1142
86	177	264	353	442	531	620	709	798	887	91	431	520	609	698	787	876	965	1054	1143
87	178	265	354	443	532	621	710	799	888	92	432	521	610	699	788	877	966	1055	1144
88	179	266	355	444	533	622	711	800	889	93	433	522	611	700	789	878	967	1056	1145

Witnesses:
Ed. H. Hohl
Ruth A. Miller

Inventor:
John Knause
by Harry Trease
Attorney

J. KNAUSE.

COMPUTING TABLE.

APPLICATION FILED DEC. 1, 1911

Patented Sept. 3, 1912.

4 SHEETS-SHEET 4.

1,037,640.

COMPUTING TABLE FOR N^o 99 as MULTIPLIER OR DIVISOR.

SECTION 1

SECTION 2

SECTION 4

DIVISION A										DIVISION B										DIVISION C									
a										a										a									
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
0	0	55	108	162	216	270	324	378	432	000	0000	0009	0018	0027	0036	0045	0054	0063	0072	0081	0000	0009	0018	0027	0036	0045	0054	0063	0072
1	990	1079	1168	1257	1346	1435	1524	1613	1702	001	0990	1079	1168	1257	1345	1434	1523	1612	1701	002	1980	2069	2158	2247	2336	2425	2514	2603	2692
2	1980	2070	2160	2250	2340	2430	2520	2610	2700	003	0990	1079	1168	1257	1345	1434	1523	1612	1701	004	2970	3060	3150	3240	3330	3420	3510	3600	3690
3	2970	3060	3160	3240	3360	3465	3564	3663	3762	005	2970	3060	3160	3247	3346	3445	3544	3643	3742	006	3960	4050	4140	4230	4320	4410	4500	4590	4680
4	3960	4050	4140	4230	4320	4410	4500	4590	4680	007	3960	4050	4140	4230	4320	4410	4500	4590	4680	008	4950	5040	5130	5220	5310	5400	5490	5580	5670
5	4950	5040	5130	5220	5310	5400	5490	5580	5670	009	4950	5040	5130	5220	5310	5400	5490	5580	5670	010	5940	6030	6120	6210	6300	6390	6480	6570	6660
6	5940	6030	6120	6210	6300	6390	6480	6570	6660	011	5940	6030	6120	6210	6300	6390	6480	6570	6660	012	6930	7020	7110	7200	7290	7380	7470	7560	7650
7	6930	7020	7110	7200	7290	7380	7470	7560	7650	013	6930	7020	7110	7200	7290	7380	7470	7560	7650	014	7920	8010	8100	8190	8280	8370	8460	8550	8640
8	7920	8010	8100	8190	8280	8370	8460	8550	8640	015	7920	8010	8100	8190	8280	8370	8460	8550	8640	016	8910	9000	9090	9180	9270	9360	9450	9540	9630
9	8910	9000	9090	9180	9270	9360	9450	9540	9630	017	8910	9000	9090	9180	9270	9360	9450	9540	9630	018	9900	9990	10080	10170	10260	10350	10440	10530	10620
0	1	100	199	298	397	496	595	694	793	019	0000	0009	0018	0027	0036	0045	0054	0063	0072	020	0990	1079	1168	1257	1345	1434	1523	1612	1701
1	991	1090	1189	1288	1387	1486	1585	1684	1783	021	0990	1079	1168	1257	1345	1434	1523	1612	1701	022	1980	2069	2158	2247	2336	2425	2514	2603	2692
2	1981	2080	2179	2278	2377	2476	2575	2674	2773	023	1980	2069	2158	2247	2336	2425	2514	2603	2692	024	2970	3060	3150	3240	3330	3420	3510	3600	3690
3	2971	3070	3169	3268	3367	3466	3565	3664	3763	025	2970	3060	3150	3240	3330	3420	3510	3600	3690	026	3960	4050	4140	4230	4320	4410	4500	4590	4680
4	3961	4060	4159	4258	4357	4456	4555	4654	4753	027	3960	4050	4140	4230	4320	4410	4500	4590	4680	028	4950	5040	5130	5220	5310	5400	5490	5580	5670
5	4951	5050	5149	5248	5347	5446	5545	5644	5743	029	4950	5040	5130	5220	5310	5400	5490	5580	5670	030	5940	6030	6120	6210	6300	6390	6480	6570	6660
6	5941	6040	6139	6238	6337	6436	6535	6634	6733	031	5940	6030	6120	6210	6300	6390	6480	6570	6660	032	6930	7020	7110	7200	7290	7380	7470	7560	7650
7	6931	7030	7129	7228	7327	7426	7525	7624	7723	033	6930	7020	7110	7200	7290	7380	7470	7560	7650	034	7920	8010	8100	8190	8280	8370	8460	8550	8640
8	7921	8020	8119	8218	8317	8416	8515	8614	8713	035	7920	8010	8100	8190	8280	8370	8460	8550	8640	036	8910	9000	9090	9180	9270	9360	9450	9540	9630
9	8911	9010	9109	9208	9307	9406	9505	9604	9703	037	8910	9000	9090	9180	9270	9360	9450	9540	9630	038	9900	9990	10080	10170	10260	10350	10440	10530	10620
0	2	101	200	299	398	497	596	695	794	039	0000	0009	0018	0027	0036	0045	0054	0063	0072	040	0990	1079	1168	1257	1345	1434	1523	1612	1701
1	992	1091	1190	1289	1388	1487	1586	1685	1784	041	0990	1079	1168	1257	1345	1434	1523	1612	1701	042	1980	2069	2158	2247	2336	2425	2514	2603	2692
2	1982	2081	2180	2279	2378	2477	2576	2675	2774	043	1980	2069	2158	2247	2336	2425	2514	2603	2692	044	2970	3060	3150	3240	3330	3420	3510	3600	3690
3	2972	3071	3170	3269	3368	3467	3566	3665	3764	045	2970	3060	3150	3240	3330	3420	3510	3600	3690	046	3960	4050	4140	4230	4320	4410	4500	4590	4680
4	3962	4061	4160	4259	4358	4457	4556	4655	4754	047	3960	4050	4140	4230	4320	4410	4500	4590	4680	048	4950	5040	5130	5220	5310	5400	5490	5580	5670
5	4952	5051	5150	5249	5348	5447	5546	5645	5744	049	4950	5040	5130	5220	5310	5400	5490	5580	5670	050	5940	6030	6120	6210	6300	6390	6480	6570	6660
6	5942	6041	6140	6239	6338	6437	6536	6635	6734	051	5940	6030	6120	6210	6300	6390	6480	6570	6660	052	6930	7020	7110	7200	7290	7380	7470	7560	7650
7	6932	7031	7130	7229	7328	7427	7526	7625	7724	053	6930	7020	7110	7200	7290	7380	7470	7560	7650	054	7920	8010	8100	8190	8280	8370	8460	8550	8640
8	7922	8021	8120	8219	8318	8417	8516	8615	8714	055	7920	8010	8100	8190	8280	8370	8460	8550	8640	056	8910	9000	9090	9180	9270	9360	9450	9540	9630
9	8912	9011	9110	9209	9308	9407	9506	9605	9704	057	8910	9000	9090	9180	9270	9360	9450	9540	9630	058	9900	9990	10080	10170	10260	10350	10440	10530	10620

Fig. 4.

Witnesses
R. H. Kohl
Ruth A. Miller

Inventor:
John Knause
By Harry Trease
Attorney

UNITED STATES PATENT OFFICE.

JOHN KNAUSE, OF LOCUST CORNER, OHIO, ASSIGNOR OF ONE-HALF TO CHARLES O. HAYS, OF LOCUST CORNER, OHIO.

COMPUTING-TABLE.

1,037,640.

Specification of Letters Patent.

Patented Sept. 3, 1912.

Application filed December 1, 1911. Serial No. 663,407.

To all whom it may concern:

Be it known that I, JOHN KNAUSE, a citizen of the United States, residing at Locust Corner, in the county of Clermont and State of Ohio, have invented certain new and useful Improvements in Computing-Tables, of which the following is a specification.

The invention relates to a tabular calculating sheet for use in multiplying or dividing any given number within the limits of the table by the certain number, not exceeding two figures, for which the particular table is constructed; and the object of the invention is to provide a computing table by means of which such multiplication or division can generally be accomplished by a mere inspection of the table.

In the accompanying drawings, forming part of this specification, Figure 1 shows the beginning of a table constructed in accordance with the present invention for multiplying by a mere inspection any number not exceeding four figures by the number 23 as a multiplier, or for dividing any number not greater than 229,977, by the number 23 as a divisor; Fig. 2 shows the first part or half of a computing table constructed according to the present invention for multiplying by inspection any number not exceeding four figures by the number 89 as a multiplier, or for dividing any number not greater than 889,911 by the number 89 as a divisor. Fig. 3, a continuation showing the second part or half of the table; and Fig. 4 shows the first part of a modified or extended form of a computing table constructed according to the present invention for multiplying by inspection any number not exceeding six figures by the number 99 as a multiplier, or for dividing any number not exceeding 98,999,901 by the number 99 as a divisor.

In the preferred or simpler form of the invention illustrated in Figs. 1, 2 and 3, the table is composed of a series of vertical columns and transverse rows of figures, the middle column of which is designated for distinction by the letter X placed at the head of the column, and contains in series down the column numbers corresponding to the two intermediate figures of any pro-

posed multiplicand, that is to say, the numerals indicating the ten and hundred figures thereof. In this column the same number is occasionally duplicated, as shown; for the particular purposes of the table; and ciphers are prefixed when necessary to make a two-figure number.

To the left of the middle or X column are provided ten several columns forming what is designated as Division A at the head of these columns, and the head of each column is further designated by the ten arabic digits or numerals, namely, 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9, representing respectively the lefthand or thousand figure of any proposed multiplicand, so that this division might well be called the thousand division of the table. And to the right of the middle or X column are also provided ten several columns forming what is designated as Division B at the head of these columns, and the head of each column is further designated by the ten arabic digits or numerals, namely, 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9, representing respectively the righthand or unit figure of any proposed multiplicand, so that this division might well be called the unit division of the table.

The several vertical columns are preferably separated for convenience of inspection by the vertical lines *a* and *b*, the vertical lines *a* dividing the several columns in Division A and Division B being preferably distinguished from the vertical lines *b* at each side of the middle or X column and at each side of the table, which distinction may be made by using a single line for the former and a double line for the latter, as shown, or by printing the respective lines in different widths or colors.

In the construction of the table, consecutive multiples of the multiplier to be used in a given table are entered in series from left to right in the several rows of Division B. These multiples begin with 000 in the first row of the 0 column and thence in series to the right are entered the successive multiples as 023, 046, 069, etc., as shown in Fig. 1 for the multiplier 23; and so on in the several successive rows up to the largest multiple which can be expressed in three figures which is 989 located in row 04 in the X col-

umn, and column 3 in Division B. In this division, ciphers are prefixed to the smaller multiples when necessary to make a three-figure number. This multiple and row completes what may be termed and is designated Section 1 at either side of the table shown in part in Fig. 1, and the next succeeding multiple 1012 of the multiplier instead of being entered in the table in the same transverse row with the 989 multiple, is entered in the next row below; and the thousand figure 1 is omitted, so that this multiple appears in column 4 of Division B as 012, being the first multiple in the first row of Section 2 of the table, in which row the number 04 of the X column is repeated as the first number in Section 2. Beginning with the multiple (1)012 in Section 2 of Division B, consecutive multiples of the multiplier are entered in series from left to right and in successive rows as before, until the next thousand is reached, at which we have the multiple (1)978 entered in row 08 in the middle or X column and in column 6 of Division B, this number being the last number in Section 2; and the last three figures of the next succeeding multiple (2)001 are entered in column 7 of Division B in the next row below and become the first multiple in Section 3 of the table, for which row the number 08 is duplicated or repeated in the middle or X column of the table.

The several transverse rows are preferably separated for convenience of inspection by the transverse lines *c* and *d*, the transverse lines *c* dividing the several rows in each section being preferably distinguished from the transverse lines *d* between the several sections, which distinction may be made by using a lighter line for the former and a heavier line for the latter, as shown, or by printing the respective lines in different colors.

In the thousand Division A of the simpler form of table, only one row of multiples of the multiplier is entered and used in each section of the table. In Section 1, the multiple begins with 0 in the cipher column, and thence in series to the right are entered the successive multiples 23, 46, 69, and so on to 207 in column 9 of this division; and, for the purposes of the table, it is not necessary to prefix ciphers to the respective multiples to make a three-figure number as is done in Division B of the table. In the next section in Division A of the table, the row of numbers is each increased by one so that we have the series 1, 24, 47, and so on to 208 in Section 2; and the numbers 2, 25, 48, and so on to 209 in Section 3; and likewise for each succeeding section of the table.

In the use of the table, thus described, which is constructed for the multiplier 23, for multiplying any number not exceeding

four figures, as, for instance, 3147, the multiplicand is pointed off or separated mentally or otherwise into the thousand figure 3, the two intermediate figures 14 and the unit figure 7, as follows—3 14 7; and the three righthand figures of the product are readily found by mere inspection in column 7 of Division B and in the row designated 14 in the X column—the figures thus found in the table being 381; and the lefthand figures of the product are readily found by mere inspection in column 3 of Division A in the same Section 4 wherein the right-hand figures were found—which left-hand figures as shown by the table are 72: and by merely prefixing these left-hand figures to the 80 right-hand figures, we have the proper product 72,381, from multiplying 3147 by 23.

From the foregoing description of the construction and use of the table, it appears that the two-figure numbers in the middle or X column are continued consecutively except when a section ends before the last row of multiples in Division B is completed, that is, before all the columns are filled; in which event the number in the X column must be continued or repeated until such line is completed, one row below in the first row of the next section, since the several multiples in the broken line in Division B require the same number in the X column, but correspond to the numbers in Division A which are entered in the respective sections in Division B.

A complete table for multiplying by a mere inspection any number containing not more than four figures by the number 89 as a multiplier is shown in two parts in Figs. 2 and 3, Fig. 2 being part 1 and Fig. 3 being part 2 of the table, and part 2 being merely a continuation of part 1. In this table it will be seen that the several sections, (which are not designated excepting as they are separated by heavier transverse lines), are limited to two parallel transverse rows in Division B of the table; and it is evident generally that the size of sections varies inversely with the value of the multiplier, and that the number of sections in a given table is equal to the number of units in the multiplier.

In the use of the table illustrated in Figs. 2 and 3 for multiplying by mere inspection any number containing not more than four figures, as, for instance, 7859, the product can be readily obtained by merely separating the multiplicand as before described, as follows—7 85 9; after which the three right figures of the product are readily found in column 9 of Division B and row 85 as designated in the X column, the three figures thus found being 451; to which are prefixed the figures or number found in column 7 of Division A in the same section from which

the right-hand figures are taken, the prefix figures thus found being 699; thus making the complete product 699,451. In the use of the same table, if it be desired to multiply any number consisting of more than four figures by the number 89, the same can be done by beginning at the right and dividing the multiplicand into periods of four figures each, as, for instance, if the multiplicand is 2,785,349, it is first divided as follows: 278 5349, whereupon the multiplication of the first four figures, 5349, by 89 is made as before described by an inspection of the table and a partial product of 476,061 is found; after which the multiplication of the next three figures, 278, (with a cipher prefixed to make four figures 0278), is likewise made by a mere inspection of the table and a second partial product is found to be 24,742, which, being located four places to the left and added to the first partial product, gives the complete product of 247,896,061 for the multiplication.

These examples illustrate the general use of computing tables constructed, as described above, according to the present invention; and general rules may be stated as follows for making any multiplication.

Multiplication.

Case I.—To multiply any number not exceeding four figures by any other number not exceeding two figures.

Rule.—Point off unit figure of multiplicand, find next two figures in the X column, then proceed to the right in same section to column headed by unit figure, and the number thus found will be the first three right-hand figures of product. Then proceed in same section to the left to column headed by fourth figure of multiplicand, and the number thus found is prefixed to the right-hand figures already found and the product is thus completed.

Case II.—To multiply any number consisting of five or more figures by any other number not exceeding two figures.

Rule.—Beginning at the right, divide the multiplicand into periods of four places each. Proceed with the four figures in the first period as directed in Case I for the first partial product. Then proceed with the figures in the next period in the same manner for the second partial product and write the same four places to the left under the first partial product. Proceed with the figures in each additional period in the same manner, always writing each successive partial product four places to the left of its predecessor; and the sum of the several partial products thus written is the complete product.

Case III.—When multiplier consists of three or more figures.

Rule.—Beginning at the right, divide the

multiplier into periods of two figures each. Proceed with each period of the multiplier precisely as in Cases I and II, placing each successive partial product two places to the left of its predecessor, and the sum will be the complete product.

Note.—Should multiplicand contain fewer than four figures, prefix ciphers to make four places. After a little experience this will become merely a mental process.

From the foregoing examples and rules it is evident that, by reversing the processes, the tables may be used for division as well as multiplication. The table constructed for a particular multiplier being employed for the same number as a divisor; and for such use the normal capacity of the table is a dividend equal to 9,999 multiplied by the multiplier for which the particular table is constructed, as, for instance, 889,911 in the table constructed for 89 as the multiplier. General rules may be stated as follows for such

Division.

Case I.—When the dividend is the capacity of the table or less.

Rule.—Point off three figures from right of dividend. Find remaining figures, or nearest less in first row of Division A, and proceed downward in the same column until exact figures are found. The figure heading the column so found is first figure of the quotient. In Division B in the same section find the three figures pointed off, or the nearest number less. In the same row of column X find the next two figures of the quotient, and, at the head of the same vertical column, find the fourth figure of the quotient. If the number referred to is less than the three figures of the dividend pointed off, subtract the one from the other and the difference will be the remainder.

Case II.—When dividend is greater than the capacity of the table. Begin at right of dividend and point off three figures, or as many times three figures as may be necessary to reduce dividend to capacity of table. Then proceed with the left-hand period as in Case I. In the event a remainder is left, annex the next period to the remainder and proceed as before for each successive period until operation is complete.

Case III.—To reduce a remainder to a decimal.

Rule.—Annex one cipher to remainder. Proceed as in Case I to find a number one less than remainder with annexed cipher. The figure at the head of the column so found is first figure of decimal. In the same transverse section in Division B, find greatest number. The figures in the same row in the X column are the next two decimal places, and the figure at the head of the col-

umn containing said greatest number is the fourth decimal place.

Note.—Should dividend contain fewer than four figures, prefix ciphers to make four places. Very rarely, the first period of the dividend is less than the smallest number in the same section; in which case, use the preceding section, and then subtract the largest number in Division B, in the same section, from the first period with 1 prefixed.

A modified or extended form of table constructed according to the present invention is illustrated in Fig. 4. The principle of construction in this extended form is substantially the same as for the simpler form, but admits the use of a multiplicand of six figures and the capacity of a section is ten thousand instead of one thousand. The columns in Division B contain consecutive multiples of the multiplier up to the largest which can be expressed in four figures, and the numbers in Section 1 of the ten thousand Division A are the same as in Section B except the prefixed ciphers are omitted in the multiples containing less than four figures and the multiples occurring in the last row of the section are also omitted. In Section 2 and in each succeeding section of Division A, the numbers are respectively greater by a unit than the corresponding number in the preceding section; so that each section of Division A has always just ten rows of multiples. The intermediate column includes a series of numbers each composed of three figures from 000 up to 999 in a complete table (not shown), the number in the X column in the row at the bottom of each section being repeated in the row at the top of the section next below. And finally, an additional column is provided at the left of the table in which are entered the numerals 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9, respectively, in the first ten rows of each section, which additional column may be termed the hundred thousand column as the figures in each section correspond with the first figure of any particular multiplicand having six figures. For the use of this extended table, the rule for multiplication is practically the same as explained above for the simpler table, and may be expressed as follows:

Rule.—Find first or unit figure of multiplicand at the head of Division B and proceed downward in the same unit column containing this figure to the row containing the next three figures of the multiplicand in the X column, in which row and in the same unit column will be found the first four figures of product. Find the fifth figure of the multiplicand at the head of the column in the ten thousand Division A and proceed downward to the same section from

which the partial product of the row has been taken, and, in this section, find the row which contains the sixth figure of multiplicand in the hundred thousand column, in which row and ten thousand column will be found the remainder of product to be prefixed to the partial product already found in the unit division.

I claim:

1. A computing table including a middle column containing a series of numbers severally representing the intermediate figures of a multiplicand, a lateral division containing a series of columns having therein a series of multiples of a particular multiplier severally representing the right-hand figures of a product of a multiplicand by the multiplier, and another lateral division containing a series of columns having therein a series of numbers severally representing the left-hand figures of said product.

2. A computing table including a middle column containing a series of numbers severally representing the intermediate figures of a multiplicand, a lateral division having ten columns headed by numerals in series severally representing the unit figure of the multiplicand, and another lateral division having ten columns headed by numerals in series severally representing a left-hand figure of the multiplicand; there being multiples of a particular multiplier entered in series and transverse rows in the columns of one division, ciphers being prefixed or the left-hand figure omitted when necessary to make a given-figure number, and the first multiple from which each several left-hand figure is omitted being entered in a row below the last preceding multiple to form separate transverse sections, the last number in the middle column in each section being repeated as the first number in the next section when a row of multiples is broken; and there being a series of numbers in the first section of the other division like the first row of multiples in the one division, and a similar series of numbers each increased by one unit in each succeeding section of said other division.

3. A computing table composed of a middle column containing a series of numbers severally representing the two intermediate figures of a four-figure multiplicand, a lateral division containing ten columns headed by numerals in series severally representing the unit figure of the multiplicand, and another lateral division having ten columns headed by numerals in series severally representing the thousand figure of the multiplicand; there being a series of multiples of a particular multiplier entered in series and transverse rows in the columns of one division, ciphers being prefixed or the left-hand figure omitted when necessary to make

a three-figure number, and the first multiple from which each several left-hand figure is omitted being entered in a row below the last preceding multiple to form separate
5 transverse sections, the last number in the middle column in each section being repeated as the first number in the next section when a row of multiples is broken; and there being a series of numbers in the

first section of the other division like the 10 first row of multiples in the one division, and a similar series of numbers each increased by one unit in each succeeding section of said other division.

JOHN KNAUSE.

Witnesses:

W. A. JOSEPH,
T. R. BREEDING.