TABLE III.—*Data of Oman and Watson*

w, lb./hr.	*G*, lb. ft.$^{-2}$.hr.$^{-1}$	*Re*	Δp, in. H_2O	Δp_{40}, p. s. i./ft.	*f*
	Run a.—Cylinders D_p=0.333 inch, D_t=4.026 inch *CH**=0.66 ft., voids=36.1 percent				
195.8	2,217	1,402	18.28	0.689	0.811
213.5	2,418	1,530	21.57	.810	.804
236.5	2,680	1,696	26.10	.981	.790
246.3	2,790	1,767	28.05	1.051	.782
	CH=1.37 ft., voids=36.5 percent				
153.7	1,742	1,103	25.60	0.447	0.858
167.7	1,900	1,202	27.40	.520	.842
178.8	2,024	1,280	30.70	.583	.833
	CH=1.95 ft., voids=37.2 percent				
146.2	1,656	1,046	27.32	0.388	0.834
147.8	1,673	1,058	27.65	.393	.827
156.1	1,768	1,118	31.15	.444	.838
165.7	1,876	1,186	34.70	.494	.828
	CH=0.77 ft., voids=45.5 percent				
231	2,618	1,656	11.63	0.885	0.730
265	3,000	1,900	15.13	1.049	.660
312	3,530	2,235	20.53	1.560	.611
307	3,478	2,202	19.93	1.514	.710
	CH=1.61 ft., voids=45.7 percent				
191	2,162	1,370	17.07	0.633	0.778
211	2,390	1,512	19.66	.731	.735
234	2,652	1,678	23.95	.889	.718
237	2,684	1,700	24.78	.920	.735
	CH=2.03 ft., voids=46.1 percent				
183	2,075	1,312	18.52	0.566	0.758
197	2,230	1,412	21.60	.611	.708
211	2,390	1,513	24.60	.754	.756
	Run b.—Raschig rings, D_p=0.400 inch, D_t=4.026 inch				
	Air temperature=87.2° F. *CH*=0.37 ft., voids=56.3 percent				
270	3,060	2,285	9.06	3.37	1.382
308	3,490	2,605	11.64	4.31	1.360
341	3,860	2,880	14.31	5.30	1.365
389	4,405	3,295	18.41	6.84	1.348
	CH=0.77 ft., voids=55.8 percent				
236	2,675	1,988	14.89	2.56	1.433
261	2,960	2,210	18.20	3.13	1.411
287	3,250	2,430	22.21	3.81	1.426
312	3,535	2,640	25.59	4.39	1.386
	CH=1.19 ft., voids=55.55 percent				
210	2,380	1,778	19.37	2.125	1.508
231	2,620	1,957	23.17	2.54	1.484
248	2,810	2,100	26.51	2.91	1.470
268	3,040	2,270	30.83	3.38	1.460

**CH*=column height=*L*.

TABLE III.—*Data of Oman and Watson*—Con.

w, lb./hr.	*G*, lb. ft.$^{-2}$.hr.$^{-1}$	*Re*	Δp, in. H_2O	Δp_{40}, p. s. i./ft.	*f*
	Run b—Raschig rings, D_p=0.400 inch. D_t=4.026 inch—Continued				
	CH=1.60 ft., voids=55.55 percent				
194	2,200	1,642	22.62	1.842	1.532
212	2,400	1,792	26.65	2.07	1.444
230	2,610	1,948	30.93	2.52	1.480
	CH=1.93 ft., voids=55.45 percent				
124	1,405	1,048	11.70	0.784	1.576
134	1,518	1,132	14.03	.940	1.624
147	1,667	1,245	16.48	1.102	1.585
162	1,837	1,371	19.46	1.303	1.537
172	1,950	1,456	21.81	1.464	1.533
179	2,030	1,516	23.50	1.585	1.528
193	2,190	1,634	26.90	1.808	1.497
213	2,414	1,800	32.39	2.173	1.484
	Air temperature=89.5° F. *CH*=0.416 ft., voids=61.35 percent				
283	3,210	2,400	5.81	2.73	1.011
359	4,065	3,040	9.21	4.33	.995
409	4,635	3,460	11.95	5.62	1.000
	CH=0.804 ft., voids=62.07 percent				
266	3,017	2,250	10.02	2.65	1.127
325	3,682	2,750	14.91	3.95	1.130
368	4,160	3,115	19.00	5.02	1.122
	CH=1.442 ft., voids=62.13 percent				
235	2,665	1,978	13.33	1.975	1.092
271	3,075	2,295	17.62	2.62	1.083
287	3,255	2,430	19.61	2.92	1.077
325	3,680	2,750	24.73	3.67	1.060
	CH=2 ft., voids=62.3 percent				
155	1,756	1,310	8.37	0.908	1.151
178	2,018	1,504	10.90	1.175	1.130
200	2,261	1,690	13.66	1.472	1.123
221	2,500	1,868	16.41	1.772	1.112
249	2,820	2,105	20.47	2.21	1.090
292	3,310	2,470	27.67	3.00	1.070
	Run c.—Berl saddles, D_p=0.480 inch, D_t=4.026 inches				
	Air temperature=87° F. *CH*=0.345 ft., voids=72.05 percent				
299	3,390	3,240	3.29	4.35	1.305
340	3,850	3,675	4.26	5.14	1.188
384	4,350	4,150	5.46	7.23	1.310
426	4,835	4,610	6.69	8.85	1.300
	CH=0.789 ft., voids=71.33 percent				
273	3,095	2,950	6.88	3.72	1.345
329	3,725	3,550	9.90	5.36	1.337
375	4,250	4,055	12.77	6.92	1.330

TABLE III.—*Data of Oman and Watson*—Con.

w, lb./hr.	G, lb. ft.$^{-2}$.hr.$^{-1}$	Re	Δp, in. H_2O	Δp_{40}, p. s. i./ft.	f
	Run c.—Berl saddles, D_p=0.480 inch, D_t=4.026 inches—Continued				
	CH=1.403 ft., voids=71.05 percent				
257	2,910	2,775	10.80	3.26	1.350
306	3,470	3,310	15.23	4.60	1.340
322	3,650	3,485	16.93	5.12	1.355
	CH=1.96 ft., voids=71.25 percent				
173	1,960	1,870	7.03	1.54	1.380
220	2,495	2,380	11.25	2.47	1.396
266	3,010	2,870	16.20	3.56	1.378
296	3,350	3,200	20.08	4.41	1.382
	Air temperature=85° F. CH=0.586 ft., voids=76.3 percent				
292	3,310	3,160	3.32	3.58	1.118
340	3,850	3,670	4.45	4.79	1.106
366	4,150	3,960	5.19	5.59	1.112
421	4,775	4,555	6.87	7.42	1.118
	CH=1.121 ft., voids=76.35 percent				
282	3,190	3,045	5.72	3.24	1.100
335	3,795	3,620	8.01	4.55	1.092
382	4,330	4,130	10.46	5.95	1.102
	CH=1.633 ft., voids=75.90 percent				
270	3,060	2,920	8.01	3.04	1.145
311	3,520	3,360	10.69	4.02	1.142
357	4,045	3,860	14.05	5.29	1.140
	CH=2.115 ft., voids=76.15 percent				
186	2,105	2,005	4.96	1.474	1.180
224	2,535	2,435	7.07	2.10	1.160
260	2,940	2,805	9.41	2.81	1.152
287	3,250	3,100	11.44	3.42	1.144
317	3,590	3,425	13.96	4.15	1.134
346	3,920	3,740	16.57	4.94	1.130
	Run d.—Celite spheres, D_p=0.217 inch, D_t=4.026 inches				
	Air temperature=83.7° F. CH=0.326 ft., voids=37.85 percent				
233	2,640	1,089	15.67	1.417	0.901
276	3,128	1,292	21.29	1.928	.871
313	3,546	1,463	26.43	2.432	.853
	CH=0.641 ft., voids=37.90 percent				
198	2,244	929	22.65	1.047	0.938
218	2,470	1,019	27.16	1.255	.922
232	2,630	1,086	30.43	1.407	.913
	CH=0.963 ft., voids=37.75 percent				
172	1,948	805	26.20	0.805	0.791
183	2,074	856	29.51	.856	.892
216	2,447	1,009	39.72	1.009	1.197

TABLE III.—*Data of Oman and Watson*—Con.

w, lb./hr.	G, lb. ft.$^{-2}$.hr.$^{-1}$	Re	Δp, in. H_2O	Δp_{40}, p. s. i./ft.	f
	Run d. Celite sphres, D_p=0.217 inch, D_t=4.026 inches—Continued				
	CH=1.235 ft., voids=37.85 percent				
107	1,212	501	14.30	0.340	1.039
123	1,390	574	18.90	.450	1.048
137	1,552	641	22.90	.546	1.020
146	1,655	684	25.66	.612	1.005
160	1,813	749	30.80	.735	1.003
185	2,096	866	39.15	.931	.953
	Air temperature=87.6° F. CH=0.426 ft., voids=46.90 percent				
252	2,854	1,172	12.13	1.882	1.007
304	3,448	1,418	17.50	2.712	.985
	CH=0.767 ft., voids=46.80 percent				
224	2,538	1,041	16.91	1.433	0.985
248	2,812	1,156	20.63	1.753	.980
290	3,290	1,352	27.56	2.337	.948
	CH=1.062 ft., voids=46.90 percent				
208	2,358	971	20.02	1.249	0.994
231	2,618	1,075	24.53	1.532	.996
260	2,946	1,212	30.45	1.898	.971
	CH=1.432 ft., voids=46.40 percent				
130	1,473	606	11.44	0.504	1.030
156	1,768	728	15.79	.695	.987
171	1,938	798	18.86	.830	.980
186	2,107	868	21.93	.966	.965
207	2,344	965	26.77	1.176	.945
218	2,472	1,015	29.61	1.307	.946
244	2,763	1,137	36.48	1.604	.930
	Run e.—MgO granules, D_p=0.217 inch, D_t=4.026 inches				
	Air temperature=84.5° F. CH=0.265 ft., voids=43.45 percent				
227	2,575	923	17.52	3.38	1.96
245	2,775	987	20.36	3.78	1.88
271	3,070	1,097	24.64	4.57	1.85
	CH=0.546 ft., voids=43.30 percent				
184	2,085	747	24.38	2.16	1.94
199	2,255	808	28.84	2.66	2.04
213	2,415	866	32.38	2.87	1.92
	CH=0.727 ft., voids=42.70 percent				
159	1,802	645	26.55	1.68	2.01
168	1,905	683	29.50	1.865	1.99
196	2,220	795	38.83	2.46	1.93
105	1,190	426	12.56	.798	2.19
117	1,328	475	15.46	.983	2.16
132	1,496	535	19.39	1.228	2.12
142	1,610	576	22.49	1.423	2.12

TABLE III.—*Data of Oman and Watson*—Con.

w, lb./hr.	G, lb. ft.$^{-2}$ hr.$^{-1}$	Re	Δp, in. H_2O	Δp_{ft}, p. s. i./ft.	f
	Run e.—MgO granules, D_p=0.217 inch, D_t=4.026 inches—Continued				
	CH=0.197 ft., voids=42.5 percent				
221	2,503	897	14.44	3.31	2.02
266	3,015	1,078	20.37	4.68	1.98
298	3,380	1,208	25.13	5.78	1.95
337	3,820	1,365	31.59	7.26	1.91
	Air temperature=83.6° F. CH=0.230 ft., voids=50.8 percent				
262	2,685	962	10.25	3.99	2.10
294	3,330	1,191	12.89	5.01	1.71
351	3,970	1,420	18.24	7.11	1.71
	CH=0.426 ft., voids=51.2 percent				
237	2,685	962	14.48	3.14	1.68
269	3,050	1,090	18.66	4.06	1.68
311	3,520	1,258	24.51	5.33	1.65
	CH=0.686 ft., voids=51.6 percent				
209	2,365	848	17.57	2.35	1.62
244	2,765	991	23.24	3.25	1.64
	CH=0.903 ft., voids=51.4 percent				
135	1,530	548	10.04	1.055	1.74
162	1,836	658	14.01	1.474	1.69
184	2,088	749	17.80	1.87	1.66
201	2,280	817	21.31	2.24	1.66
219	2,480	889	24.75	2.60	1.64
238	2,700	967	28.90	3.03	1.61

TABLE IV.—*Data on prediction of voids in packed tubes*

Run No.	D_t, inches	D_p/D_t	Packing method	CH, cm.	V_P, cc.	Voids, percent
	Packing "a"—0.172-inch glass spheres					
1-a	4.026	0.0427	A	21.9	1,133	37.1
b	4.026	.0427	A	21.8	1,147	36.3
c	4.026	.0427	B	20.9	1,133	34.1
d	4.026	.0427	B	20.9	1,147	33.3
2-a	3.068	.0560	A	37.8	1,133	37.2
b	3.068	.0560	A	36.7	1,147	34.5
c	3.068	.0560	B	35.7	1,133	33.4
d	3.068	.0560	B	35.6	1,147	32.6
3-a	2.067	.0830	A	40.6	562	36.1
b	2.067	.0830	A	38.7	546	34.9
c	2.067	.0830	B	39.1	562	33.5
d	2.067	.0830	B	38.2	546	34.1
4-a	1.610	.1068	A	65.9	546	37.0
b	1.610	.1068	B	64.8	546	36.0
5-a	1.049	.1640	A	47.4	155	41.2
b	1.049	.1640	A	59.9	197	41.0
c	1.049	.1640	B	43.6	155	36.2
d	1.049	.1640	B	58.0	197	39.1
6-a	.824	.2085	A	64.8	130	41.6
b	.824	.2085	B	61.2	130	38.3

TABLE IV.—*Data on prediction of voids in packed tubes*—Continued

Run No.	D_t, inches	D_p/D_t	Packing method	CH, cm.	V_P, cc.	Voids, percent
	Packing "b"—0.228-inch glass spheres					
7-a	4.026	0.0565	A	26.6	1,374	37.2
b	4.026	.0565	A	26.1	1,388	35.4
c	4.026	.0565	B	25.5	1,374	34.5
d	4.026	.0565	B	25.2	1,388	33.3
8-a	3.068	.0742	A	45.0	1,374	35.9
b	3.068	.0742	A	44.6	1,388	34.7
c	3.068	.0742	B	44.1	1,374	34.7
d	3.068	.0742	B	43.6	1,388	33.3
9-a	2.067	.1103	A	49.6	675	37.0
b	2.067	.1103	A	47.0	647	36.4
c	2.067	.1103	B	49.0	675	36.2
d	2.067	.1103	B	46.3	647	35.3
10-a	1.610	.1418	A	80.0	647	38.4
b	1.610	.1418	A	79.0	647	37.7
11-a	1.049	.2173	A	60.9	188	44.5
b	1.049	.2173	A	62.3	197	43.2
c	1.049	.2173	B	58.6	188	42.5
d	1.049	.2173	B	60.9	197	41.8
12-a	.824	.2763	A	59.2	111	45.5
b	.824	.2763	B	56.8	111	43.1
	Packing "c"—0.388-inch glass spheres					
13-a	4.026	0.0963	A	21.1	1,068	38.4
b	4.026	.0963	A	21.1	1,073	38.2
c	4.026	.0963	B	20.8	1,068	37.6
d	4.026	.0963	B	20.9	1,073	37.7
14-a	3.068	.1267	A	35.9	1,068	37.6
b	3.068	.1267	A	35.8	1,073	37.2
c	3.068	.1267	B	35.1	1,068	36.2
d	3.068	.1267	B	35.4	1,073	36.5
15-a	2.067	.1880	A	39.8	515	40.3
b	2.067	.1880	A	48.2	618	41.6
c	2.067	.1880	B	39.5	515	39.9
d	2.067	.1880	B	47.7	618	40.1
16-a	1.610	.2412	A	84.2	618	44.1
b	1.610	.2412	A	83.2	618	43.4
17-a	1.049	.3700	A	51.6	140	51.4
b	1.049	.3700	A	60.0	161	51.9
c	1.049	.3700	B	49.1	140	48.8
d	1.049	.3700	B	59.2	161	51.2
18-a	.824	.4703	A	65.4	107	52.3
b	.824	.4703	B	64.0	107	51.4
	Packing "d"—0.5075-inch porcelain spheres					
19-a	2.067	0.2458	A	46.6	583	42.1
b	2.067	.2458	A	44.5	557	42.3
c	2.067	.2458	B	45.6	583	41.0
d	2.067	.2458	B	43.4	557	40.8
20-a	1.610	.3152	A	80.6	583	45.0
b	1.610	.3152	A	76.8	557	44.8
c	1.610	.3152	B	78.8	583	43.6
d	1.610	.3152	B	74.6	557	43.4
21-a	1.049	.484	A	63.1	151	57.0
b	1.049	.484	A	63.3	157	55.5
c	1.049	.484	B	55.1	151	50.8
d	1.049	.484	B	56.8	157	50.5
22-a	.824	.616	A	67.2	80	65.3
b	.824	.616	A	65.2	78	65.1
c	.824	.616	B	62.0	80	62.4
d	.824	.616	B	59.6	78	61.8
	Packing "e"—0.437-inch steel spheres					
23-a	1.049	0.416	A	37.8	100	52.5
b	1.049	.416	A	30.7	83	51.6
c	1.049	.416	B	37.0	100	51.5
d	1.049	.416	B	30.3	83	51.1

TABLE IV.—*Data on prediction of voids in packed tubes*—Continued

Run No.	D_t, inches	D_p/D_t	Packing method	CH, cm.	V_P, cc.	Voids, percent
Packing "f"—0.73-inch porcelain spheres						
24-a	4.026	0.1818	A	29.6	1,436	41.0
b	4.026	.1818	A	30.1	1,436	42.1
c	4.026	.1818	B	29.1	1,436	40.1
d	4.026	.1818	B	29.2	1,436	40.3
25-a	3.068	.2382	A	52.3	1,436	42.4
b	3.068	.2382	A	52.4	1,426	42.5
c	3.068	.2382	B	50.9	1,436	40.8
d	3.068	.2382	B	51.0	1,436	41.0
26-a	2.067	.3534	A	45.4	505	48.6
b	2.067	.3534	A	49.6	563	47.5
c	2.067	.3534	B	41.5	505	43.9
d	2.067	.3534	B	47.2	563	44.8
27-a	1.610	.454	A	81.4	505	52.7
b	1.610	.454	A	87.3	563	50.9
c	1.610	.454	B	76.0	505	49.5
d	1.610	.454	B	85.0	563	49.6
Packing "g"—0.200-inch glass spheres						
28-a	4.026	0.0497	A	20.8	1,144	33.2
b	4.026	.0497	B	20.2	1,144	31.2
29-a	3.068	.0651	A	35.7	1,144	32.8
b	3.068	.0651	B	34.6	1,144	30.7
30-a	2.067	.0966	A	39.7	551	35.4
b	2.067	.0966	A	45.9	642	34.9
c	2.067	.0966	B	38.8	551	33.9
d	2.067	.0966	B	44.9	642	33.4
31-a	1.610	.1242	A	67.0	551	37.5
b	1.610	.1242	A	78.8	642	37.9
c	1.610	.1242	B	65.5	551	36.1
d	1.610	.1242	B	76.5	642	36.0
Packing "h"—0.298-inch glass spheres						
32-a	4.026	0.0740	A	19.4	1,070	33.2
b	4.026	.0740	B	19.1	1,070	32.0
33-a	2.067	.1444	A	40.7	568	35.6
b	2.067	.1444	A	46.0	637	36.1
c	2.067	.1444	B	40.3	568	34.9
d	2.067	.1444	B	45.0	637	34.7
34-a	1.610	.1853	A	70.6	568	38.9
b	1.610	.1853	A	79.2	637	38.7
c	1.610	.1853	B	69.0	568	37.4
d	1.610	.1853	B	76.8	637	36.9
Packing "i"—0.386-inch glass and porcelain spheres						
35-a	4.026	0.0958	A	19.8	1,075	34.0
b	4.026	.0958	B	19.4	1,075	32.8
36-a	3.068	.1260	A	33.1	1,075	34.0
b	3.068	.1260	B	32.6	1,075	33.0
37-a	2.067	.1868	A	50.2	706	35.0
b	2.067	.1868	B	49.0	706	33.4
38-a	1.610	.240	A	86.6	706	38.0
b	1.610	.240	A	45.0	369	37.6
c	1.610	.240	B	83.6	706	35.7
d	1.610	.240	B	44.7	369	37.1
Packing "j"—0.536-inch glass and porcelain spheres						
39-a	4.026	0.1333	A	19.3	1,054	33.7
b	4.026	.1333	B	18.6	1,054	31.2
40-a	3.068	.1750	A	32.5	1,054	32.0
b	3.068	.1750	B	31.8	1,054	30.5
41-a	2.067	.260	A	45.9	616	38.1
b	2.067	.260	A	31.6	438	36.1
c	2.067	.260	B	44.8	616	36.6
d	2.067	.260	B	30.6	438	34.1
42-a	1.610	.333	A	80.1	616	41.5
b	1.610	.333	A	53.5	438	37.9
c	1.610	.333	B	78.0	616	39.9
d	1.610	.333	B	52.1	438	36.1
Packing "k"—0.208-inch glass spheres						
43-a	0.824	0.252	A	49.8	100	41.5
b	.824	.252	A	59.8	121	41.3
c	.824	.252	B	48.6	100	40.1
d	.824	.252	B	58.5	121	39.9

TABLE IV.—*Data on prediction of voids in packed tubes*—Continued

Run No.	D_t, inches	D_p/D_t	Packing method	CH, cm.	V_P, cc.	Voids, percent
Packing "l"—0.271-inch glass spheres						
44-a	0.824	0.329	A	56.9	115	41.3
b	.824	.329	A	64.6	130	41.5
c	.824	.329	B	55.3	115	39.6
d	.824	.329	B	62.3	130	39.3
Packing "m"—0.323-inch glass and porcelain spheres						
45-a	0.824	0.392	A	69.4	134	43.7
b	.824	.392	A	68.7	134	43.2
c	.824	.392	B	67.5	134	42.4
d	.824	.392	B	68.2	134	42.7
Packing "n"—0.325-inch clay spheres						
46-a	0.824	0.395	A	45.5	74	52.6
b	.824	.395	A	65.7	108	52.1
c	.824	.395	B	43.5	74	50.4
d	.824	.395	B	60.6	108	48.0
47-a	1.049	.310	A	66.7	181	51.3
b	1.049	.310	A	43.7	122	50.0
c	1.049	.310	B	61.5	181	47.2
d	1.049	.310	B	41.6	122	47.4
48-a	1.610	.202	A	39.8	289	44.8
b	1.610	.202	B	38.9	289	43.4
Packing "o"—0.368-inch clay spheres						
49-a	1.610	0.229	A	49.7	358	45.3
b	1.610	.229	A	75.0	513	47.9
c	1.610	.229	B	48.4	358	43.7
d	1.610	.229	B	71.8	513	45.6
50-a	2.067	.178	A	28.9	358	42.8
b	2.067	.178	A	43.1	513	45.1
c	2.067	.178	B	27.9	358	40.8
d	2.067	.178	B	41.2	513	42.5
51-a	3.068	.120	A	29.7	825	41.9
b	3.068	.120	A	43.7	1215	41.8
c	3.068	.120	B	28.2	825	38.7
d	3.068	.120	B	41.6	1215	39.0
52-a	4.026	.0912	A	16.8	825	40.3
b	4.026	.0912	A	24.3	1215	39.4
c	4.026	.0912	B	16.5	825	39.3
d	4.026	.0912	B	23.7	1215	37.8
Packing "p"—0.466-inch cobalt oxide cylinders						
53-a	4.026	0.1162	A	9.8	515	36.3
b	4.026	.1162	B	9.4	515	33.6
54-a	3.068	.1522	A	17.1	515	37.0
b	3.068	.1522	B	16.1	515	33.0
55-a	1.610	.290	A	71.5	515	45.3
b	1.610	.290	B	63.6	515	38.6
56-a	1.049	.445	A	62.4	158	54.5
b	1.049	.445	B	52.6	158	46.2
57-a	.824	.566	A	70.1	86	64.3
b	.824	.566	B	57.0	86	56.1
58-a	.622	.750	A	72.7	61	57.1
b	.622	.750	B	72.6	61	57.0
Packing "q"—0.254-inch alundum cylinders						
59-a	0.824	0.308	A	21.0	39	46.1
b	.824	.308	B	20.2	39	43.9
60-a	.622	.408	A	42.9	39	53.5
b	.622	.408	B	38.3	39	48.0
Packing "r"—0.274-inch copper cylinders						
61-a	1.049	0.261	A	23.4	70	46.3
b	1.049	.261	B	22.0	70	42.9
62-a	.824	.333	A	39.7	70	48.6
b	.824	.333	B	35.9	70	44.1
63-a	.622	.440	A	82.3	70	56.5
b	.622	.440	A	59.5	52	55.1
c	.622	.440	B	70.2	70	49.0
d	.622	.440	B	50.0	52	46.9

TABLE IV.—*Data on prediction of voids in packed tubes*—Continued

Run No.	D_t, inches	D_p/D_t	Packing method	CH, cm.	V_P, cc.	Voids, percent
Packing "s"—0.239-inch chromium oxide cylinders						
64-a	4.026	0.0594	A	10.7	585	33.8
b	4.026	.0594	B	10.3	585	31.2
65-a	1.049	.228	A	66.6	226	39.2
b	1.049	.228	B	60.6	226	33.1
66-a	.622	.384	A	64.5	66.9	47.0
b	.622	.384	A	77.7	81.5	46.4
c	.622	.384	B	57.2	66.9	40.1
d	.622	.384	B	68.5	81.5	39.2
Packing "t"—0.180-inch Alundum cylinders						
67-a	3.068	0.0593	A	11.2	354	33.8
b	3.068	.0593	B	11.0	354	32.5
68-a	2.067	.0879	A	25.9	354	36.8
b	2.067	.0879	A	20.6	286	35.8
c	2.067	.0879	B	25.3	354	35.4
d	2.067	.0879	B	20.4	286	35.3
69-a	1.610	.113	A	42.5	354	36.4
b	1.610	.113	A	34.5	286	37.0
c	1.610	.113	B	41.9	354	35.7
d	1.610	.113	B	34.0	286	36.1
70-a	1.049	.1758	A	24.6	75	45.3
b	1.049	.1758	A	23.6	75	43.0
71-a	.824	.2237	A	39.2	75	44.4
b	.824	.2237	A	37.5	75	41.8
72-a	.622	.278	A	77.1	75	50.0
b	.622	.278	A	46.8	44.5	51.5
c	.622	.278	B	68.0	75	43.3
d	.622	.278	B	40.5	44.5	43.9
73-a	.493	.373	A	85.1	44.5	57.5
b	.493	.373	A	77.3	42.5	55.3
c	.493	.373	B	68.7	44.5	47.4
d	.493	.373	B	64.0	42.5	46.1
74-a	.364	.500	A	55.4	14.06	62.1
b	.364	.500	A	51.8	13.13	62.2
c	.364	.500	B	41.0	14.06	48.8
d	.364	.500	B	36.8	13.13	46.7
Packing "u"—0.252-inch Raschig rings						
75-a	4.026	0.0625	A	21.1	804	53.8
b	4.026	.0625	B	20.7	804	52.9
76-a	3.068	.0820	A	37.3	804	54.9
b	3.068	.0820	B	35.5	804	52.5
77-a	2.067	.122	A	31.2	298	56.0
b	2.067	.122	A	41.6	397	56.1
c	2.067	.122	B	30.0	298	54.1
d	2.067	.122	B	39.7	397	53.9
78-a	1.610	.1567	A	52.7	298	57.1
b	1.610	.1567	A	69.2	397	56.4
c	1.610	.1567	B	51.2	298	55.8
d	1.610	.1567	B	66.6	397	54.8
79-a	1.049	.240	A	42.3	88	62.6
b	1.049	.240	B	40.5	88	61.0
80-a	.824	.306	A	52.9	60	67.0
b	.824	.306	A	72.4	88	64.5
c	.824	.306	B	48.8	60	64.2
d	.824	.306	B	67.0	88	61.6
81-a	.622	.405	A	79.6	48	68.8
b	.622	.405	B	75.1	48	67.4
82-a	.493	.511	A	83.4	25	75.5
b	.493	.511	A	66.8	18.5	77.5
c	.493	.511	B	69.1	25	71.6
d	.493	.511	B	58.1	18.5	74.1

TABLE IV.—*Data on prediction of voids in packed tubes*—Continued

Run No.	D_t, inches	D_p/D_t	Packing method	CH, cm.	V_P, cc.	Voids, percent
Packing "v"—0.397-inch Raschig rings						
83-a	4.026	0.0992	A	18.6	685	55.2
b	4.026	.0992	B	18.1	685	54.1
84-a	3.068	.1305	A	32.7	685	56.1
b	3.068	.1305	B	31.7	685	54.7
85-a	2.067	.1936	A	34.6	300	60.0
b	2.067	.1936	A	41.6	366	59.5
c	2.067	.1936	B	32.3	300	57.2
d	2.067	.1936	B	39.8	366	57.6
86-a	1.610	.248	A	59.6	300	61.8
b	1.610	.248	A	74.8	366	62.8
c	1.610	.248	B	58.5	300	61.0
d	1.610	.248	B	71.3	366	61.1
87-a	1.049	.382	A	34.2	57	70.0
b	1.049	.382	A	66.1	109	70.4
c	1.049	.382	B	30.5	57	66.5
d	1.049	.382	B	58.5	109	66.4
88-a	.824	.485	A	68.5	57	75.6
b	.824	.485	A	47.8	39	76.1
c	.824	.485	B	60.4	57	72.4
d	.824	.485	B	41.8	39	72.7
Packing "w-1"—0.1209-inch Aloxite granules						
89-a	1.049	0.115	A	19.3	51.5	52.2
b	1.049	.115	A	25.4	69	51.3
c	1.049	.115	B	18.3	51.5	49.7
d	1.049	.115	B	23.7	69	47.8
90-a	1.469	.0824	A	12.1	69	47.9
b	1.469	.0824	B	12.0	69	47.4
Packing "w-2"—0.1511-inch Aloxite granules						
91-a	0.622	0.243	A	42.6	33	60.5
b	.622	.243	B	34.6	33	51.2
92-a	.824	.184	A	23.5	33	59.2
b	.824	.184	B	20.6	33	53.4
93-a	1.049	.144	A	13.1	33	55.1
b	1.049	.144	B	12.6	33	53.2
Packing "w-3"—0.2224-inch Aloxite granules						
94-a	0.622	0.358	A	56.0	39	64.5
b	.622	.358	A	61.9	43	64.5
c	.622	.358	B	43.0	39	53.7
d	.622	.358	B	46.0	43	52.2
95-a	.824	.271	A	33.6	44	62.0
b	.824	.271	A	37.0	50	60.7
c	.824	.271	B	27.4	44	53.4
d	.824	.271	B	31.9	50	54.5
96-a	1.049	.212	A	37.7	88	58.2
b	1.049	.212	A	45.7	106	58.4
c	1.049	.212	B	32.4	88	51.2
d	1.049	.212	B	38.5	106	50.7
97-a	1.469	.152	A	33.6	164	55.5
b	1.469	.152	B	30.3	164	50.5

TABLE IV.—*Data on prediction of voids in packed tubes*—Continued

Run No.	D_t, inches	D_p/D_t	Packing method	*CH*, cm.	V_P, cc.	Voids, percent
Packing "x-1"—0.0898-inch Fe_3O_4 granules						
98-a	0.622	0.144	A	46.9	44.0	52.1
b	.622	.144	A	59.1	56.2	51.5
c	.622	.144	B	42.1	44.0	46.7
d	.622	.144	B	52.8	56.2	48.9
99-a	.824	.109	A	30.4	48.2	53.9
b	.824	.109	A	37.0	59.2	53.4
c	.824	.109	B	28.2	48.2	50.3
d	.824	.109	B	33.0	59.2	47.8
100-a	1.049	.0857	A	29.6	80.8	51.0
b	1.049	.0857	A	46.4	121.2	52.2
c	1.049	.0857	B	27.7	80.8	47.8
d	1.049	.0857	B	39.8	121.2	45.4
101-a	1.469	.0612	A	22.3	123	45.5
b	1.469	.0612	A	33.3	190	42.4
c	1.469	.0612	B	20.4	123	44.8
d	1.469	.0612	B	30.6	190	43.1
Packing "x-2"—0.1058-inch Fe_3O_4 granules						
102-a	0.622	0.170	A	46.0	45.6	49.4
b	.622	.170	A	61.1	59.2	50.5
c	.622	.170	B	42.4	45.6	45.0
d	.622	.170	B	55.1	59.2	45.2
103-a	.824	.128	A	23.1	38.0	52.2
b	.824	.128	A	36.8	60.2	52.5
c	.824	.128	B	21.8	38.0	49.3
d	.824	.128	B	33.8	60.2	48.3
104-a	1.049	.101	A	33.2	94.2	49.2
b	1.049	.101	A	43.5	120.2	50.5
c	1.049	.101	B	31.1	94.2	45.7
d	1.049	.101	B	39.4	120.2	45.3
105-a	1.469	.0721	A	28.3	163.6	47.1
b	1.469	.0721	A	37.8	217	47.6
c	1.469	.0721	B	26.5	163.6	47.5
d	1.469	.0721	B	34.8	217	42.9
Packing "x-3"—0.1418-inch Fe_3O_4 granules						
106-a	0.622	0.228	A	43.3	40.8	51.7
b	.622	.228	A	62.9	60.2	51.0
c	.622	.228	B	39.0	40.8	46.5
d	.622	.228	B	55.9	60.2	44.9
107-a	.824	.172	A	30.5	51.4	51.0
b	.824	.172	A	42.3	70.8	51.4
c	.824	.172	B	27.9	51.4	46.5
d	.824	.172	B	39.2	70.8	47.5
108-a	1.049	.135	A	31.9	92.6	48.0
b	1.049	.135	A	42.4	122.6	48.1
c	1.049	.135	B	29.7	92.6	44.2
d	1.049	.135	B	39.8	122.6	44.7
109-a	1.469	.0966	A	27.3	163.4	45.1
b	1.469	.0966	A	35.0	207.2	45.7
c	1.469	.0966	B	25.4	163.4	41.1
d	1.469	.0966	B	32.8	207.2	42.1

TABLE IV.—*Data on prediction of voids in packed tubes*—Continued

Run No.	D_t, inches	D_p/D_t	Packing method	*CH*, cm.	V_P, cc.	Voids, percent
Packing "x-4"—0.2034-inch Fe_3O_4 granules						
110-a	0.622	0.330	A	47.1	40.6	56.0
b	.622	.330	A	61.9	53.0	56.2
c	.622	.330	B	40.1	40.6	48.4
d	.622	.330	B	51.2	53.0	47.1
111-a	.824	.249	A	33.7	54.0	53.3
b	.824	.249	A	41.2	66.0	53.5
c	.824	.249	B	30.0	54.0	47.7
d	.824	.249	B	36.4	66.0	47.3
112-a	1.049	.196	A	35.2	100.8	48.7
b	1.049	.196	A	47.5	134	49.4
c	1.049	.196	B	33.3	100.8	45.7
d	1.049	.196	B	44.0	134	46.5
Packing "y-1"—0.0732-inch Alundum granules						
113-a	1.049	0.0698	A	31.3	94.3	48.0
b	1.049	.0698	A	45.6	134.4	47.2
c	1.049	.0698	B	29.6	94.3	43.0
d	1.049	.0698	B	41.9	134.4	42.5
114-a	1.469	.0498	A	21.3	134.4	42.1
b	1.469	.0498	B	20.8	134.4	40.8
Packing "y-2"—0.1007-inch Alundum granules						
115-a	0.622	0.162	A	40.7	40.6	49.1
b	.622	.162	A	57.4	57.3	48.8
c	.622	.162	B	37.9	40.6	45.2
d	.622	.162	B	52.9	57.3	44.8
116-a	.824	.122	A	35.4	61.3	49.7
b	.824	.122	B	33.8	61.3	47.3
117-a	1.049	.0961	A	29.7	87.4	47.3
b	1.049	.0961	A	38.8	114.2	47.2
c	1.049	.0961	B	28.8	87.4	45.7
d	1.049	.0961	B	37.1	114.2	44.9
118-a	1.469	.0687	A	18.8	114.2	44.6
b	1.469	.0687	B	18.4	114.2	43.3
Packing "y-3"—0.1601-inch Alundum granules						
119-a	0.622	0.258	A	45.8	37.3	58.4
b	.622	.258	A	57.2	47.3	57.8
c	.622	.258	B	39.9	37.3	52.3
d	.622	.258	B	48.8	47.3	50.7
120-a	.824	.195	A	35.2	52.5	56.6
b	.824	.195	A	37.3	56.4	56.0
c	.824	.195	B	31.5	52.5	51.5
d	.824	.195	B	34.4	56.4	52.2
121-a	1.049	.153	A	31.6	82.4	53.3
b	1.049	.153	A	38.4	99.4	53.5
c	1.049	.153	B	30.0	82.4	50.8
d	1.049	.153	B	35.1	99.4	49.3
122-a	1.469	.109	A	17.9	99.4	49.1
b	1.469	.109	B	17.5	99.4	48.0
123-a	.493	.325	A	21.9	11.3	58.2
b	.493	.325	A	29.4	13.6	52.4
c	.493	.325	B	19.1	11.3	52.3
d	.493	.325	B	24.8	13.6	55.6

TABLE V.—*Pressure-drop data with round and sharp sands in 1-inch standard pipe*

Run No.	w, lb./hr.	G, lb. hr.$^{-1}$ ft.$^{-2}$	Re	Δp, cm. CCl_4	Δp, cm. Hg	ΔP, lb. ft.$^{-2}$ ft.–CH^{-1}	$\Delta P_{(40)}$, lb. ft.$^{-2}$ ft.–CH^{-1}	f
Round sand, D_p=0.01505 inch, wt.=275 gm., RT*=73° F., BP=727 mm. Hg, D_t=1.049 inches, CH*=31.6 cm., δ=41.0 percent, air.								
a	0. 070	11. 68	0. 340	4. 0	--------	12. 57	14. 15	385
	. 135	22. 5	. 657	8. 3	--------	26. 1	29. 4	214
	. 227	37. 7	1. 10	13. 7	--------	43. 0	48. 5	126
	. 320	53. 3	1. 55	19. 5	--------	61. 3	69. 1	89. 5
	. 416	69. 3	2. 02	25. 4	--------	80. 0	90. 2	69. 4
	. 480	79. 9	2. 32	29. 7	--------	93. 6	105. 5	61
	. 518	86. 2	2. 51	31. 5	--------	99. 6	112	55. 6
	. 686	114. 7	3. 34	----------	5. 1	137	154	43. 4
	. 985	164. 5	4. 80	----------	7. 1	190. 5	214	29. 4
	1. 332	222	6. 49	----------	10. 0	268	302	22. 6
	1. 666	277	8. 10	----------	12. 6	338	381	18. 3
	2. 005	334	9. 75	----------	15. 6	419	471	15. 6
	2. 38	396	11. 5	----------	18. 6	500	564	13. 3
	2. 75	457	13. 3	----------	22. 5	605	682	12. 05
	3. 14	523	15. 23	----------	25. 7	691	780	10. 55
	3. 68	613	17. 86	----------	30. 0	807	911	8. 95
Round sand, D_p=0.01505 inch, wt.=275 gm., RT=73° F., BP=727 mm.Hg, D_t=1.049 inches, CH=28.8 cm., δ=35.4 percent, air.								
a	0. 0701	11. 70	0. 341	7. 3	--------	24. 8	14. 8	400
	. 136	22. 6	. 660	14. 3	--------	49. 4	29. 5	213
	. 2285	38. 0	1. 11	24. 1	--------	83. 3	49. 8	127
	. 325	54. 0	1. 57	34. 2	--------	118	71. 3	90
	. 425	70. 7	2. 06	----------	5. 0	147	88. 0	64. 8
	. 490	81. 4	2. 37	----------	5. 6	165	98. 8	55
	. 591	98. 4	2. 86	----------	6. 9	204	122	46. 4
	. 701	117	3. 42	----------	8. 3	245	147	39. 6
	1. 032	172	5. 03	----------	12. 8	378	226	28. 4
	1. 388	230	6. 72	----------	17. 3	511	306	21. 3
	1. 758	292	8. 53	----------	22. 2	656	393	17. 0
	2. 135	355	10. 33	----------	27. 1	801	480	14. 04
	2. 29	381	11. 1	----------	30	888	531	13. 54
Round sand, D_p=0.01505 inch, wt.=250 gm., RT=76° F., BP=745 mm. Hg, D_t=1.049 inches, CH=28.4 cm., δ=40.4 percent, helium.								
a	0. 0170	2. 83	0. 785	7. 0	--------	24. 4	25. 6	1, 550
	. 0340	5. 65	. 1565	14. 2	--------	49. 6	52. 1	1, 057
	. 0464	7. 71	. 214	19. 0	--------	66. 5	69. 8	570
	. 0629	10. 48	. 290	25. 8	--------	90	94. 5	418
	. 0699	11. 64	. 323	31. 3	--------	109	114	410
	. 0846	14. 10	. 391	----------	3. 7	110. 5	116	283
	. 1066	17. 73	. 491	----------	4. 8	143. 5	150	232
	. 1297	21. 55	. 597	----------	6. 0	179	188	198
	. 1525	25. 4	. 705	----------	6. 9	206	216	149
	. 1745	29. 0	. 806	----------	7. 9	236	247	142
Round sand, D_p=0.01505 inch, *wt.*=250 gm., RT=76° F., BP=745 mm. Hg, D_t=1.049 inches, CH=26.0 cm., δ=34.9 percent, helium.								
a	0. 0226	3. 74	0. 1035	18. 0	--------	68. 7	38. 8	1, 380
	. 040	6. 65	1. 84	29. 6	--------	113	62. 8	705
	. 0661	11. 0	. 305	----------	5. 3	173	96	395
	. 1075	17. 9	. 496	----------	9. 0	294	166	257
	. 1339	22. 4	. 616	----------	10. 8	352	199	201
	. 1828	30. 4	. 845	----------	14. 2	464	262	137

* RT=temperature of gas; CH=column height=L.

TABLE V.—*Pressure-drop data with round and sharp sands in 1-inch standard pipe*—Continued

Run No.	w, lb./hr.	G, lb. hr.$^{-1}$ ft.$^{-2}$	Re	Δp, cm. CCl_4	Δp, cm. Hg	ΔP, lb. ft.$^{-2}$ ft.–CH^{-1}	$\Delta P_{(40)}$, lb. ft.$^{-2}$ ft.–CH^{-1}	f
	Round sand, D_p=0.01268 inch, wt.=275 gm., RT=73 °F., BP=727 mm. Hg, D_t=1.049 inches, CH=30.3 cm., δ=38.6 percent, air.							
b	0.0705	11.77	0.288	8.7		28.5	24.9	561
	.1334	22.2	.545	17.5		57.3	50.1	317
	.193	32.1	.788	24.7		81.0	70.9	214
	.230	38.3	.940	29.5		96.8	84.6	179
	.271	45.0	1.10	35		114.5	100	154
	.360	59.8	1.465		5.1	143	125	109
	.461	76.7	1.88		6.4	179	156	82.8
	.530	88.3	2.16		7.5	210	183	73.1
	.613	102	2.50		8.6	241	210	62.8
	.709	118	2.89		10.4	292	255	57.3
	1.048	174	4.28		15.5	434	379	38.8
	1.41	234	5.76		20.8	584	510	28.9
	1.786	296	7.29		25.7	721	631	22.4
	2.06	342	8.42		30	842	736	19.6
	Round sand, D_p=0.01268 inch, wt.=275 gm., RT=73° F., BP=727 mm. Hg, D_t=1.049 inches, CH=28.6 cm., δ=35.0 percent, air.							
b	0.0706	11.79	0.289	11.6		40.0	23.0	515
	.1340	22.3	.547	23.2		80.6	46.0	287
	.196	32.6	.800	33.3	3.7	113	64.5	189
	.2315	38.5	.945		4.1	126	71.5	150
	.273	45.4	1.11		5.0	148	83.2	126
	.314	60.5	1.48		6.5	193	110	92.5
	.465	78.4	1.92		8.5	252	143	72.6
	.537	89.3	2.19		9.8	291	166	64.7
	.624	104	2.55		11.2	332	189	54.4
	.722	120.5	2.95		13.4	397	226	48.6
	1.078	179	4.40		20.7	614	350	33.9
	1.460	243	5.95		27.2	808	460	24.2
	1.616	268	6.58		30	892	509	22.0
	Round sand, D_p=0.01062 inch, wt.=275 gm., RT=70° F., BP=728 mm. Hg, D_t=1.049 inches, CH=31.7 cm., δ=41.4 percent, air.							
c	0.0701	11.69	0.241	9.5		29.7	34.5	665
	.1018	16.92	.350	14.3		44.9	52.1	476
	.1815	30.2	.625	24.0		75.5	87.8	249
	.258	42.9	.888	35.5	3.9	112	130	186
	.309	51.4	1.06		4.6	112.5	142	141
	.361	60.0	1.24		5.5	147	171	125
	.461	76.7	1.59		7.0	187	218	97
	.531	88.3	1.83		8.0	214	248	83
	.606	101	2.08		9.1	243	282	72.7
	.709	118	2.44		10.7	286	332	62.8
	1.054	175.3	3.62		16.4	439	510	43.4
	1.418	236	4.88		21.5	575	645	30.3
	1.805	300	6.20		27.1	726	845	24.6
	2.05	340	7.04		30.0	802	933	21.0

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TABLE V.—*Pressure-drop data with round and sharp sands in 1-inch standard pipe*—Continued

Run No.	w, lb./hr.	G, lb. hr.$^{-1}$ ft.$^{-2}$	Re	Δp, cm. CCl_4	Δp, cm. Hg	ΔP, lb. ft.$^{-2}$ ft.–CH^{-1}	$\Delta P_{(40)}$, lb. ft.$^{-2}$ ft.–CH^{-1}	f
	Round sand, D_p=0.01062 inch, wt.=275 gm., RT=70° F., BP=728 mm. Hg, D_t=1.049 inches, CH=29.0 cm., δ=35.8 percent, air.							
c	0. 0702	11. 71	0. 242	14. 5	----------	49. 7	31. 1	595
	. 1022	17. 02	. 352	22. 4	----------	76. 8	48. 1	435
	. 1655	27. 5	. 569	35. 6	----------	121. 5	76. 3	265
	. 263	43. 8	. 907	----------	6. 0	176	110	150
	. 314	52. 2	1. 08	----------	7. 5	220	138	138
	. 369	61. 4	1. 27	----------	9. 0	264	165	115
	. 474	78. 8	1. 63	----------	11. 0	323	202	85. 6
	. 546	90. 8	1. 88	----------	12. 7	372	233	74. 4
	. 626	104. 3	2. 16	----------	14. 4	422	265	64. 0
	. 738	123	2. 54	----------	17. 3	507	318	55. 2
	1. 105	184	3. 80	----------	25. 5	749	469	36. 2
	1. 306	217	4. 48	----------	30. 2	887	556	30. 8
	Round sand, D_p=0.00818 inch, wt.=275 gm., RT=73° F., BP=747 mm. Hg, D_t=1.049 inches, CH=33.0 cm., δ=43.5 percent, air.							
d	0. 0693	11. 56	0. 184	13. 4	----------	40. 2	58. 8	880
	. 131	21. 8	. 348	24. 8	----------	74. 5	109	456
	. 193	32. 1	. 513	37. 0	----------	107	156	302
	. 333	55. 4	. 885	----------	6. 8	175	256	167
	. 432	71. 9	1. 14	----------	8. 6	221	323	125
	. 496	82. 3	1. 31	----------	10. 1	260	380	112
	. 610	102	1. 63	----------	12. 0	309	452	86. 8
	. 731	122	1. 95	----------	14. 6	376	550	73. 5
	1. 082	180	2. 87	----------	21. 2	546	800	49. 2
	1. 49	245	3. 41	----------	28. 5	735	1, 065	35. 4
	Round sand, D_p=0.00818 inch, wt.=275 gm., RT=73° F., BP=747 mm. Hg, D_t=1,049 inches, CH=29.4 cm., δ=36.7 percent, air.							
d	0. 0710	11. 83	0. 189	23. 5	----------	79. 6	55. 4	794
	. 0990	16. 5	. 263	33. 9	----------	114. 5	79. 8	590
	. 1674	27. 8	. 444	----------	6. 3	182	126	330
	. 228	37. 9	. 635	----------	8. 5	246	171	242
	. 331	55. 1	. 880	----------	12. 0	347	241	161
	. 429	71. 3	1. 14	----------	15. 7	454	308	123
	. 493	82. 0	1. 31	----------	18. 4	533	370	111. 5
	. 580	96. 5	1. 54	----------	20. 9	599	416	90. 3
	. 636	106	1. 61	----------	22. 5	651	454	81. 9
	. 737	121	1. 93	----------	27. 3	791	550	75. 8
	. 805	134	2. 14	----------	30. 5	884	614	69. 0
	Round sand, D_p=0.00632 inch, wt.=150 gm., RT=73° F., BP=747 mm. Hg, D_t=1.049 inches, CH=18.4 cm., δ=44.6 percent, air.							
e	0. 0716	11. 92	0. 147	9. 5	----------	51. 2	84. 1	932
	. 1353	22. 5	. 278	18. 6	----------	99. 6	163	510
	. 200	33. 3	. 411	27. 2	----------	146. 4	240	342
	. 328	54. 6	. 675	----------	5. 1	235	385	205
	. 467	77. 7	. 960	----------	7. 0	323	530	139
	. 606	101	1. 25	----------	9. 1	420	689	106. 5
	. 730	122	1. 51	----------	11. 1	512	841	89
	1. 065	177	2. 18	----------	16. 5	761	1, 246	62. 8
	1. 432	238	2. 94	----------	22. 3	1, 027	1, 681	46. 9
	1. 813	302	3. 73	----------	27. 5	1, 268	2, 078	36. 0

TABLE V.—*Pressure-drop data with round and sharp sands in 1-inch standard pipe*—Continued

Run No.	w, lb./hr.	G, lb. hr.$^{-1}$ ft.$^{-2}$	Re	Δp, cm. CCl_4	Δp, cm. Hg	ΔP, lb. ft.$^{-2}$ ft.–CH^{-1}	$\Delta P_{(40)}$, lb. ft.$^{-2}$ ft.–CH^{-1}	f
Round sand, D_p=0.00632 inch, wt.=150 gm., RT=73° F., BP=747 mm. Hg, D_t=1.049 inches, CH=16.3 cm., δ=38.1 percent, air.								
e	0.0715	11.9	0.147	17.8		108	88.2	995
	.132	22.0	.272	33.9		206	168	556
	.238	39.6	.490		6.5	338	276	282
	.341	56.7	.701		9.1	474	387	193
	.485	80.6	.996		13.3	694	566	140
	.635	106	1.31		17.1	891	729	104
	.766	128	1.58		21.1	1,095	895	87.4
	1.14	190	2.34		30.7	1,596	1,300	57.8
Round sand, D_p=0.00488 inch, wt.=102.5 gm., RT=72° F., BP=747 mm. Hg, D_t=1.049 inches, CH=12.4 cm., δ=44.5 percent, air.								
f	0.0715	11.92	0.114	11.7		94	152	1,338
	.1355	22.5	.214	21.8		174	281	694
	.200	33.2	.316	32.6		260	420	475
	.3315	55.1	.535		5.9	403	652	268
	.470	78.1	.746		8.1	554	896	171
	.615	102.4	.979		10.6	725	1,170	139
	.734	122	1.16		13.6	930	1,502	126
	1.085	180.5	1.72		19.7	1,346	2,173	83.2
	1.465	244	2.32		26.0	1,776	2,870	60.2
	1.73	287	2.73		30.4	2,077	3,355	49.0
Round sand, D_p=0.00488 inch, wt.=200 gm., RT=76° F., BP=745 mm. Hg, D_t=1.049 inches, CH=22.2 cm., δ=39.1 percent, air.								
f	0.106	17.63	0.167		6.0	229	208	815
	.289	48.0	.455		15.8	604	548	290
	.389	64.8	.615		22.5	860	780	227
	.501	83.4	.790		26.2	1,000	908	159
	.526	87.6	.831		28.5	1,087	991	157
Round sand, D_p=0.00488 inch, wt.=200 gm., RT=76° F., BP=745 mm. Hg, D_t=1.049 inches, CH=22.2 cm., δ=39.1 percent, helium.								
f	0.265	4.41	0.0399		13.0	496	450	3,910
	.292	4.85	.0439		15.8	604	547	3,950
	.0465	7.73	.0698		21.2	811	736	2,078
	.0601	10.0	.0905		26.5	1,012	919	1,550
	.0693	11.54	.1042		30.0	1,144	1,038	1,318
Round sand, D_p=0.00345 inch, wt.=77 gm., RT=72° F., BP=747 mm. Hg, D_t=1.049 inches, CH=9.5 cm., δ=45.0 percent, air.								
g	0.0711	11.88	0.079	13.8		144.6	245	1,518
	.1357	22.6	.150	27.6		290	493	845
	.235	39.1	.259		5.0	446	758	438
	.335	55.8	.371		7.0	625	1,058	298
	.477	79.3	.526		10.2	914	1,547	215
	.621	103.7	.689		13.0	1,158	1,963	160
	.746	124.5	.829		17.0	1,515	2,570	145
	1.11	183	1.21		24.3	2,166	3,670	96
	1.388	230	1.53		30.0	2,678	4,543	75.2

TABLE V.—*Pressure-drop data with round and sharp sands in 1-inch standard pipe*—Continued

Run No.	w, lb./hr.	G, lb. hr.$^{-1}$ ft.$^{-2}$	Re	Δp, cm. CCl_4	Δp, cm. Hg	ΔP, lb. ft.$^{-2}$ ft.–CH^{-1}	$\Delta P_{(40)}$, lb. ft.$^{-2}$ ft.–CH^{-1}	f
	Round sand, D_p=0.00264 inch, wt.=51 gm., RT=71° F., BP=747 mm. Hg, D_t=1.049 inches, CH=6.7 cm., δ=48.5 percent, air.							
h	0. 0711	11. 88	0. 604	13. 4	--------	199	483	2, 284
	. 1357	22. 6	. 1147	26. 6	--------	395	957	1, 255
	. 236	39. 2	. 199	----------	4. 6	584	1, 412	615
	. 335	55. 8	. 283	----------	6. 6	840	2, 035	435
	. 476	79. 3	. 402	----------	9. 5	1, 200	2, 905	308
	. 621	103. 7	. 527	----------	12. 4	1, 572	3, 805	236
	. 743	124	. 630	----------	15. 5	1, 968	4, 760	207
	1. 100	183	. 930	----------	23. 9	3, 036	7, 360	147
	1. 452	242	1. 23	----------	30	3, 810	9, 245	106
	Sharp sand, D_p=0.01505 inch, wt.=250 gm., RT=77° F., BP=739 mm. Hg, D_t=1.049 inches, CH=32.9 cm., δ=48.6 percent, helium.							
a′	0. 0131	2. 18	0. 0601	4. 5	--------	13. 6	33. 2	3, 340
	. 0232	3. 86	. 1062	9. 0	--------	27. 2	66. 5	2, 138
	. 334	5. 55	. 1528	11. 0	--------	33. 2	81. 1	1, 262
	. 519	8. 61	. 237	17. 0	--------	51. 4	125	807
	. 618	10. 3	. 284	20. 5	--------	62. 0	151	683
	. 0827	13. 78	. 380	26. 8	--------	81. 0	197. 5	500
	. 1040	17. 30	. 477	----------	3. 7	98. 2	239. 5	383
	. 278	21. 2	. 585	----------	4. 5	116	283	301
	. 1488	24. 7	. 681	----------	5. 2	134	327	256
	. 1722	28. 65	. 791	----------	6. 0	154. 6	378	220
	Sharp sand, D_p=0.01505 inch, wt.=250 gm., RT=77° F., BP=739 mm. Hg, D_t=1.049 inches, CH=32.9 cm., δ=48.6 percent, air.							
a′	0. 1012	16. 82	0. 490	4. 2	--------	12. 68	30. 95	509
	. 1938	32. 2	. 938	8. 3	--------	25. 1	61. 3	275
	. 2895	48. 1	1. 40	12. 3	--------	37. 2	91. 0	184
	. 397	66. 0	1. 92	16. 9	--------	51. 0	124	134
	. 511	85. 0	2. 47	21. 9	--------	66. 2	161. 5	105
	. 574	95. 5	2. 78	24. 9	--------	75. 3	184	94. 3
	. 674	112. 3	3. 27	----------	3. 3	85. 2	208	77. 3
	. 987	164. 5	4. 79	----------	5. 1	131. 5	321	55. 4
	1. 300	216	6. 29	----------	6. 9	178	435	43. 6
	1. 952	325	9. 46	----------	10. 8	279	681	30. 1
	2. 65	440	12. 78	----------	15. 6	402	983	23. 7
	3. 42	568	16. 52	----------	21. 7	560	1, 365	19. 8
	3. 82	635	18. 45	----------	23. 7	613	1, 494	17. 4
	4. 19	698	20. 3	----------	26. 3	679	1, 655	15. 9
	4. 59	763	22. 2	----------	30	775	1, 890	15. 2

TABLE V.—*Pressure-drop data with round and sharp sands in 1-inch standard pipe*—Continued

Run No.	w, lb./hr.	G, lb. hr.$^{-1}$ ft.$^{-2}$	Re	Δp, cm. CCl_4	Δp, cm. Hg	ΔP, lb. ft.$^{-2}$ ft.$-CH^{-1}$	$\Delta P_{(40)}$, lb. ft.$^{-2}$ ft.$-CH^{-1}$	f
	Sharp sand, D_p=0.01268 inch, wt=250 gm., RT=77° F., BP=739 mm. Hg, D_t=1.049 inches, CH=33.4 cm., δ=49.4 percent, air.							
b′	0.0701	11.7	0.290	4.0	---	11.9	31.5	729
	.1325	22.1	.546	8.7	---	25.9	68.5	444
	.2276	37.8	.933	13.0	---	38.7	102.4	227
	.320	53.2	1.32	18.4	---	54.7	145	163
	.420	70.0	1.73	24.1	---	71.7	190	123
	.515	85.6	2.12	29.6	---	88.0	233	101
	.578	96.0	2.37	---	3.7	94.1	249	85.5
	.684	114	2.82	---	4.4	112	297	72.7
	.994	165	4.08	---	6.8	173	458	53
	1.317	219	5.41	---	9.3	263	696	45.8
	1.975	329	8.12	---	14.5	369	976	28.6
	2.73	454	11.2	---	20.5	521	1,380	21.2
	3.11	518	12.8	---	23.6	600	1,590	18.8
	3.52	585	14.5	---	27.5	700	1,854	17.2
	3.80	632	15.6	---	30	763	2,020	16.1
	Sharp sand, D_p=0.01268 inch, wt=250 gm., RT=77° F., BP=739 mm. Hg, D_t=1.049 inches, CH=29.7 cm., δ=43.1 percent, air.							
b′	0.0702	11.70	0.286	6.6	---	22	30.8	713
	.1720	28.6	.700	16.3	---	54.4	76.2	294
	.286	47.5	1.16	27.2	---	91	127.5	179
	.488	81.1	1.98	---	5.1	146	204	99
	.586	97.5	2.38	---	6.0	171.5	240	80
	.696	116	2.84	---	7.8	223	313	73.9
	1.362	226	5.54	---	15.7	450	631	39.1
	1.746	290	7.10	---	19.9	570	800	30.2
	2.110	350	8.57	---	24.5	703	987	25.5
	2.580	429	10.48	---	30.2	865	1,210	20.8

TABLE VI.—*Pressure-drop data with large particles in 1-inch standard pipe (downflow of air and helium)*

Run No.	w, lb./hr.	G, lb. ft.$^{-2}$ hr.$^{-1}$	Re	Δp, cm. CCl_4	Δp, cm. Hg	ΔP, lb. ft.$^{-2}$ ft. CH^{-1}	f
	D_p=0.0779 inch lead shot, RT*=79° F., BP=743 mm. Hg, air, D_t=1.049 inches, CH*=32.3 cm., δ=35.4 percent.						
1a	0.256	42.6	6.30	0.5	---	1.54	8.00
	.380	63.1	9.46	.9	---	2.76	6.57
	.472	78.5	11.75	1.2	---	3.69	5.69
	.544	90.5	13.5	1.5	---	4.61	5.35
	.665	111	16.6	1.9	---	5.85	4.52
	.958	160	24.0	3.4	---	10.43	3.79
	1.253	208	31.2	5.0	---	15.35	3.27
	1.840	306	45.9	8.5	---	26.1	2.57
	2.44	405	60.6	13.4	---	41.2	2.32
	3.04	505	75.7	18.6	---	57.1	2.07
	3.66	609	91.3	24.5	---	75.4	1.88
	4.27	710	106	30.2	---	93.0	1.71
	4.69	780	117	33.0	3.5	98.0	1.34
	4.90	815	122	---	4.1	108.5	1.36
	5.65	939	140	---	5.2	137.5	1.29
	6.18	1,030	154	---	6.2	164	1.28
	6.85	1,140	171	---	7.2	190.5	1.22
	7.53	1,255	188	---	8.2	217	1.14

* CH=column height=L; RT=temperature of gas.

TABLE VI.—*Pressure-drop data with large particles in 1-inch standard pipe (downflow of air and helium)*—Continued

Run No.	w, lb./hr.	G, lb. ft.$^{-2}$ hr.$^{-1}$	Re	Δp, cm. CCl_4	Δp, cm. Hg	ΔP, lb. ft.$^{-2}$ ft. CH^{-1}	f
	D_p=0.0779 inch, lead shot, RT=79° F., BP=743 mm. Hg, helium, D_t=1.049 inches, CH=32.3 cm., δ=35.4 percent.						
1b	0.0418	6.95	0.99	0.7		2.15	65.2
	.0826	13.8	1.96	1.5		4.61	35.4
	.125	20.8	2.96	2.4		7.39	24.9
	.168	27.9	3.97	3.2		9.85	18.5
	.230	38.2	5.44	5.0		15.35	15.4
	.332	55.1	7.85	7.6		23.4	11.3
	.551	91.8	13.0	13.6		41.8	7.25
	.788	131	18.6	21.2		65.1	5.56
	1.036	173	24.4	30.1		92.6	4.58
	1.360	226	32.2		4.3	113.5	3.24
	D_p=0.0779 inch, lead shot, RT=75° F., BP=740 mm. Hg, air, D_t=1,049 inch, CH=116.4 cm., δ=38.2 percent.						
1c	0.0703	11.7	1.76	1.2		1.02	98.5
	.1945	32.3	4.85	2.5		2.12	27.5
	.319	53.0	7.97	3.8		3.22	15.2
	.508	84.5	12.65	6.3		5.35	9.92
	.620	111.5	16.7	8.5		7.25	7.76
	.969	161.5	24.2	14.2		12.05	5.75
	1.269	211	31.7	20.5		17.4	4.85
	1.58	262	39.4	27.3		23.2	4.19
	1.88	312	46.9		3.6	26.2	2.84
	2.20	366	55.0		4.5	32.8	2.58
	2.516	418	62.8		5.7	41.5	2.51
	2.85	474	71.3		7.0	51.1	2.41
	3.18	529	79.5		8.2	59.8	2.26
	D_p=0.0779 inch, lead shot, RT=75° F., BP=740 mm. Hg, helium, D_t=1.049 inches, CH=116.4 cm., δ=38.2 percent.						
1d	0.0419	6.97	0.996	3.6		3.06	128
	.0830	13.82	1.97	7.1		6.05	64
	.1268	21.1	3.00	10.7		9.16	41.5
	.171	28.4	4.05	14.3		12.15	30.5
	.1325	22.0	3.14	12.3		10.47	43.9
	.228	37.8	5.40	21.0		17.90	25.4
	.340	56.5	8.08	32.0		27.2	17.3
	D_p=0.143 inch, glass beads, RT=83° F., BP=736 mm. Hg, helium, D_t=1.049 inches, CH=110.7 cm., δ=37.8 percent.						
2a	0.0612	10.2	2.64	1.3		1.165	32.1
	.1236	20.6	5.32	2.7		2.42	16.4
	.177	29.5	7.63	3.9		3.50	11.5
	.227	37.7	9.75	5.6		5.01	10.1
	.328	54.5	14.1	8.5		7.62	7.34
	.439	72.9	18.8	11.9		10.66	5.74
	.554	92.0	23.8	15.9		14.25	4.81
	.667	111	28.7	20.0		17.9	4.17
	.786	131	33.8	25.5		22.84	3.84

TABLE VI.—*Pressure-drop data with large particles in 1-inch standard pipe (downflow of air and helium)*—Continued

Run No.	w, lb./hr.	G, lb. ft.$^{-2}$ hr.$^{-1}$	Re	Δp, cm. CCl_4	Δp, cm. Hg	ΔP, lb. ft.$^{-2}$ ft. CH^{-1}	f
	D_p=0.143-inch glass beads, RT=83° F., BP=736 mm. Hg, air, D_t=1.049 inches, CH=110.5 cm., δ=38.8 percent.						
2a	1. 853	308	87. 6	12	----------	10. 65	2. 91
	1. 55	258	73. 7	9. 1	----------	8. 10	3. 17
	1. 245	207	58. 8	6. 6	----------	5. 87	3. 56
	. 681	113. 5	32. 3	2. 7	----------	2. 40	4. 85
	. 566	94	26. 7	1. 8	----------	1. 60	4. 68
	D_p=0.143-inch glass beads, RT=83° F., BP=736 mm. Hg, air, D_t=1.049 inches, CH=113.2 cm., δ=38.2 percent.						
2a	0. 460	76. 5	21. 7	1. 6	----------	1. 455	5. 43
	. 610	101. 6	28. 8	2. 3	----------	2. 09	4. 45
	. 906	151	42. 9	4. 2	----------	3. 82	3. 69
	1. 242	206. 5	58. 7	6. 8	----------	6. 20	3. 11
	1. 728	287	81. 6	9. 0	----------	8. 20	2. 19
	1. 852	308	87. 6	12. 7	----------	11. 55	2. 69
	D_p=0.172-inch glass beads, RT=79° F., BP=740 mm. Hg, air, D_t=1.049 inches, CH=151 cm., δ=40.5 percent.						
3a	0. 949	158	52. 3	3. 7	----------	2. 52	3. 44
	. 665	111	36. 7	2. 0	----------	1. 365	3. 84
	. 577	96	31. 7	1. 6	----------	1. 09	4. 20
	. 479	79. 6	26. 3	1. 2	----------	. 820	4. 41
	. 383	63. 8	21. 1	. 9	----------	. 614	5. 14
	. 289	48. 1	15. 9	. 6	----------	. 410	6. 01
	. 1936	32. 2	10. 6	. 3	----------	. 205	6. 73
	D_p=0.172-inch glass beads, RT=79° F., BP=740 mm. Hg, air, D_t=1.049 inches, CH=147 cm., δ=39.1 percent.						
3a	0. 964	161	53. 8	3. 9	----------	2. 73	3. 22
	. 673	112. 2	37. 5	2. 3	----------	1. 61	3. 93
	. 585	97. 4	32. 5	1. 7	----------	1. 19	3. 82
	. 486	80. 9	27. 0	1. 2	----------	. 843	3. 94
	. 388	64. 6	21. 6	. 9	----------	. 631	4. 60
	. 260	43. 4	14. 5	. 5	----------	. 350	5. 68
	D_p=0.252-inch Raschig rings, RT=83° F., BP=736 mm. Hg, helium, D_t=1.049 inches, CH=141 cm., δ=56.6 percent.						
4a	0. 135	22. 5	10. 3	1. 0	----------	0. 705	17. 4
	. 127	21. 1	9. 67	1. 0	----------	. 705	20. 3
	. 229	38. 0	17. 3	1. 6	----------	1. 125	9. 93
	. 330	54. 8	25. 0	2. 5	----------	1. 76	7. 47
	. 439	72. 9	33. 2	3. 5	----------	2. 46	5. 93
	. 548	91. 0	41. 5	4. 8	----------	3. 38	5. 22
	. 661	110. 0	50. 3	6. 3	----------	4. 54	4. 77
	. 780	130	59. 4	7. 9	----------	5. 56	4. 20
	. 901	150	68. 5	9. 8	----------	6. 91	3. 92
	1. 025	170	77. 8	11. 7	----------	8. 27	3. 66

TABLE VI.—*Pressure-drop data with large particles in 1-inch standard pipe (downflow of air and helium)*—Continued

Run No.	w, lb./hr.	G, lb. ft.$^{-2}$ hr.$^{-1}$	Re	Δp, cm. CCl_4	Δp, cm. Hg	ΔP, lb. ft.$^{-2}$ ft. CH^{-1}	f
	D_p=0.182-inch Alundum cylinders, RT=83° F., BP=736 mm. Hg, helium, D_t=1.049 inches, CH=140.4 cm., δ=36.2 percent.						
5a	0.0238	3.96	1.32	0.8		0.565	101
	.0610	10.16	3.39	1.8		1.27	34.5
	.1028	17.1	5.70	3.0		2.12	20.4
	.1668	27.7	9.23	5.0		3.53	12.9
	.128	21.3	7.09	4.2		2.96	18.2
	.224	37.2	12.4	7.3		5.15	10.4
	.330	54.8	18.3	11.5		8.12	7.57
	.444	73.8	24.6	16.4		11.56	5.95
	.560	93.0	31.0	21.4		15.1	4.90
	.688	114.8	38.2	27.0		19.0	4.05
	.774	129	43.0	31.6		22.3	3.76
	D_p=0.182-inch Alundum cylinders, RT=83° F., BP=736 mm. Hg, air, D_t=1.049 inches, CH=140.4 cm., δ=36.2 percent.						
5b	0.665	111	39	3.5		2.47	4.45
	.960	160	56.3	6.2		4.39	3.80
	1.258	210	73.9	9.3		6.58	3.29
	1.57	263	92.6	12.5		8.84	2.82
	1.867	312	109.5	16.3		11.5	2.61
	2.187	363	127.5	20.8		14.7	2.46
	2.490	414	145	26.3		18.5	2.39
	2.82	469	164.5	31.3		22.1	2.23

TABLE VII.—*Fluidization data of uniform round sands in the 2.5-inch tube*

Run No.	w, lb./hr.	G, lb.ft.$^{-2}$hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	f
	D_p=0.01505 inch, weight=756 gm., RT*=69° F., BP=746 mm. Hg, air, D_t=2.5 inches, CH*=15.4 cm.								
a-1	0.0712	2.05	0.0673	0.3	0.975	42.2	1.00		1936
	.1665	4.79	.1574	.6	1.95	42.2	1.00		727
	.324	9.33	.313	1.0	3.25	42.2	1.00		320
	.515	14.83	.487	1.8	5.85	42.2	1.00		227.8
	.787	22.65	.870	3.0	9.75	42.2	1.00		162.5
	1.148	33.10	1.087	4.4	14.3	42.2	1.00		111.8
	1.50	43.2	1.42	5.8	18.85	42.2	1.00		86.5
	1.988	57.3	1.882	7.7	25.02	42.2	1.00		65.2
	2.35	67.7	2.223	9.3	30.02	42.2	1.00		56.3
	2.82	81.2	2.668	11.4	37.0	42.2	1.00		48.3
	3.42	98.5	3.232	14.0	45.5	42.2	1.00		39.4
	3.66	105.4	3.46	14.7	47.75	42.2	1.00		36.8
	3.802	110.0		14.5	47.1	42.3	1.002	63.5	
	4.045	116.5		14.5	47.1	42.9	1.013	68.0	
	4.415	127.0		14.5	47.1	43.4	1.021	74.0	
	4.77	137.4		14.7	47.75	44.7	1.045	82.8	
	4.95	142.5		14.9	48.4	45.5	1.06	87.0	
	5.19	149.5		14.9	48.7	46.0	1.071	92.0	
	5.49	158.0		15.0	48.7	46.5	1.081	98.5	
	5.79	166.8		15.2	49.4	49.0	1.136	109.0	
	6.10	175.6		15.25	49.45	49.3	1.142	116.0	
	6.70	193		15.1	49.1	50.3	1.168	130.0	
	7.30	210		15.2	49.4	52.5	1.217	148.0	

* RT=temperature of gas; CH=column height=L.

TABLE VII.—*Fluidization data of uniform round sands in the 2.5-inch tube*—Continued

Run No.	w, lb./hr.	G, lb.ft.$^{-2}$hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_c	$G\mu l_c/\rho$ lb./hr.^{2}	f
	D_p=0.01505 inch, weight=1193 gm., RT=69° F., BP=746 mm. Hg, air, D_t=2.5 inches, CH=23.9 cm.								
a-2	0.2235	6.76	0.198	1.4	4.40	41.6	1.00	----------	505
	.565	16.27	.477	3.3	10.7	41.6	1.00	----------	212
	.916	26.38	.775	5.4	17.7	41.6	1.00	----------	134
	1.455	41.90	1.23	9.1	29.6	41.6	1.00	----------	88.8
	2.348	67.6	1.98	14.7	47.5	41.6	1.00	----------	54.4
	2.948	84.8	2.48	18.7	60.5	41.6	1.00	----------	44.2
	3.78	108.8	----------	23.25	75.8	41.8	1.004	62.2	----------
	4.02	115.8	----------	23.3	76.0	42.1	1.007	67.0	----------
	4.39	126.5	----------	23.1	75.0	43.0	1.025	74.8	----------
	4.77	137.3	----------	23.65	76.8	44.7	1.055	83.5	----------
	5.19	149.5	----------	24.1	78.2	45.8	1.076	93.0	----------
	5.48	157.8	----------	24.15	78.4	47.3	1.107	100	----------
	5.80	167.0	----------	24.2	78.6	47.8	1.118	107	----------
	6.10	175.6	----------	24.0	78.0	48.7	1.140	115	----------
	6.69	192.6	----------	24.1	78.2	50.5	1.182	132	----------
	7.31	210.6	----------	24.7	80.2	53.2	1.247	152	----------
	D_p=0.01268 inch, weight=750 gm., RT=74° F., BP=739 mm. Hg, air, D_t=2.5 inches, CH=14.9 cm								
b-1	0.1336	3.85	0.0938	0.7	2.38	41.0	1.00	----------	955
	.2582	7.44	.181	1.3	4.35	41.0	1.00	----------	468
	.510	14.68	.357	2.7	8.70	41.0	1.00	----------	241
	.779	22.32	.544	4.2	13.65	41.0	1.00	----------	164
	1.24	35.7	.870	6.7	21.8	41.0	1.00	----------	102
	1.848	53.2	1.295	10.2	33.2	41.0	1.00	----------	69.5
	2.138	61.6	1.50	11.6	37.8	41.0	1.00	----------	60.8
	2.46	70.8	1.726	13.8	44.9	41.0	1.00	----------	53.2
	2.59	74.6	1.81	14.5	47.2	41.0	1.00	----------	50.5
	2.82	81.2	----------	13.7	44.5	41.6	1.012	47.4	----------
	3.052	87.9	----------	13.9	45.3	41.8	1.017	51.5	----------
	3.36	96.8	----------	14.2	46.2	43.1	1.038	57.7	----------
	3.66	105.4	----------	14.1	45.9	44.0	1.053	64.0	----------
	3.954	113.8	----------	14.0	45.5	44.2	1.058	69.1	----------
	4.25	122.4	----------	14.3	46.4	46.4	1.100	77.5	----------
	4.56	131.4	----------	14.4	46.7	46.7	1.106	83.6	----------
	4.85	139.6	----------	14.3	46.4	47.0	1.115	89.5	----------
	5.23	150.6	----------	14.2	46.2	47.3	1.122	97.3	----------
	5.46	157.3	----------	14.4	46.7	49.0	1.157	105.0	----------
	D_p=0.01268 inch, weight=1,150 gm., RT=74° F., BP=739 mm. Hg, air, D_t=2.5 inches, CH=23.0 cm.								
b-2	0.1336	3.85	0.0938	0.7	2.28	41.4	1.00	----------	686
	.2582	7.44	.181	1.6	5.20	41.4	1.00	----------	420
	.510	14.68	.357	3.7	12.0	41.4	1.00	----------	249
	.779	22.32	.544	5.7	18.5	41.4	1.00	----------	166
	1.016	29.28	.713	8.4	27.3	41.4	1.00	----------	142
	1.24	35.7	.870	10.2	33.2	41.4	1.00	----------	116
	1.848	53.2	1.295	15.1	49.0	41.4	1.00	----------	77.3
	2.46	70.8	1.726	20.5	66.6	41.4	1.00	----------	59.3
	2.77	79.8	1.945	22.5	73.0	41.4	1.00	----------	51.1
	3.06	88.1	----------	21.6	70.4	42.5	1.018	51.5	----------
	3.37	97.0	----------	21.9	71.2	43.1	1.03	57.5	----------
	3.67	105.6	----------	22.1	71.8	45.0	1.066	64.8	----------
	3.96	114.0	----------	22.15	71.9	45.0	1.066	70.0	----------
	4.40	126.7	----------	22.7	73.7	47.2	1.11	81.0	----------
	4.70	135.4	----------	23.25	75.4	48.4	1.137	88.5	----------
	5.0	144	----------	23.05	74.8	48.6	1.142	94.8	----------
	5.47	157.5	----------	22.9	74.4	50	1.175	107.0	----------

TABLE VII.—*Fluidization data of uniform round sands in the 2.5-inch tube*—Continued

Run No.	w, lb./hr.	G, lb.ft.$^{-2}$hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	f
	D_p=0.01268 inch, weight=1,511 gm., RT=73° F., BP=739 mm. Hg, air, D_t=2.5 inches, CH=29.9 cm.								
b–3	0. 1343	3. 87	0. 0943	1. 4	4. 55	40. 8	1. 00	----------	986
	. 2598	7. 48	. 182	2. 8	9. 11	40. 8	1. 00	----------	514
	. 512	14. 75	. 349	5. 2	16. 9	40. 8	1. 00	----------	254
	. 672	19. 35	. 471	7. 4	24. 0	40. 8	1. 00	----------	210
	1. 246	35. 9	. 876	13. 7	44. 5	40. 8	1. 00	----------	112
	1. 858	53. 5	1. 302	20. 3	66. 1	40. 8	1. 00	----------	75. 4
	2. 474	71. 2	1. 735	27. 4	89. 1	40. 8	1. 00	----------	57. 3
	2. 776	79. 9	----------	29. 6	96. 3	41. 0	1. 004	46. 1	----------
	3. 07	88. 4	----------	29. 5	96. 0	42. 1	1. 024	52. 1	----------
	3. 38	97. 3	----------	29. 55	96. 0	42. 9	1. 037	58. 1	----------
	3. 68	106. 0	----------	30. 1	97. 6	44. 0	1. 06	64. 6	----------
	4. 042	116. 5	----------	30. 9	100. 3	45. 5	1. 087	73. 0	----------
	4. 41	127	----------	31. 2	101. 3	46. 3	1. 103	80. 7	----------
	4. 88	140. 6	----------	31. 8	103. 2	47. 1	1. 122	90. 8	----------
	D_p=0.01268 inch, weight=750 gm., RT=72° F., BP=739 mm. Hg, CO_2, D_t=2.5 inches, CH=14.9 cm.								
b–4	0. 1646	4. 74	0. 147	0. 7	2. 28	41. 0	1. 00	----------	1, 000
	. 395	11. 38	. 344	1. 4	4. 54	41. 0	1. 00	----------	344
	. 703	20. 3	. 620	2. 1	6. 82	41. 0	1. 00	----------	164
	. 960	27. 64	. 840	3. 2	10. 4	41. 0	1. 00	----------	134
	1. 924	55. 4	1. 68	4. 8	15. 6	41. 0	1. 00	----------	50. 2
	2. 292	66. 0	2. 02	6. 8	22. 1	41. 0	1. 00	----------	50. 0
	3. 02	86. 8	2. 64	9. 2	30. 0	41. 0	1. 00	----------	39. 5
	3. 748	108	3. 29	11. 2	36. 4	41. 0	1. 00	----------	31. 0
	4. 492	129. 4	3. 94	12. 9	42. 0	41. 0	1. 00	----------	----------
	4. 782	137. 7	4. 19	13. 8	44. 9	41. 0	1. 00	----------	----------
	5. 09	146. 6	4. 45	14. 7	47. 7	41. 0	1. 00	----------	----------
	5. 22	150. 4	----------	14. 0	45. 5	41. 6	1. 012	47. 0	----------
	5. 59	161	----------	----------	46. 2	42. 1	1. 018	50. 4	----------
	5. 95	171. 4	----------	----------	46. 9	43. 0	1. 036	54. 5	----------
	6. 33	182. 2	----------	----------	46. 6	44. 3	1. 059	59. 2	----------
	6. 69	192. 6	----------	----------	47. 2	45. 4	1. 080	64. 0	----------
	7. 43	214	----------	----------	46. 9	46. 6	1. 103	72. 5	----------
	8. 16	235	----------	----------	46. 6	48. 2	1. 139	82. 0	----------
	8. 88	255. 8	----------	----------	46. 9	49. 0	1. 157	90. 7	----------
	D_p=0.01268 inch, weight=1,150 gm., RT=70° F., BP=739 mm. Hg, CO_2, D_t=2.5 inches, CH=22.8 cm.								
b–5	0. 1656	4. 77	0. 144	0. 9	2. 93	41. 0	1. 00	----------	840
	. 3202	9. 22	. 278	1. 5	4. 89	41. 0	1. 00	----------	374
	. 632	18. 2	. 551	2. 9	9. 45	41. 0	1. 00	----------	181
	. 966	27. 8	. 843	5. 0	16. 3	41. 0	1. 00	----------	137
	1. 536	44. 25	1. 34	7. 5	24. 4	41. 0	1. 00	----------	80. 8
	2. 292	66. 0	1. 99	10. 9	35. 5	41. 0	1. 00	----------	52. 9
	3. 02	86. 8	2. 62	14. 5	47. 2	41. 0	1. 00	----------	40. 7
	3. 782	109	3. 30	18. 0	58. 6	41. 0	1. 00	----------	32. 1
	4. 53	130. 5	3. 95	20. 7	67. 4	41. 0	1. 00	----------	25. 8
	4. 90	141. 2	4. 28	22. 3	72. 6	41. 0	1. 00	----------	23. 8
	5. 26	151. 4	----------	21. 4	69. 7	41. 7	1. 013	47. 1	----------
	5. 64	162. 5	----------	21. 8	71. 0	42. 2	1. 021	51. 0	----------
	6. 01	173. 2	----------	21. 8	71. 0	42. 9	1. 035	55. 0	----------
	6. 39	184	----------	----------	71. 6	44. 6	1. 066	60. 2	----------
	6. 75	194. 4	----------	----------	71. 6	45. 3	1. 079	64. 4	----------
	7. 13	205. 4	----------	----------	72. 2	46. 7	1. 107	70. 0	----------
	7. 51	216. 2	----------	----------	72. 2	47. 8	1. 130	75. 0	----------
	8. 24	237. 2	----------	----------	74. 2	50. 0	1. 183	86. 2	----------

TABLE VII.—*Fluidization data of uniform round sands in the 2.5-inch tube*—Continued

Run No.	w, lb./hr.	G, lb. ft.$^{-2}$ hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$, lb./hr.^{2}	f
	D_p=0.01268 inch, weight=1,511 gm., RT=74° F., BP=739 mm. Hg, CO_2, D_t=2.5 inches, CH=29.8 cm.								
b-6	0. 1652	4. 76	0. 142	1. 2	3. 91	40. 7	1. 00	----------	831
	. 3192	9. 18	. 273	2. 1	6. 85	40. 7	1. 00	----------	395
	. 630	18. 20	. 540	4. 1	13. 34	40. 7	1. 00	----------	197
	. 825	23. 80	. 709	5. 7	18. 55	40. 7	1. 00	----------	159
	1. 184	34. 1	1. 014	8. 1	26. 4	40. 7	1. 00	----------	109
	1. 532	44. 1	1. 315	10. 4	33. 9	40. 7	1. 00	----------	84
	1. 916	55. 2	1. 645	12. 6	40. 0	40. 7	1. 00	----------	63. 4
	2. 282	65. 7	1. 955	15. 1	49. 2	40. 7	1. 00	----------	55
	3. 045	87. 7	2. 61	19. 8	64. 5	40. 7	1. 00	----------	40. 5
	3. 78	108. 8	3. 24	24. 5	79. 8	40. 7	1. 00	----------	32. 6
	4. 53	130. 5	3. 89	28. 4	92. 5	40. 7	1. 00	----------	26. 4
	4. 975	143. 3	----------	30. 9	100. 5	41. 0	1. 004	44. 0	----------
	5. 26	151. 5	----------	29. 4	95. 8	41. 6	1. 016	47. 4	----------
	5. 72	164. 8	----------	30. 0	97. 6	42. 3	1. 028	52. 0	----------
	6. 00	172. 7	----------	30. 0	97. 6	43. 1	1. 043	55. 3	----------
	6. 31	181. 6	----------	----------	97. 5	44. 4	1. 065	59. 3	----------
	6. 75	194. 4	----------	----------	98. 8	44. 8	1. 073	64. 1	----------
	7. 13	205. 2	----------	----------	99. 9	46. 0	1. 098	69. 0	----------
	7. 50	216	----------	----------	101	47. 3	1. 125	74. 7	----------
	8. 23	237	----------	----------	105	49. 5	1. 175	85. 5	----------
	D_p=0.01062 inch, weight=874 gm., RT=72° F., BP=740 mm. Hg, air, D_t=2.5 inches, CH=17.8 cm.								
c-1	0. 0705	2. 06	0. 0421	0. 7	2. 28	42. 3	1. 00	----------	2, 790
	. 321	9. 24	. 189	3. 0	9. 76	42. 3	1. 00	----------	596
	. 572	16. 48	. 337	5. 2	16. 9	42. 3	1. 00	----------	325
	. 779	22. 32	. 456	7. 5	24. 4	42. 3	1. 00	----------	256
	1. 24	35. 7	. 731	12. 2	39. 7	42. 3	1. 00	----------	163
	1. 552	44. 7	. 915	15. 0	48. 9	42. 3	1. 00	----------	127
	1. 848	53. 2	1. 088	17. 8	58. 0	42. 3	1. 00	----------	107
	2. 16	62. 2	----------	17. 6	57. 2	43. 8	1. 027	36. 8	----------
	2. 46	70. 8	----------	17. 62	57. 3	45. 1	1. 05	42. 8	----------
	2. 76	79. 4	----------	17. 95	58. 2	46. 2	1. 072	49. 0	----------
	3. 052	87. 9	----------	17. 85	57. 9	47. 1	1. 09	55. 1	----------
	3. 36	96. 8	----------	17. 95	58. 0	48. 0	1. 108	61. 6	----------
	3. 66	105. 4	----------	18. 1	58. 4	48. 7	1. 123	68. 3	----------
	3. 954	113. 8	----------	18. 0	58. 1	49. 6	1. 146	75. 0	----------
	4. 25	122. 4	----------	18. 1	58. 4	49. 8	1. 152	81. 5	----------
	D_p=0.01062 inch, weight=874 gm., RT=76° F., BP=740 mm. Hg, CO_2, D_t=2.5 inches, CH=17.8 cm.								
c-2	0. 0873	2. 514	0. 0642	0. 7	2. 28	42. 3	1. 00	----------	2, 950
	. 3972	11. 45	. 292	2. 9	9. 45	42. 3	1. 00	----------	590
	. 709	20. 4	. 523	4. 1	13. 3	42. 3	1. 00	----------	260
	. 828	23. 8	. 609	5. 4	17. 6	42. 3	1. 00	----------	252
	1. 187	34. 2	. 874	7. 2	23. 4	42. 3	1. 00	----------	164
	1. 536	44. 3	1. 126	9. 1	29. 6	42. 3	1. 00	----------	123
	1. 923	55. 4	1. 41	10. 9	35. 4	42. 3	1. 00	----------	94
	2. 29	65. 9	1. 68	13. 1	42. 6	42. 3	1. 00	----------	80
	2. 665	76. 8	1. 96	14. 7	47. 8	42. 3	1. 00	----------	66. 3
	3. 034	87. 4	2. 23	17. 0	55. 3	42. 3	1. 00	----------	58. 9
	3. 404	98. 1	----------	17. 7	57. 6	43. 1	1. 014	30. 6	----------
	3. 765	108. 4	----------	17. 7	57. 6	43. 8	1. 026	34. 2	----------
	4. 144	119. 4	----------	----------	57. 6	44. 5	1. 038	38. 2	----------
	4. 515	130	----------	----------	57. 6	45. 1	1. 051	42. 0	----------
	4. 875	140. 5	----------	----------	58. 6	45. 6	1. 061	46. 0	----------
	5. 24	151	----------	----------	57. 3	46. 9	1. 086	50. 4	----------
	5. 62	161. 8	----------	----------	57. 9	48. 0	1. 110	55. 1	----------
	5. 99	172. 5	----------	----------	58. 8	49. 7	1. 150	60. 9	----------

TABLE VII.—*Fluidization data of uniform round sands in the 2.5-inch tube*—Continued

Run No.	w, lb./hr.	G, lb. ft.$^{-2}$ hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	f
	D_p=0.00818 inch, weight=650 gm., RT=72° F., BP=750 mm. Hg, air, D_t=2.5 inches, CH=13.7 cm.								
d–1	0. 0696	2. 01	0. 0314	1. 0	3. 25	44. 4	1. 00	----------	5, 340
	. 1870	5. 38	. 0842	2. 1	6. 82	44. 4	1. 00	----------	1, 560
	. 2605	7. 50	. 1175	2. 8	9. 0	44. 4	1. 00	----------	1, 069
	. 3742	10. 76	. 1685	4. 0	13. 1	44. 4	1. 00	----------	742
	. 561	16. 15	. 253	5. 7	18. 5	44. 4	1. 00	----------	470
	. 688	19. 82	. 3104	7. 1	23. 1	44. 4	1. 00	----------	388
	. 906	26. 1	. 409	9. 8	31. 9	44. 4	1. 00	----------	309
	1. 235	35. 58	. 557	13. 2	42. 9	44. 4	1. 00	----------	224
	1. 362	39. 20	----------	----------	41. 6	45. 6	1. 023	23. 1	----------
	1. 502	43. 28	----------	----------	41. 6	46. 3	1. 040	26. 0	----------
	1. 848	53. 2	----------	----------	42. 2	47. 3	1. 060	32. 4	----------
	2. 15	61. 9	----------	----------	41. 9	48. 9	1. 092	39. 0	----------
	2. 433	70. 0	----------	----------	42. 7	49. 8	1. 113	45. 0	----------
	2. 64	76. 0	----------	----------	42. 6	50. 9	1. 140	50. 0	----------
	2. 905	83. 6	----------	----------	42. 6	51. 8	1. 164	56. 0	----------
	3. 32	95. 6	----------	----------	42. 6	52. 2	1. 206	66. 3	----------
	3. 62	104. 3	----------	----------	42. 6	54. 3	1. 224	73. 5	----------
	4. 00	115. 3	----------	----------	42. 3	55. 0	1. 245	82. 6	----------
	4. 60	132. 5	----------	----------	41. 5	56. 4	1. 280	87. 5	----------
	4. 94	142. 3	----------	----------	43. 2	57. 6	1. 319	108	----------
	D_p=0.00818 inch, weight=1,116 gm., RT=72° F., BP=750 mm. Hg, air, D_t=2.5 inches, CH=23.6 cm.								
d–2	0. 0696	2. 01	0. 0315	1. 60	5. 20	44. 7	1. 00	----------	4, 950
	. 1347	3. 88	. 0608	2. 50	8. 12	44. 7	1. 00	----------	2, 068
	. 2656	7. 64	. 1197	4. 5	14. 63	44. 7	1. 00	----------	963
	. 4078	11. 74	. 1838	6. 7	21. 78	44. 7	1. 00	----------	774
	. 619	17. 83	. 2792	10. 0	32. 5	44. 7	1. 00	----------	393
	. 688	19. 82	. 3103	11. 6	37. 7	44. 7	1. 00	----------	369
	. 801	23. 08	. 3615	13. 7	44. 5	44. 7	1. 00	----------	321
	. 912	26. 27	. 4112	16. 1	52. 3	44. 7	1. 00	----------	291
	1. 123	32. 35	. 507	19. 8	64. 3	44. 7	1. 00	----------	236
	1. 235	35. 56	. 526	22. 1	71. 8	44. 7	1. 00	----------	218
	1. 395	40. 16	----------	21. 6	70. 2	45. 3	1. 009	23. 4	----------
	1. 72	49. 52	----------	21. 9	71. 2	46. 3	1. 029	29. 4	----------
	1. 848	53. 2	----------	22. 3	72. 5	46. 9	1. 047	32. 0	----------
	2. 15	61. 9	----------	----------	72. 6	47. 9	1. 063	38. 0	----------
	2. 442	70. 3	----------	----------	72. 8	49. 7	1. 102	44. 7	----------
	2. 752	79. 3	----------	----------	73. 0	51. 1	1. 133	51. 8	----------
	3. 046	87. 7	----------	----------	73. 1	52. 5	1. 165	58. 9	----------
	3. 32	95. 6	----------	----------	73. 3	53. 0	1. 175	64. 6	----------
	3. 62	104. 2	----------	----------	73. 4	54. 3	1. 208	72. 5	----------
	4. 238	122	----------	----------	75. 4	56. 4	1. 273	89. 5	----------
	4. 84	139. 5	----------	----------	75. 7	60. 3	1. 399	112	----------
	D_p=0.00632 inch, weight=980 gm., RT=72° F., BP=740 mm. Hg, air, D_t=2.5 inches, CH=20.7 cm.								
e–1	0. 1338	3. 86	0. 0473	3. 3	10. 72	44. 5	1. 00	----------	2, 460
	. 2586	7. 44	. 0913	5. 9	19. 2	44. 5	1. 00	----------	1, 188
	. 510	14. 7	. 180	12. 1	39. 4	44. 5	1. 00	----------	621
	. 779	22. 3	. 273	20. 0	65. 1	44. 5	1. 00	----------	446
	. 968	27. 9	----------	19. 3	62. 8	45. 6	1. 02	16. 4	----------
	1. 254	36. 1	----------	19. 6	63. 7	46. 9	1. 046	21. 75	----------
	1. 568	45. 2	----------	----------	64. 1	48. 2	1. 073	28. 0	----------
	1. 87	53. 8	----------	----------	64. 4	49. 8	1. 106	34. 3	----------
	2. 16	62. 2	----------	----------	63. 8	50. 5	1. 122	40. 2	----------
	2. 46	70. 8	----------	----------	64. 0	52. 1	1. 16	47. 3	----------
	2. 76	79. 4	----------	----------	65. 7	52. 6	1. 172	53. 6	----------
	3. 054	88. 0	----------	----------	65. 1	53. 6	1. 196	60. 6	----------
	3. 36	96. 8	----------	----------	66. 1	54. 5	1. 22	68. 1	----------
	3. 66	105. 4	----------	----------	65. 3	54. 9	1. 232	74. 7	----------
	3. 954	113. 8	----------	----------	64. 7	56. 4	1. 28	79. 0	----------
	4. 63	133. 4	----------	----------	65. 1	57. 1	1. 303	100. 0	----------

TABLE VII.—*Fluidization data of uniform round sands in the 2.5-inch tube*—Continued

Run No.	w, lb./hr.	G, lb.ft.$^{-2}$hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	f
	D_p=0.00632 inch, weight=980 gm., RT=72° F., BP=740 mm. Hg, CO_2, D_t=2.5 inches, CH=20.6 cm.								
e-2	0. 1652	4. 76	0. 0722	3. 0	9. 76	44. 3	1. 00	----------	2, 220
	. 3192	9. 18	. 1386	5. 5	17. 5	44. 3	1. 00	----------	1, 062
	. 630	18. 2	. 275	8. 6	28. 0	44. 3	1. 00	----------	431
	. 963	27. 7	. 419	15. 7	51. 0	44. 3	1. 00	----------	337
	1. 532	44. 1	----------	19. 4	63. 1	45. 9	1. 030	14. 0	----------
	1. 918	55. 2	----------	19. 8	64. 4	46. 6	1. 043	17. 7	----------
	2. 285	65. 8	----------	19. 6	63. 8	47. 3	1. 058	21. 4	----------
	2. 662	76. 7	----------	----------	63. 8	48. 7	1. 086	25. 6	----------
	3. 032	87. 3	----------	----------	64. 8	49. 8	1. 112	30. 0	----------
	3. 40	97. 9	----------	----------	64. 8	51. 6	1. 152	34. 6	----------
	3. 762	108. 4	----------	----------	64. 1	51. 6	1. 152	38. 4	----------
	4. 14	119. 2	----------	----------	64. 8	52. 1	1. 164	42. 6	----------
	4. 51	130. 0	----------	----------	64. 8	53. 6	1. 200	48. 0	----------
	4. 87	140. 3	----------	----------	67. 0	54. 1	1. 213	52. 4	----------
	5. 24	151	----------	----------	66. 4	54. 9	1. 236	57. 4	----------
	5. 78	166. 5	----------	----------	64. 1	55. 3	1. 248	63. 7	----------
	6. 15	177. 2	----------	----------	65. 4	56. 4	1. 286	70. 0	----------
	6. 72	193. 5	----------	----------	68. 0	58. 2	1. 334	79. 2	----------
	D_p=0.00632 inch, weight=980 gm., RT=74° F., BP=737 mm. Hg, helium, D_t=2.5 inches, CH=20.4 cm.								
e-3	0. 01134	0. 327	0. 00384	2. 2	7. 16	43. 6	1. 00	----------	29, 200
	. 0238	. 685	. 00807	4. 9	15. 95	43. 6	1. 00	----------	14, 800
	. 0442	1. 272	. 0150	8. 2	26. 7	43. 6	1. 00	----------	7, 140
	. 0613	1. 766	. 0208	12. 0	39. 0	43. 6	1. 00	----------	5, 430
	. 0823	2. 37	. 0279	16. 1	52. 4	43. 6	1. 00	----------	4, 035
	. 1042	3. 00	. 0353	20. 6	66. 8	43. 6	1. 00	----------	3, 120
	. 1254	3. 61	----------	19. 9	64. 2	45. 4	1. 034	15. 6	----------
	. 1472	4. 24	----------	20. 1	65. 4	45. 8	1. 037	18. 3	----------
	. 1685	4. 85	----------	20. 2	65. 7	46. 4	1. 052	21. 2	----------
	. 2281	6. 57	----------	----------	65. 7	48. 0	1. 087	29. 8	----------
	. 3308	9. 53	----------	----------	64. 5	51. 4	1. 163	46. 2	----------
	. 4418	12. 72	----------	----------	67. 0	52. 8	1. 196	63. 2	----------
	. 550	15. 85	----------	----------	66. 4	54. 0	1. 226	80. 6	----------
	. 6635	19. 1	----------	----------	67. 0	55. 7	1. 276	101	----------
	D_p=0.00488 inch, weight=557 gm., RT=69° F., BP=746 mm. Hg, air, D_t=2.5 inches, CH=12.0 cm.								
f-1	0. 1215	3. 50	0. 0334	2. 6	8. 46	45. 4	1. 00	----------	3, 516
	. 334	9. 61	. 0918	7. 5	24. 4	45. 4	1. 00	----------	1, 345
	. 496	14. 28	----------	10. 2	33. 3	45. 8	1. 007	8. 25	----------
	. 598	17. 22	----------	10. 5	34. 1	46. 2	1. 015	10. 0	----------
	. 675	19. 44	----------	10. 7	34. 75	47. 1	1. 033	11. 6	----------
	. 968	27. 87	----------	10. 9	35. 4	48. 9	1. 07	17. 2	----------
	1. 253	36. 06	----------	----------	35. 4	50. 2	1. 098	22. 8	----------
	1. 506	43. 34	----------	----------	35. 4	51. 4	1. 125	28. 2	----------
	1. 88	54. 1	----------	----------	35. 1	52. 8	1. 157	36. 1	----------
	2. 172	62. 6	----------	----------	35. 1	53. 1	1. 165	42. 0	----------
	2. 43	69. 9	----------	----------	35. 4	55. 0	1. 216	49. 0	----------
	2. 778	80. 0	----------	----------	35. 1	55. 0	1. 216	56. 0	----------
	3. 07	88. 4	----------	----------	35. 4	55. 4	1. 23	62. 6	----------
	3. 38	97. 3	----------	----------	35. 4	56. 1	1. 248	70. 0	----------
	3. 682	106	----------	----------	35. 1	57. 7	1. 29	78. 5	----------
	4. 022	115. 8	----------	----------	35. 1	58. 4	1. 312	87. 3	----------
	4. 468	128. 6	----------	----------	34. 4	60. 3	1. 373	102	----------
	4. 882	140. 6	----------	----------	34. 9	60. 8	1. 393	113	----------

TABLE VII.—*Fluidization data of uniform round sands in the 2.5-inch tube*—Continued

Run No.	w, lb./hr.	G, lb. ft.$^{-2}$ hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	f
	D_p=0.00488 inch, weight=858 gm., RT=69° F., BP=746 mm. Hg, air, D_t=2.5 inches, CH=18.2 cm.								
f–2	0. 1740	5. 01	0. 0479	5. 8	18. 85	44. 5	1. 00		2, 308
	. 4065	11. 71	. 1072	14. 1	45. 8	44. 5	1. 00		1, 026
	. 510	14. 69		16. 0	52. 0	45. 0	1. 010	8. 52	
	. 788	22. 4		16. 8	54. 6	47. 3	1. 055	13. 6	
	1. 026	29. 56		16. 9	54. 9	48. 0	1. 068	18. 2	
	1. 254	36. 1		16. 8	54. 6	48. 7	1. 086	22. 6	
	1. 506	43. 4		16. 9	54. 9	50. 3	1. 120	28. 0	
	1. 868	53. 8		16. 9	54. 9	51. 8	1. 154	35. 8	
	2. 176	62. 7		16. 8	54. 6	53. 0	1. 181	42. 7	
	2. 478	71. 3			54. 9	53. 5	1. 194	49. 0	
	2. 78	80. 0			55. 1	54. 0	1. 208	55. 7	
	3. 073	88. 5			55. 2	55. 0	1. 236	63. 0	
	3. 384	97. 3			55. 4	55. 9	1. 263	71. 0	
	3. 685	106			55. 6	56. 3	1. 276	77. 8	
	4. 05	116. 6			55. 7	57. 0	1. 305	87. 5	
	4. 47	128. 7			56. 0	58. 8	1. 346	100. 0	
	4. 89	140. 8			56. 2	61. 0	1. 428	116	
	D_p=0.00488 inch, weight=858 gm., RT=74° F., BP=739 mm. Hg, CO_2, D_t=2. 5 inches, CH=18.0 cm.								
f–3	0. 0868	2. 50	0. 0288	2. 5	8. 15	44. 2	1. 00		5, 700
	. 2405	6. 92	. 0797	6. 6	21. 4	44. 2	1. 00		1, 965
	. 4735	13. 65	. 1455	11. 9	38. 7	44. 2	1. 00		908
	. 703	20. 3	. 233	14. 6	47. 6	44. 2	1. 00		505
	. 960	27. 64		16. 5	53. 8	46. 3	1. 039	8. 81	
	1. 252	36. 08		16. 8	54. 6	47. 5	1. 064	11. 8	
	1. 526	43. 94			54. 3	47. 8	1. 070	14. 5	
	1. 924	55. 4			54. 3	48. 7	1. 088	18. 5	
	2. 292	66. 0			53. 7	50. 1	1. 122	22. 8	
	2. 65	76. 3			53. 7	50. 9	1. 138	26. 7	
	3. 02	87. 0			54. 7	51. 1	1. 144	30. 6	
	3. 388	97. 5			55. 0	52. 1	1. 166	34. 9	
	3. 748	108			54. 7	52. 7	1. 178	39. 0	
	4. 124	118. 7			54. 4	53. 3	1. 195	43. 5	
	4. 492	129. 4			54. 4	53. 3	1. 195	47. 5	
	4. 85	139. 6			54. 7	55. 4	1. 252	53. 7	
	5. 22	150. 4			54. 7	55. 7	1. 264	58. 4	
	5. 75	165. 6			54. 7	56. 9	1. 305	66. 4	
	5. 95	171. 4			54. 0	56. 9	1. 305	68. 8	
	D_p=0.00345 inch, weight=898 gm., RT=74° F., BP=739 mm. Hg, air, D_t=2.5 inches, CH=20.0 cm.								
g–1	0. 0705	2. 03	0. 0134	4. 0	13. 0	47. 4	1. 00		6, 300
	. 1357	3. 85	. 0256	8. 1	26. 4	47. 4	1. 00		4, 690
	. 2584	7. 44	. 0493	15. 6	50. 9	47. 4	1. 00		2, 410
	. 3415	9. 83		17. 2	56. 0	48. 4	1. 02	5. 76	
	. 347	9. 99		17. 5	57. 0	49. 1	1. 035	5. 95	
	. 566	16. 30		17. 7	57. 6	50. 0	1. 055	9. 90	
	. 779	22. 42		17. 7	57. 6	51. 1	1. 078	13. 90	
	1. 016	29. 28		17. 9	58. 3	51. 6	1. 09	18. 40	
	1. 24	35. 70		17. 8	57. 9	52. 6	1. 11	22. 80	
	1. 552	44. 7		17. 9	58. 3	53. 9	1. 142	29. 50	
	1. 867	53. 8		17. 9	58. 3	54. 6	1. 162	36. 10	
	2. 160	62. 2		17. 85	58. 1	56. 0	1. 20	43. 0	
	2. 46	70. 8		18. 4	59. 9	56. 4	1. 212	49. 5	
	2. 76	79. 5		18. 3	59. 6	57. 9	1. 25	57. 2	
	3. 052	87. 9		18. 5	60. 3	58. 6	1. 275	64. 6	
	3. 36	96. 8		18. 3	59. 6	59. 0	1. 286	71. 7	
	3. 78	109. 0		18. 5	60. 3	60. 2	1. 325	83. 1	
	4. 25	122. 5		18. 2	59. 3	61. 0	1. 350	95. 0	
	4. 85	139. 7		18. 05	58. 8	62. 4	1. 40	113	

TABLE VII.—*Fluidization data of uniform round sands in the 2.5-inch tube*—Continued

Run No.	w, lb./hr.	G, lb.ft.$^{-2}$hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_c/\rho$ lb./hr.^{2}	f
	D_p=0.00345 inch, weight=1,080 gm., RT=70° F., BP=740 mm. Hg, air, D_t=2.5 inches, CH=23.5 cm.								
g-2	0. 1102	3. 17	0. 0211	8. 4	27. 3	46. 1	1. 00	----------	5, 300
	. 1585	4. 56	. 0303	12. 3	40. 0	46. 1	1. 00	----------	3, 740
	. 222	6. 39	. 0424	17. 3	56. 3	46. 1	1. 00	----------	2, 670
	. 2976	8. 56	----------	22. 0	71. 6	46. 3	1. 004	4. 94	----------
	. 335	9. 64	----------	22. 0	71. 6	46. 9	1. 016	5. 65	----------
	. 398	11. 46	----------	21. 1	68. 6	48. 4	1. 046	5. 92	----------
	. 467	13. 45	----------	----------	68. 4	48. 9	1. 056	8. 18	----------
	. 548	15. 78	----------	----------	69. 4	49. 4	1. 068	9. 70	----------
	. 592	17. 06	----------	----------	69. 4	49. 4	1. 068	9. 82	----------
	. 675	19. 45	----------	----------	70. 4	50. 0	1. 08	12. 1	----------
	. 915	26. 34	----------	----------	69. 4	50. 5	1. 092	16. 6	----------
	1. 253	36. 1	----------	----------	70. 7	51. 0	1. 123	23. 4	----------
	1. 567	45. 6	----------	----------	68. 4	53. 0	1. 148	29. 9	----------
	1. 868	53. 6	----------	----------	69. 4	54. 6	1. 190	36. 8	----------
	2. 16	62. 2	----------	----------	68. 6	55. 4	1. 212	43. 5	----------
	2. 46	70. 8	----------	----------	71. 4	56. 1	1. 233	50. 3	----------
	2. 76	79. 4	----------	----------	65. 8	56. 6	1. 256	57. 3	----------
	3. 054	88. 0	----------	----------	70. 0	61. 7	1. 276	64. 8	----------
	3. 36	96. 8	----------	----------	72. 6	62. 3	1. 296	72. 4	----------
	D_p=0.00345 inch, weight=898 gm., RT=72° F., BP=739 mm. Hg, CO_2, D_t=2.5 inches, CH=20.0 cm.								
g-3	0. 0868	2. 50	0. 0204	4. 6	14. 95	47. 4	1. 00	----------	9, 500
	. 1646	4. 74	. 0386	6. 3	20. 45	47. 4	1. 00	----------	3, 630
	. 1355	9. 38	. 0766	11. 3	36. 8	47. 4	1. 00	----------	1, 660
	. 576	16. 6	----------	17. 4	56. 8	48. 2	1. 016	5. 19	----------
	. 713	20. 54	----------	17. 5	57. 0	48. 9	1. 03	6. 50	----------
	. 823	23. 7	----------	17. 8	58. 0	50. 1	1. 055	7. 70	----------
	. 960	27. 64	----------	----------	58. 0	50. 6	1. 066	9. 05	----------
	1. 252	36. 1	----------	----------	58. 6	51. 3	1. 081	12. 0	----------
	1. 626	43. 94	----------	----------	58. 3	52. 2	1. 10	14. 95	----------
	1. 824	55. 4	----------	----------	58. 9	52. 8	1. 115	19. 0	----------
	2. 292	66. 0	----------	----------	59. 2	54. 1	1. 145	23. 3	----------
	2. 65	76. 3	----------	----------	59. 6	55. 4	1. 18	27. 6	----------
	3. 02	87. 0	----------	----------	58. 9	56. 0	1. 20	32. 2	----------
	3. 388	97. 5	----------	----------	59. 8	56. 5	1. 215	36. 5	----------
	3. 748	108	----------	----------	59. 2	57. 5	1. 238	41. 0	----------
	4. 124	118. 7	----------	----------	59. 8	59. 6	1. 274	46. 5	----------
	4. 492	129. 4	----------	----------	59. 2	59. 6	1. 274	50. 6	----------
	4. 85	139. 6	----------	----------	58. 9	59. 6	1. 274	54. 7	----------
	5. 22	150. 4	----------	----------	58. 9	60. 2	1. 325	61. 2	----------
	5. 95	171. 4	----------	----------	58. 9	60. 9	1. 348	71. 0	----------
	D_p=0.00345 inch, weight=1,080 gm., RT=70° F., BP=740 mm. Hg, helium, D_t=2.5 inches, CH=23.5 cm.								
g-4	0. 01582	0. 456	0. 00290	10. 6	34. 5	46. 1	1. 00	----------	44, 300
	. 03698	1. 065	. 00680	22. 0	71. 6	46. 1	1. 00	----------	16, 800
	. 0524	1. 51	----------	21. 4	69. 6	48. 9	1. 055	6. 62	----------
	. 0616	1. 77	----------	21. 5	70. 0	49. 0	1. 058	7. 80	----------
	. 0724	2. 08	----------	20. 8	70. 9	49. 2	1. 063	9. 20	----------
	. 0826	2. 38	----------	20. 8	70. 9	49. 3	1. 067	10. 5	----------
	. 1048	3. 02	----------	----------	70. 9	49. 8	1. 076	13. 5	----------
	. 1262	3. 63	----------	----------	72. 0	50. 5	1. 092	16. 6	----------
	. 1481	4. 36	----------	----------	72. 4	51. 4	1. 114	19. 8	----------
	. 1695	4. 88	----------	----------	70. 4	51. 7	1. 118	22. 8	----------
	. 209	6. 02	----------	----------	70. 9	53. 8	1. 170	29. 3	----------
	. 2925	8. 42	----------	----------	69. 7	55. 4	1. 211	42. 5	----------
	. 3794	10. 92	----------	----------	69. 0	55. 4	1. 213	55. 0	----------
	. 4445	12. 80	----------	----------	70. 3	57. 8	1. 276	68. 0	----------
	. 554	15. 95	----------	----------	69. 7	60. 6	1. 363	90. 5	----------

TABLE VII.—*Fluidization data of uniform round sands in the 2.5-inch tube*—Continued

Run No.	w, lb./hr.	G, lb.ft.$^{-2}$hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	f
	D_p=0.00310 inch, weight=1,865 gm., RT=78° F., BP=736 mm. Hg, air, D_t=2.5 inches, CH=44.9 cm.								
h–1	0.1335	5.84	0.0252	19.0	61.9	51.1	1.00		7,050
	.258	7.43	.0490	34.1	110.8	51.1	1.00		3,375
	.322	9.26		32.3	105	52.3	1.029	5.63	
	.448	12.92		32.9	107	53.2	1.042	7.97	
	.673	19.45		33.1	107.5	54.3	1.068	12.28	
	.969	28.0		34.0	110.5	55.3	1.090	18.1	
	1.260	36.3		34.0	110.5	55.9	1.100	23.6	
	1.558	44.8			112.2	58.0	1.165	30.9	
	1.85	53.3			112.6	59.0	1.191	37.6	
	2.152	62.0			113.8	59.7	1.210	44.4	
	2.438	70.3			115.1	61.4	1.263	52.6	
	2.73	78.6			117.8	61.8	1.282	59.7	
	D_p=0.00310 inch, weight=2,376 gm., RT=75° F., BP=736 mm. Hg, air, D_t=2.5 inches, CH=57.7 cm.								
h–2	0.1952	5.63	0.0371	33.5	109	51.6	1.00		4,790
	.258	7.43		41.2	134	52.5	1.019	4.36	
	.511	14.78		42.1	137	53.2	1.032	8.80	
	.673	19.45		42.6	138.5	54.5	1.063	11.9	
	.969	28.0		42.8	139	55.3	1.081	17.4	
	1.26	36.3			141.2	57.6	1.142	23.9	
	1.558	44.8			143.2	58.5	1.166	29.5	
	1.85	53.3			146.5	59.8	1.204	37.0	
	2.152	62.0			147.8	61.1	1.241	44.4	
	2.438	70.3			147.8	61.3	1.250	50.6	
	2.73	78.6			148.8	62.6	1.293	58.5	
	D_p=0.00310 inch, weight=2,376 gm., RT=75° F., BP=736 mm. Hg, helium, D_t=2.5 inches, CH=57.7 cm.								
h–3	0.01132	0.326	0.00205	14.2	46.1	51.6	1.00		83,900
	.0486	1.40		42.3	137.5	52.9	1.030	6.34	
	.105	3.02		43.1	140.5	54.9	1.070	14.22	
	.134	3.85		43.6	142	56.1	1.104	18.74	
	.232	6.68		44.3	144	59.5	1.195	35.2	
	.335	9.65		46.2	150	62.2	1.280	54.4	
	.448	12.93		45.4	148	63.8	1.340	76.3	
	D_p=0.00290 inch, weight=1,185 gm., RT=77° F., BP=736 mm. Hg, air, D_t=2.5 inches., CH=28.0 cm.								
i–1	0.0706	2.04	0.0114	7.0	22.8	50.8	1.00		12,265
	.1952	5.63	.0314	20.0	65.0	50.8	1.00		4,580
	.289	8.34		20.3	66.1	52.5	1.040	5.14	
	.385	11.1		20.8	67.5	53.6	1.063	7.00	
	.511	14.78		20.9	67.9	54.1	1.075	9.42	
	.673	19.45		21.1	68.5	54.5	1.084	12.48	
	.969	28.0		21.1	68.8	54.9	1.094	18.17	
	1.26	36.3			69.0	56.1	1.127	24.2	
	1.558	44.8			71.0	57.1	1.149	30.5	
	1.850	53.3			70.4	58.1	1.179	37.3	
	2.152	62.0			70.4	59.0	1.202	44.2	
	2.438	70.3			71.6	60.0	1.230	51.1	
	2.73	78.6			72.3	61.1	1.265	59.0	
	3.04	87.6			73.2	61.7	1.288	66.7	
	3.63	104.8			75.7	62.5	1.318	81.8	

TABLE VII.—*Fluidization data of uniform round sands in the 2.5-inch tube*—Continued

Run No.	w, lb./hr.	G, lb.ft.$^{-2}$hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	f
	D_p=0.00290 inch, weight =1,185 gm., RT=77° F., BP=736 mm. Hg, helium, D_t=2.5 inches, CH=28.0 cm.								
i-2	0. 01132	0. 326	0. 00173	7. 2	23. 4	50. 8	1. 00	----------	67, 900
	. 0237	. 683	. 00362	17. 5	56. 9	50. 8	1. 00	----------	37, 400
	. 0619	1. 785	----------	20. 8	67. 9	54. 7	1. 093	8. 85	----------
	. 105	3. 02	----------	21. 2	69. 0	54. 4	1. 080	14. 75	----------
	. 146	4. 20	----------	21. 3	69. 3	55. 1	1. 098	20. 9	----------
	. 232	6. 68	----------	22. 0	71. 5	57. 3	1. 154	34. 9	----------
	. 335	9. 65	----------	22. 2	72. 4	60. 0	1. 232	53. 9	----------
	. 448	12. 93	----------	23. 0	74. 7	62. 1	1. 300	76. 1	----------
	. 551	15. 90	----------	24. 6	80. 0	63. 6	1. 357	97. 6	----------
	D_p=0.00202 inch, weight =920 gm., RT=71° F., BP=736 mm. Hg, air, D_t=2.5 inches, CH=24.15 cm.								
j-1	0. 0706	2. 04	0. 00795	9. 4	30. 6	55. 0	1. 00	----------	19, 720
	. 1335	3. 84	. 0150	17. 5	56. 8	55. 0	1. 00	----------	10, 310
	. 1952	5. 63	----------	14. 9	48. 5	57. 4	1. 056	3. 48	----------
	. 258	7. 43	----------	15. 3	49. 8	58. 2	1. 072	4. 66	----------
	. 322	9. 26	----------	15. 3	49. 8	59. 2	1. 101	5. 98	----------
	. 385	11. 1	----------	15. 6	50. 7	59. 2	1. 101	7. 16	----------
	. 448	12. 92	----------	15. 7	51. 1	59. 8	1. 119	8. 46	----------
	. 511	14. 78	----------	15. 8	51. 4	58. 7	1. 085	9. 40	----------
	. 574	16. 55	----------	15. 8	51. 4	58. 7	1. 087	10. 53	----------
	. 673	19. 45	----------	15. 6	50. 8	58. 7	1. 087	12. 38	----------
	. 897	25. 8	----------	----------	50. 2	58. 9	1. 092	16. 48	----------
	1. 152	33. 2	----------	----------	50. 5	59. 8	1. 119	21. 7	----------
	1. 260	36. 3	----------	----------	51. 2	60. 3	1. 130	24. 0	----------
	1. 558	44. 8	----------	----------	51. 2	61. 2	1. 160	30. 4	----------
	1. 850	53. 3	----------	----------	51. 4	62. 5	1. 198	37. 5	----------
	D_p=0.00202 inch, weight =1,339 gm., RT=71° F., BP=736 mm. Hg, air, D_t=2.5 inches, CH=33.8 cm.								
j-2	0. 0706	2. 04	0. 00795	14. 0	45. 5	53. 3	1. 00	----------	17, 850
	. 1335	3. 84	----------	21. 6	70. 1	54. 9	1. 035	2. 32	----------
	. 1952	5. 63	----------	22. 0	71. 4	55. 9	1. 059	3. 47	----------
	. 258	7. 43	----------	22. 4	72. 9	56. 7	1. 077	4. 66	----------
	. 322	9. 26	----------	22. 6	73. 6	58. 7	1. 125	6. 08	----------
	. 385	11. 1	----------	----------	74. 3	58. 1	1. 112	7. 20	----------
	. 448	12. 92	----------	----------	74. 3	58. 1	1. 112	8. 39	----------
	. 511	14. 78	----------	----------	73. 6	57. 6	1. 097	9. 43	----------
	. 574	16. 55	----------	----------	74. 0	57. 8	1. 104	10. 62	----------
	. 673	19. 45	----------	----------	73. 9	58. 0	1. 109	12. 55	----------
	. 969	28. 0	----------	----------	73. 6	58. 7	1. 124	18. 32	----------
	1. 26	36. 3	----------	----------	73. 6	59. 0	1. 139	24. 0	----------
	1. 558	44. 8	----------	----------	73. 3	60. 1	1. 168	30. 4	----------
	1. 85	53. 3	----------	----------	74. 3	60. 8	1. 188	36. 9	----------
	2. 152	62. 0	----------	----------	75. 5	61. 6	1. 216	43. 9	----------
	2. 438	70. 3	----------	----------	75. 5	62. 4	1. 238	50. 6	----------
	2. 73	78. 6	----------	----------	75. 5	62. 9	1. 258	57. 7	----------

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TABLE VII.—*Fluidization data of uniform round sands in the 2.5-inch tube*—Continued

Run No.	w, lb./hr.	G, lb. ft.$^{-2}$hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	f
	D_p=0.00202 inch, weight=1,339 gm., RT=74° F., BP=736 mm. Hg, helium, D_t=2.5 inches, CH=33.25 cm.								
j-3	0. 01132	0. 326	0. 00120	19. 5	63. 5	52. 8	1. 00	----------	128, 700
	. 0155	. 446	----------	23. 6	76. 6	54. 1	1. 023	2. 06	----------
	. 0237	. 683	----------	23. 1	75. 0	57. 8	1. 113	3. 43	----------
	. 0425	1. 227	----------	23. 4	76. 2	59. 2	1. 152	6. 37	----------
	. 0619	1. 785	----------	23. 5	76. 5	58. 4	1. 132	9. 11	----------
	. 0840	2. 42	----------	23. 5	76. 5	57. 8	1. 113	12. 12	----------
	. 105	3. 02	----------	----------	76. 6	58. 0	1. 120	15. 23	----------
	. 126	3. 63	----------	----------	76. 9	58. 2	1. 123	18. 37	----------
	. 170	4. 90	----------	----------	75. 6	59. 0	1. 145	23. 2	----------
	. 232	6. 68	----------	----------	75. 6	60. 9	1. 202	36. 2	----------
	. 336	9. 63	----------	----------	77. 6	62. 5	1. 257	54. 5	----------
	. 448	12. 93	----------	----------	79. 4	64. 3	1. 323	77. 1	----------
	. 551	15. 90	----------	----------	78. 5	66. 8	1. 415	101	----------

TABLE VIII.—*Fluidization data of uniform sharp sands in the 2.5-inch tube*

Run No.	w, lb./hr.	G, lb. ft.$^{-2}$ hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	f
	D_p=0.01268 inch, weight=755 gm., RT*=70° F., BP=740 mm. Hg, air, D_t=2.5 inches, CH*=0.580 ft.								
b'-1	0. 1276	3. 675	0. 0898	0. 4	1. 30	50. 0	1. 00	----------	1, 348
	. 234	6. 73	. 164	. 8	2. 60	50. 0	1. 00	----------	806
	. 334	9. 62	. 235	1. 1	3. 58	50. 0	1. 00	----------	542
	. 5045	14. 54	. 355	1. 7	5. 54	50. 0	1. 00	----------	367
	. 572	16. 47	. 401	2. 0	6. 51	50. 0	1. 00	----------	338
	. 668	19. 23	. 470	2. 5	8. 15	50. 0	1. 00	----------	307
	. 957	27. 56	. 672	3. 5	11. 38	50. 0	1. 00	----------	210
	1. 24	35. 7	. 872	4. 8	15. 6	50. 0	1. 00	----------	172
	1. 55	44. 7	1. 09	6. 1	19. 85	50. 0	1. 00	----------	139
	1. 85	53. 2	1. 30	7. 3	23. 8	50. 0	1. 00	----------	118
	2. 14	61. 7	1. 505	8. 5	27. 6	50. 0	1. 00	----------	102
	2. 44	70. 3	1. 72	9. 9	32. 2	50. 0	1. 00	----------	91. 5
	2. 74	78. 9	1. 925	10. 9	35. 5	50. 0	1. 00	----------	79. 8
	3. 03	87. 2	2. 13	12. 5	40. 7	50. 0	1. 00	----------	75. 2
	3. 334	96. 0	2. 34	13. 7	44. 5	50. 0	1. 00	----------	67. 6
	3. 63	104. 5	2. 55	14. 9	48. 5	50. 0	1. 00	----------	62. 5
	3. 922	113	----------	14. 2	46. 3	50. 6	1. 012	66	----------
	4. 22	121. 5	----------	14. 6	47. 5	51. 1	1. 024	71. 6	----------
	4. 525	130. 4	----------	14. 6	47. 5	51. 7	1. 035	77. 8	----------
	4. 814	138. 6	----------	----------	48. 5	52. 2	1. 046	83. 5	----------
	5. 12	147. 5	----------	----------	49. 2	53. 5	1. 073	91. 2	----------
	5. 41	155. 6	----------	----------	47. 5	54. 6	1. 100	98. 5	----------
	5. 72	164. 6	----------	----------	48. 7	54. 9	1. 107	105	----------
	6. 02	173. 0	----------	----------	48. 9	55. 6	1. 129	112. 6	----------
	6. 31	181. 6	----------	----------	51. 4	57. 3	1. 170	122. 4	----------
	6. 60	190	----------	----------	50. 8	57. 8	1. 186	130	----------

*RT=temperature of gas; CH=column height=L.

TABLE VIII.—*Fluidization data of uniform sharp sands in the 2.5-inch tube*—Continued

Run No.	w, lb./hr.	G, lb./ft.$^{-2}$hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_c/\rho$ lb./hr.^{2}	f
	D_p=0.01268 inch, weight=1,255 gm., RT=74° F., BP=740 mm. Hg, air, D_t=2.5 inches, CH=0.945 ft.								
b′-2	0.188	5.40	0.132	1.0	3.25	49.0	1.00		866
	.400	11.5	.280	2.1	6.84	49.0	1.00		404
	.575	16.6	.405	3.2	10.35	49.0	1.00		297
	.664	19.1	.466	4.0	13.0	49.0	1.00		277
	1.25	36.0	.880	7.7	25.1	49.0	1.00		151
	1.85	53.2	1.297	11.4	37.1	49.0	1.00		102
	2.44	70.2	1.712	15.5	50.5	49.0	1.00		79.7
	3.02	87.0	2.12	19.8	64.2	49.0	1.00		66.1
	3.62	104	2.52	23.4	76.1	49.0	1.00		54.7
	3.91	112.5		24.8	80.8	49.35	1.006	65	
	4.20	121		24.8	80.8	50.5	1.03	71.5	
	4.50	130			84.0	50.6	1.032	77.4	
	4.80	138			84.9	51.4	1.050	83.4	
	5.10	147			86.3	52.4	1.070	90.5	
	5.38	155			87.3	53.4	1.095	97.6	
	5.68	164			86.9	54.1	1.110	105	
	5.98	172.5			86.4	56.2	1.165	116	
	6.55	189			90.5	57.9	1.220	133	
	D_p=0.01021 inch, weight=1,150 gm., RT=72° F., BP=739 mm. Hg, air, D_t=2.5 inches, CH=0.900 ft.								
c′-1	0.0706	2.04	0.0403	1.0	3.25	51.0	1.00		6,290
	.322	9.26	.182	3.2	10.4	51.0	1.00		985
	.673	19.45	.384	6.6	21.4	51.0	1.00		459
	.969	28.0	.553	9.6	31.2	51.0	1.00		322
	1.26	36.3	.716	12.5	40.7	51.0	1.00		249
	1.558	44.8	.885	18.8	61.2	51.0	1.00		205
	1.85	53.3	1.05	21.8	70.8	51.0	1.00		174
	2.152	62.0		21.6	70.4	51.6	1.012	35.8	
	2.438	70.3			73.6	52.4	1.032	40.7	
	2.73	78.6			70.6	53.4	1.053	45.5	
	3.04	87.6			71.6	54.5	1.078	50.6	
	3.35	96.5			72.6	55.3	1.092	55.8	
	3.63	104.8			73.6	56.5	1.128	60.5	
	3.93	113.7			74.3	57.1	1.142	65.7	
	4.22	122			74.9	58.3	1.173	70.5	
	D_p=0.00818 inch, weight=1,181 gm., RT=72° F., BP=739 mm. Hg, air, D_t=2.5 inches, CH=0.982 ft.								
d′-1	0.0706	2.04	0.0323	1.2	3.9	53.9	1.00		7,440
	.1952	5.63	.0892	3.35	10.9	53.9	1.00		2,740
	.385	11.1	.176	6.4	20.8	53.9	1.00		1,342
	.574	16.55	.262	9.65	31.4	53.9	1.00		910
	.673	19.45	.308	11.6	37.8	53.9	1.00		795
	.969	28.0	.444	16.8	54.6	53.9	1.00		555
	1.26	36.3	.575	21.6	70.4	53.9	1.00		424
	1.558	44.8		21.6	70.4	54.5	1.015	26.4	
	1.85	53.3			71.4	55.7	1.042	32.3	
	2.152	62.0			72.3	57.3	1.077	38.8	
	2.438	70.3			72.9	58.3	1.112	45.4	
	2.73	78.6			74.3	59.8	1.147	52.4	
	3.04	87.6			74.3	60.6	1.168	59.5	
	3.35	96.5			75.8	61.4	1.195	67.0	
	3.63	104.8			76.8	62.1	1.219	74.3	

TABLE VIII.—*Fluidization data of uniform sharp sands in the 2.5-inch tube*—Continued

Run No.	w, lb./hr.	G, lb. ft.$^{-2}$ hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	f
	D_p=0.00818 inch, weight=2,181 gm., RT=72° F., BP=739 mm. Hg, air, D_t=2.5 inches, CH=1.747 ft.								
d′–2	0.0706	2.04	0.0323	2.81	9.13	52.0	1.00	----------	8,100
	.322	9.26	.146	11.7	38.0	52.0	1.00	----------	1,640
	.574	16.55	.262	20.0	65	52.0	1.00	----------	878
	.673	19.45	.308	24.6	80	52.0	1.00	----------	784
	.969	28.0	.444	34.8	113	52.0	1.00	----------	534
	1.26	36.3	----------	39.6	129	53.0	1.021	21.3	----------
	1.558	44.8	----------	39.3	128	54.1	1.043	26.9	----------
	1.85	53.3	----------	40.3	131	55.3	1.069	32.8	----------
	2.152	62.0	----------	----------	134.2	57.6	1.132	40.5	----------
	2.438	70.3	----------	----------	138	58.9	1.165	47.1	----------
	2.73	78.6	----------	----------	140.7	60.2	1.203	54.5	----------
	D_p=0.00488 inch, weight=850 gm., RT=73° F., BP=740 mm. Hg, air, D_t=2.5 inches, CH=0.742 ft.								
f′–1	0.070	2.02	0.0191	1.3	4.23	55.9	1.00	----------	7,830
	.163	4.68	.0443	3.1	10.1	55.9	1.00	----------	3,500
	.215	6.18	.0585	3.9	12.7	55.9	1.00	----------	2,520
	.360	10.35	.0983	6.6	21.4	55.9	1.00	----------	1,520
	.445	12.8	.121	8.2	26.6	55.9	1.00	----------	1,220
	.570	16.4	.155	10.7	34.8	55.9	1.00	----------	974
	.666	19.15	.181	13.2	43.0	55.9	1.00	----------	885
	.962	27.7	----------	14.4	46.9	56.6	1.020	16.3	----------
	1.26	36.2	----------	14.4	46.9	57.7	1.050	22.0	----------
	1.56	44.9	----------	14.4	46.9	59.3	1.085	28.0	----------
	1.85	53.2	----------	----------	47.5	60.9	1.117	34.3	----------
	2.15	61.8	----------	----------	47.8	62.0	1.160	41.3	----------
	2.45	70.4	----------	----------	48.2	62.6	1.180	48.0	----------
	2.74	78.8	----------	----------	48.2	63.2	1.206	54.8	----------
	3.04	86.8	----------	----------	46.8	64.1	1.250	62.7	----------
	3.33	95.6	----------	----------	48.2	64.4	1.270	70.0	----------
	D_p=0.00488 inch, weight=1,150 gm., RT=73° F., BP=740 mm. Hg, air, D_t=2.5 inches, CH=1.00 ft.								
f′–2	0.090	2.60	0.0245	2.0	6.5	55.9	1.00	----------	5,240
	.165	4.74	.0447	3.72	12	55.9	1.00	----------	2,900
	.262	7.52	.0712	5.65	18.4	55.9	1.00	----------	1,780
	.355	10.2	.0968	7.8	25.4	55.9	1.00	----------	1,326
	.434	12.5	.118	9.57	31.1	55.9	1.00	----------	1,082
	.560	16.1	.152	12.3	39.9	55.9	1.00	----------	835
	.672	19.3	.182	15.6	50.7	55.9	1.00	----------	739
	.970	27.9	.263	22.6	73.6	55.9	1.00	----------	514
	1.27	36.5	----------	19.8	64.5	57.0	1.03	21.6	----------
	1.57	45.1	----------	19.5	63.5	58.6	1.07	27.8	----------
	1.87	53.7	----------	----------	66.1	60.6	1.125	34.8	----------
	2.17	62.4	----------	----------	65.2	61.5	1.15	41.4	----------
	2.47	71.0	----------	----------	66.4	62.6	1.18	48.2	----------
	2.77	79.5	----------	----------	67.0	63.0	1.19	54.5	----------
	3.07	88.2	----------	----------	67.0	64.8	1.258	63.8	----------
	3.37	97.0	----------	----------	67.3	66.7	1.277	71.1	----------

TABLE VIII.—*Fluidization data of uniform sharp sands in the 2.5-inch tube*—Continued

Run No.	w, lb./hr.	G, lb.ft.$^{-2}$hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	f
	D_p=0.00345 inch, weight=630 gm., RT=72° F., BP=740 mm. Hg, air, D_t=2.5 inches, CH=0.570 ft.								
g′-1	0.070	2.02	0.0134	1.55	5.21	57.2	1.00	----------	10,170
	.133	4.62	.0307	3.5	11.4	57.2	1.00	----------	4,240
	.196	6.81	.0454	5.4	17.5	57.2	1.00	----------	2,980
	.260	9.02	.0601	7.3	23.8	57.2	1.00	----------	2,320
	.385	13.4	.0894	11.2	36.6	57.2	1.00	----------	1,620
	.445	15.5	----------	10.1	32.9	59.2	1.042	9.3	----------
	.507	17.6	----------	10.2	33.2	59.6	1.055	10.7	----------
	.570	19.8	----------	10.2	33.2	60.3	1.070	12.2	----------
	.666	23.2	----------	10.2	33.2	60.7	1.080	14.4	----------
	.962	33.4	----------	----------	33.2	60.9	1.085	20.9	----------
	1.26	43.7	----------	----------	33.2	61.2	1.096	27.6	----------
	1.56	54.1	----------	----------	32.9	61.9	1.114	34.7	----------
	1.85	64.2	----------	----------	33.5	62.9	1.150	42.5	----------
	2.15	74.7	----------	----------	33.5	63.5	1.166	50.0	----------
	2.45	85.0	----------	----------	33.2	64.0	1.200	58.8	----------
	2.74	95.0	----------	----------	33.9	64.2	1.210	66.1	----------
	3.04	105.5	----------	----------	34.2	65.5	1.245	75.5	----------
	3.33	116	----------	----------	33.5	66.6	1.281	85.5	----------
	3.63	126	----------	----------	34.2	67.0	1.299	94.0	----------
	D_p=0.00345 inch, weight=981 gm., RT=73° F., BP=739 mm. Hg, air, D_t=2.5 inches, CH=0.868 ft.								
g′-2	0.0706	2.04	0.0135	4.8	15.6	56.6	1.00	----------	18,650
	.1335	3.84	.0254	8.65	28.4	56.6	1.00	----------	9,530
	.1952	5.63	.0375	12.9	41.9	56.6	1.00	----------	6,530
	.258	7.43	.0494	17.7	57.5	56.6	1.00	----------	5,145
	.322	9.26	----------	16.6	54.0	58.3	1.040	5.61	----------
	.385	11.1	----------	17.2	56.0	58.9	1.051	6.82	----------
	.448	12.92	----------	17.3	56.2	59.1	1.060	8.00	----------
	.574	16.55	----------	----------	56.2	59.7	1.078	10.4	----------
	.673	19.45	----------	----------	57.0	60.2	1.089	12.3	----------
	.969	28.0	----------	----------	57.3	60.5	1.096	17.9	----------
	1.26	36.3	----------	----------	57.3	61.2	1.120	23.7	----------
	1.558	44.8	----------	----------	57.9	62.4	1.153	30.1	----------
	1.85	53.3	----------	----------	59.9	63.2	1.180	36.6	----------
	2.152	62.0	----------	----------	60.5	64.2	1.211	43.9	----------
	2.438	70.3	----------	----------	61.8	65.0	1.238	50.7	----------
	2.73	78.6	----------	----------	62.8	65.7	1.268	58.1	----------
	3.04	87.6	----------	----------	63.4	66.8	1.306	66.8	----------
	D_p=0.00345 inch, weight=1,759 gm., RT=73° F., BP=739 mm. Hg, air, D_t=2.5 inches, CH=1.578 ft.								
g′-3	0.0706	2.04	0.0135	7.6	24.7	57.0	1.00	----------	16,920
	.258	7.43	.0494	----------	90.8	57.0	1.00	----------	4,670
	.385	11.1	----------	30.9	100.5	58.3	1.029	6.60	----------
	.511	14.78	----------	30.8	100	58.3	1.029	8.79	----------
	.673	19.45	----------	31.1	101	58.3	1.029	11.57	----------
	.969	28.0	----------	----------	103.8	59.9	1.070	16.7	----------
	1.26	36.3	----------	----------	104.8	61.2	1.110	23.3	----------
	1.558	44.8	----------	----------	105	62.5	1.146	29.7	----------
	1.85	53.3	----------	----------	107.5	63.4	1.178	36.3	----------
	2.152	62.0	----------	----------	109.9	64.7	1.220	43.8	----------
	2.438	70.3	----------	----------	112.5	65.3	1.240	50.5	----------
	2.73	78.6	----------	----------	112.5	65.6	1.250	57.0	----------

TABLE VIII.—*Fluidization data of uniform sharp sands in the 2.5-inch tube*—Continued

Run No.	w, lb./hr.	G, lb.ft.$^{-2}$hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	f
	D_p=0.00345 inch, weight=1,759 gm.. RT=73° F., BP=739 mm. Hg, helium D_t=2.5 inches, CH=1.578 ft.								
g′–4	0. 01132	0. 326	0. 00206	8. 5	27. 6	57. 0	1. 00		102, 750
	. 0237	. 683	. 00431	21. 5	70. 0	57. 0	1. 00		59, 400
	. 0425	1. 227		30. 9	100. 5	57. 8	1. 017	5. 47	
	. 0619	1. 785		31. 1	101	58. 2	1. 027	8. 02	
	. 146	4. 20			101. 8	60. 0	1. 074	19. 8	
	. 134	3. 85			102. 8	60. 3	1. 081	18. 2	
	. 232	6. 68			107. 2	62. 9	1. 161	33. 9	
	. 335	9. 63			110. 6	65. 0	1. 230	51. 9	
	. 448	12. 93			113. 7	67. 0	1. 300	73. 6	
	D_p=0.00229 inch, weight=900 gm., RT=67° F., BP=730 mm. Hg, air, D_t=2.5 inches, CH=0.820 ft.								
h′–1	0. 0706	2. 04	0. 00910	7. 8	25. 4	57. 8	1. 00		23, 375
	. 1335	3. 84	. 0171	15. 5	50. 4	57. 8	1. 00		13, 080
	. 1785	5. 14		15. 5	50. 4	59. 3	1. 037	3. 09	
	. 1952	5. 63		14. 6	47. 5	59. 8	1. 050	3. 44	
	. 258	7. 43		15. 2	49. 3	61. 1	1. 083	4. 68	
	. 322	9. 26		15. 5	50. 4	62. 1	1. 112	6. 00	
	. 385	11. 1		15. 5	50. 4	62. 5	1. 127	7. 28	
	. 448	12. 9		15. 5	50. 4	62. 6	1. 131	8. 50	
	. 511	14. 8			51. 6	62. 2	1. 118	9. 62	
	. 574	16. 55			51. 5	62. 2	1. 118	10. 72	
	. 673	19. 45			51. 6	60. 6	1. 072	12. 11	
	. 969	28. 0			51. 0	61. 1	1. 080	17. 60	
	1. 26	36. 3			52. 3	61. 8	1. 103	23. 3	
	1. 558	44. 8			53. 2	62. 4	1. 121	29. 2	
	1. 708	49. 1			55. 1	62. 9	1. 138	32. 5	
	1. 850	53. 3			50. 0	63. 2	1. 149	35. 6	
	1. 984	57. 1			51. 5	63. 6	1. 161	38. 6	
	2. 172	62. 5			51. 5	64. 5	1. 190	43. 3	
	2. 298	66. 1			51. 3	64. 8	1. 201	46. 3	
	2. 438	70. 2			52. 6	65. 3	1. 219	49. 8	
	2. 633	75. 8			53. 5	65. 7	1. 232	54. 3	

TABLE IX.—*Fluidization data with uniform round and sharp sands in the 4-inch tube*

Run No.	w, lb./hr.	G, lb.ft.$^{-2}$hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	f
	D_p=0.01100 inch, weight=3,239 gm., RT*=80° F., BP=730 mm. Hg, air, D_t=4.00 inches, CH*=0.891 ft.								
A–1	0. 3875	4. 44	0. 107	1. 5	4. 88	44. 7	1. 00		1, 288
	. 683	7. 84	. 189	2. 7	8. 80	44. 7	1. 00		746
	1. 283	14. 73	. 357	5. 7	18. 5	44. 7	1. 00		445
	1. 88	21. 55	. 521	8. 4	27. 3	44. 7	1. 00		306
	2. 48	28. 4	. 688	11. 4	37. 1	44. 7	1. 00		239
	3. 685	42. 3	1. 02	17. 3	56. 3	44. 7	1. 00		. 164
	4. 29	49. 1	1. 185	19. 7	64. 1	44. 7	1. 00		139
	4. 90	56. 2	1. 355	22. 5	73. 3	44. 7	1. 00		125
	5. 51	63. 3		23. 4	76. 1	45. 8	1. 020	37. 4	
	6. 13	70. 3			76. 5	46. 5	1. 032	42. 0	
	6. 71	77. 0			78. 2	47. 0	1. 042	46. 4	
	7. 31	83. 8			79. 1	47. 6	1. 054	51. 2	
	8. 09	92. 8			80. 1	49. 1	1. 093	58. 9	
	10. 8	123. 8			81. 5	51. 3	1. 138	81. 4	
	13. 83	158. 7			83. 3	55. 5	1. 247	114. 2	
	16. 78	192. 5			84. 6	55. 8	1. 254	139. 5	
	23. 0	264			91. 2	60. 0	1. 383	211	

*RT=temperature of gas; CH=column height=L.

TABLE IX.—*Fluidization data with uniform round and sharp sands in the 4-inch tube*—Continued

Run No.	w, lb./hr.	G, lb.ft.$^{-2}$hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_c/\rho$ lb./hr.^{2}	f
	D_p=0.01100 inch, weight=5,508 gm., RT=80° F., BP=730 mm. Hg, air, D_t=4.00 inches, CH=1.554 ft.								
A-2	0.3875	4.44	0.107	2.7	8.80	45.8	1.00	----------	1,520
	.683	7.84	.189	5.0	16.2	45.8	1.00	----------	901
	1.88	21.55	.521	14.2	46.2	45.8	1.00	----------	339
	2.48	28.4	.687	19.1	62.2	45.8	1.00	----------	262
	3.09	35.4	.857	24.0	78.1	45.8	1.00	----------	212
	4.29	49.1	1.187	33.0	107.2	45.8	1.00	----------	152
	4.90	56.2	1.355	38.0	120.2	45.8	1.00	----------	135
	5.51	63.3	----------	42.0	136.5	46.0	1.005	37.2	----------
	6.13	70.3	----------	41.5	135	46.8	1.019	41.7	----------
	6.71	77.0	----------	----------	136	47.7	1.034	46.6	----------
	7.31	83.8	----------	----------	136.7	48.1	1.044	51.1	----------
	8.18	93.8	----------	----------	139.2	49.5	1.074	58.9	----------
	10.95	125.7	----------	----------	144.5	53.4	1.168	85.8	----------
	14.05	161	----------	----------	146.3	56.5	1.251	117.8	----------
	D_p=0.01062 inch, weight=2,487 gm., RT=81° F., BP=735 mm. Hg, air, D_t=4.00 inches, CH=0.690 ft.								
B-1	0.452	5.19	0.105	1.6	5.21	45.3	1.00	----------	1,162
	.984	11.32	.230	4.0	13.0	45.3	1.00	----------	610
	1.283	14.73	.299	5.3	11.3	45.3	1.00	----------	478
	1.88	21.55	.437	7.8	25.4	45.3	1.00	----------	328
	2.48	28.4	.576	10.5	34.1	45.3	1.00	----------	253
	3.09	35.4	.719	13.3	43.3	45.3	1.00	----------	207
	3.685	42.3	.859	15.8	51.4	45.3	1.00	----------	172
	4.29	49.1	----------	17.8	57.8	45.9	1.010	28.4	----------
	4.90	56.2	----------	----------	56.9	46.5	1.022	32.9	----------
	5.51	63.3	----------	----------	58.2	47.8	1.046	37.0	----------
	6.13	70.3	----------	----------	59.5	48.3	1.056	42.5	----------
	6.71	77.0	----------	----------	59.8	49.1	1.075	47.4	----------
	7.31	83.8	----------	----------	60.5	50.0	1.095	52.6	----------
	10.78	123.7	----------	----------	63.1	54.5	1.202	85.3	----------
	13.70	157	----------	----------	64.4	56.3	1.255	112.8	----------
	16.83	193	----------	----------	65.7	58.2	1.313	145	----------
	19.88	228	----------	----------	67.0	59.4	1.346	175	----------
	23.14	265	----------	----------	68.3	60.3	1.380	209	----------
	27.30	313	----------	----------	70.0	63.2	1.493	267	----------
	D_p=0.01062 inch, weight=2,487 gm., RT=81° F., BP=735 mm. Hg, helium, D_t=4.00 inches, CH=0.698 ft.								
B-2	0.1040	1.193	0.0230	3.0	9.76	45.7	1.00	----------	5,865
	.1692	1.940	.0374	4.9	15.9	45.7	1.00	----------	3,610
	.233	2.67	.0516	7.4	24.1	45.7	1.00	----------	2,880
	.336	3.86	.0745	10.6	34.5	45.7	1.00	----------	1,975
	.554	6.35	.122	17.5	56.9	45.7	1.00	----------	1,208
	.671	7.70	----------	17.5	56.9	46.8	1.020	36.1	----------
	.788	9.03	----------	----------	57.9	47.9	1.042	43.3	----------
	1.035	11.88	----------	----------	60.1	49.8	1.082	59.0	----------
	1.345	14.4	----------	----------	61.1	51.3	1.118	74.0	----------

TABLE IX.—*Fluidization data with uniform round and sharp sands in the 4-inch tube*—Continued

Run No.	w, lb./hr.	G, lb. ft.$^{-2}$ hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	f
	D_p=0.00445 inch, weight=2,545 gm., RT=73° F., BP=738 mm. Hg, air, D_t=4.00 inches CH=0.737 ft.								
C–1	0. 1330	1. 525	0. 01432	2. 7	8. 78	47. 5	1. 00	----------	12, 475
	. 2576	2. 95	. 02775	5. 2	16. 9	47. 5	1. 00	----------	6, 400
	. 3875	4. 44	. 0417	7. 7	25. 0	47. 5	1. 00	----------	4, 200
	. 509	5. 83	. 0548	10. 0	32. 5	47. 5	1. 00	----------	3, 240
	. 683	7. 84	. 0738	14. 2	46. 1	47. 5	1. 00	----------	2, 475
	. 907	10. 4	. 0981	18. 2	59. 1	47. 5	1. 00	----------	1, 800
	. 983	11. 3	----------	17. 8	57. 9	47. 9	1. 007	6. 65	----------
	1. 283	14. 73	----------	18. 4	59. 9	49. 0	1. 029	8. 87	----------
	1. 585	18. 2	----------	----------	60. 5	49. 6	1. 042	11. 1	----------
	1. 880	21. 55	----------	----------	61. 1	49. 9	1. 050	13. 2	----------
	2. 19	25. 2	----------	----------	61. 8	50. 8	1. 068	15. 7	----------
	2. 48	28. 4	----------	----------	61. 8	51. 5	1. 085	18. 0	----------
	2. 78	31. 9	----------	----------	61. 8	51. 9	1. 096	20. 4	----------
	3. 085	35. 4	----------	----------	61. 8	52. 2	1. 104	22. 8	----------
	3. 40	39. 0	----------	----------	62. 5	52. 6	1. 112	25. 4	----------
	3. 685	42. 3	----------	----------	62. 5	53. 2	1. 125	27. 8	----------
	4. 005	46. 0	----------	----------	62. 5	53. 2	1. 125	30. 2	----------
	4. 29	49. 1	----------	----------	62. 5	53. 4	1. 130	32. 5	----------
	4. 63	53. 0	----------	----------	62. 5	54. 2	1. 150	35. 6	----------
	4. 90	56. 2	----------	----------	63. 1	54. 2	1. 150	37. 8	----------
	5. 51	63. 3	----------	----------	63. 1	54. 9	1. 170	43. 4	----------
	6. 13	70. 3	----------	----------	63. 1	55. 0	1. 173	48. 2	----------
	7. 33	84. 0	----------	----------	63. 4	56. 2	1. 202	59. 1	----------
	D_p=0.00445 inch, weight=2,545 gm., RT=73° F., BP=738 mm. Hg, helium, D_t=4.00 inches, CH=0.737 ft.								
C–2	0. 0236	0. 259	0. 00232	3. 5	11. 4	47. 5	1. 00	----------	77, 250
	. 0615	. 705	. 00631	9. 2	29. 9	47. 5	1. 00	----------	27, 300
	. 1040	1. 193	. 01067	15. 7	51. 1	47. 5	1. 00	----------	16, 350
	. 1294	1. 485	----------	18. 1	58. 9	48. 4	1. 019	6. 77	----------
	. 233	2. 67	----------	18. 8	61. 2	49. 8	1. 046	12. 45	----------
	. 336	3. 86	----------	18. 9	61. 5	51. 2	1. 078	18. 6	----------
	. 447	5. 12	----------	----------	62. 5	52. 2	1. 103	25. 3	----------
	. 554	6. 35	----------	----------	63. 1	52. 9	1. 120	31. 8	----------
	. 671	7. 70	----------	----------	63. 1	54. 5	1. 160	39. 9	----------
	. 788	9. 03	----------	----------	63. 4	55. 3	1. 179	47. 6	----------
	. 920	10. 60	----------	----------	63. 8	55. 9	1. 193	56. 5	----------
	1. 035	11. 88	----------	----------	64. 1	56. 5	1. 210	64. 1	----------

TABLE IX.—*Fluidization data with uniform round and sharp sands in the 4-inch tube*—Continued

Run No.	w, lb./hr.	G, lb.ft.$^{-2}$hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	f
	D_p=0.00310 inch, weight=2,355 gm., RT=76° F., BP=740 mm. Hg, air, D_t=4.00 inches, CH=0.786 ft.								
D-1	0.1330	1.525	0.0101	3.9	12.7	54.5	1.00	----------	24,000
	.2576	2.95	.01956	7.4	24.0	54.5	1.00	----------	12,175
	.3875	4.44	.0294	11.0	35.8	54.5	1.00	----------	7,980
	.509	5.83	.0386	14.5	47.1	54.5	1.00	----------	6,090
	.683	7.84	----------	16.0	52.0	54.7	1.005	4.65	----------
	.983	11.3	----------	16.8	54.6	56.2	1.038	6.91	----------
	1.283	14.73	----------	17.2	56.0	56.9	1.056	9.19	----------
	1.585	18.2	----------	17.4	56.6	57.7	1.074	11.5	----------
	1.88	21.55	----------	17.4	56.6	58.2	1.088	13.78	----------
	2.19	25.2	----------	----------	56.9	58.9	1.103	16.38	----------
	2.48	28.4	----------	----------	56.9	59.4	1.118	18.75	----------
	2.78	31.9	----------	----------	56.9	59.5	1.121	21.1	----------
	3.085	35.4	----------	----------	56.6	59.4	1.118	23.3	----------
	3.40	39.0	----------	----------	56.6	59.5	1.121	25.7	----------
	3.685	42.3	----------	----------	56.6	59.7	1.130	28.2	----------
	4.005	46.0	----------	----------	56.6	60.0	1.138	30.8	----------
	4.29	49.1	----------	----------	56.9	60.2	1.142	33.1	----------
	4.63	53.0	----------	----------	56.9	60.3	1.146	35.8	----------
	4.92	56.2	----------	----------	56.9	60.3	1.146	38.0	----------
	5.21	59.8	----------	----------	56.9	60.5	1.152	40.6	----------
	5.51	63.3	----------	----------	56.6	61.0	1.167	43.6	----------
	5.82	66.7	----------	----------	56.6	61.2	1.172	46.1	----------
	6.13	70.3	----------	----------	56.9	61.5	1.182	49.1	----------
	6.43	73.8	----------	----------	57.2	61.8	1.193	52.0	----------
	6.71	77.0	----------	----------	57.2	62.1	1.200	54.5	----------
	7.02	80.5	----------	----------	56.9	62.1	1.202	57.0	----------
	7.33	84.0	----------	----------	56.9	62.8	1.223	60.8	----------
	D_p=0.00310 inch, weight=2,355 gm., RT=76° F., BP=740 mm. Hg, helium, D_t=4.00 inches, CH=0.775 ft.								
D-2	0.0420	0.481	0.00303	5.6	18.2	53.8	1.00	----------	53,000
	.0615	.705	.00404	13.5	44.0	53.8	1.00	----------	51,100
	.1258	1.442	----------	16.8	54.8	55.5	1.038	6.75	----------
	.1294	1.485	----------	17.0	55.3	55.7	1.042	6.99	----------
	.233	2.67	----------	17.2	56.0	57.6	1.088	13.05	----------
	.336	3.86	----------	17.3	56.3	58.7	1.117	19.4	----------
	.447	5.12	----------	17.3	56.3	59.5	1.140	26.3	----------
	.554	6.35	----------	----------	56.7	60.0	1.152	33.0	----------
	.671	7.70	----------	----------	57.0	60.6	1.172	40.7	----------
	.788	9.03	----------	----------	57.0	61.2	1.190	48.4	----------
	.920	10.60	----------	----------	57.0	61.7	1.205	57.6	----------
	1.035	11.88	----------	----------	57.3	62.1	1.218	65.3	----------
	1.346	15.43	----------	----------	58.3	63.9	1.280	89.1	----------

TABLE IX.—*Fluidization data with uniform round and sharp sands in the 4-inch tube*—Continued

Run No.	w, lb./hr.	G, lb. ft.$^{-2}$ hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	f
	D_p=0.00715 inch, weight=2,168 gm., RT=81° F., BP=735 mm. Hg, air, D_t=4.00 inches, CH=0.734 ft.								
A′–1	0.323	3.70	0.0580	1.4	4.55	55.0	1.00	----------	4,160
	.576	6.60	1.035	2.6	8.46	55.0	1.00	----------	2,440
	.983	11.3	.177	5.1	16.6	55.0	1.00	----------	1,626
	1.283	14.73	.231	6.7	21.8	55.0	1.00	----------	1,262
	1.88	21.55	.338	10.0	32.5	55.0	1.00	----------	878
	2.19	25.15	.394	11.6	37.7	55.0	1.00	----------	746
	2.48	28.4	.445	13.5	44.0	55.0	1.00	----------	682
	2.782	31.9	----------	15.1	49.1	55.4	1.008	19.3	----------
	3.085	35.4	----------	15.3	49.8	55.8	1.017	21.6	----------
	3.685	42.3	----------	----------	51.4	56.5	1.032	26.2	----------
	4.29	49.1	----------	----------	52.1	57.3	1.050	31.0	----------
	4.90	56.2	----------	----------	52.7	58.2	1.073	36.3	----------
	5.51	63.3	----------	----------	53.0	59.0	1.095	41.6	----------
	6.13	70.3	----------	----------	53.0	59.4	1.105	46.7	----------
	6.71	77.0	----------	----------	53.3	60.0	1.124	52.0	----------
	7.32	84.0	----------	----------	53.7	60.6	1.141	57.5	----------
	D_p=0.00715 inch, weight=2,168 gm., RT=81° F., BP=735 mm. Hg, helium, D_t=4.00 inches, CH=0.727 ft.								
A′–2	0.0421	0.483	0.00722	1.3	4.23	54.8	1.00	----------	28,600
	.104	1.193	.0178	3.9	12.7	54.8	1.00	----------	14,150
	.1692	1.94	.0289	6.5	21.2	54.8	1.00	----------	8,910
	.233	2.67	.0398	9.8	31.9	54.8	1.00	----------	7,110
	.336	3.86	.0576	14.0	45.5	54.8	1.00	----------	4,840
	.447	5.12	----------	15.3	49.8	56.0	1.027	24.0	----------
	.554	6.35	----------	----------	51.1	56.8	1.044	30.2	----------
	.671	7.70	----------	----------	52.3	58.2	1.078	38.0	----------
	.788	9.03	----------	----------	52.7	59.1	1.103	44.9	----------
	1.035	11.88	----------	----------	53.7	60.6	1.148	62.4	----------
	1.345	14.4	----------	----------	54.6	62.1	1.190	78.3	----------
	D_p=0.00458 inch, weight=2,352 gm., RT=78° F., BP=740 mm. Hg, air, D_t=4.00 inches, CH=0.839 ft.								
B′–1	0.1970	2.26	0.0122	2.5	8.15	57.4	1.00	----------	12,280
	.3875	4.44	.0415	5.4	17.6	57.4	1.00	----------	6,830
	.576	6.60	.0619	8.2	26.7	57.4	1.00	----------	4,700
	.683	7.84	.0734	10.3	33.5	57.4	1.00	----------	4,180
	.983	11.3	.1058	14.8	48.1	57.4	1.00	----------	2,890
	1.283	14.73	----------	16.4	53.4	58.3	1.020	8.89	----------
	1.585	18.2	----------	16.8	54.8	58.9	1.037	11.12	----------
	1.880	21.55	----------	17.0	55.4	59.5	1.052	13.4	----------
	2.48	28.4	----------	17.1	55.7	60.7	1.084	18.2	----------
	3.085	35.4	----------	17.1	55.7	61.3	1.102	23.0	----------
	3.685	42.3	----------	----------	56.0	62.3	1.132	28.3	----------
	4.29	49.1	----------	----------	56.7	62.5	1.140	33.1	----------
	4.90	56.2	----------	----------	56.7	62.8	1.148	38.1	----------
	5.51	63.3	----------	----------	56.7	63.3	1.163	43.5	----------
	6.13	70.3	----------	----------	57.0	64.2	1.195	49.7	----------
	6.71	77.0	----------	----------	57.6	64.3	1.198	54.6	----------

TABLE IX.—*Fluidization data with uniform round and sharp sands in the 4-inch tube*—Continued

Run No.	w, lb./hr.	G, lb. ft.$^{-2}$ hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	f
	D_p=0.00458 inch, weight=2,352 gm., RT=78° F., BP=740 mm. Hg, helium, D_t=4.00 inches, CH=0.842 ft.								
B′–2	0. 0420	0. 481	0. 00428	4. 2	13. 7	57. 3	1. 00	----------	60, 700
	. 1040	1. 193	. 0106	11. 3	36. 8	57. 3	1. 00	----------	26, 650
	. 169	1. 935	----------	15. 6	50. 7	57. 6	1. 005	8. 79	----------
	. 233	2. 67	----------	16. 8	54. 7	58. 7	1. 031	12. 4	----------
	. 336	3. 86	----------	17. 0	55. 3	60. 0	1. 068	18. 6	----------
	. 447	5. 12	----------	17. 0	55. 3	61. 4	1. 107	25. 5	----------
	. 554	6. 35	----------	----------	56. 0	62. 5	1. 140	32. 5	----------
	. 788	9. 03	----------	----------	56. 6	63. 2	1. 162	47. 3	----------
	1. 035	11. 88	----------	----------	57. 9	64. 9	1. 217	65. 2	----------
	1. 346	15. 43	----------	----------	58. 5	65. 8	1. 251	87. 1	----------
	D_p=0.00305 inch, weight=1,793 gm., RT=73° F., BP=738 mm. Hg, air, D_t=4.00 inches, CH=0.658 ft.								
C′–1	0. 1330	1. 525	0. 0102	3. 2	10. 4	58. 7	1. 00	----------	35, 600
	. 2576	2. 95	. 0197	6. 0	19. 5	58. 7	1. 00	----------	17, 800
	. 509	5. 83	. 0390	11. 5	37. 4	58. 7	1. 00	----------	8, 740
	. 675	7. 73	----------	12. 5	40. 6	59. 4	1. 018	4. 64	----------
	. 973	11. 2	----------	13. 0	42. 3	60. 6	1. 049	6. 91	----------
	1. 265	14. 5	----------	13. 2	42. 9	61. 5	1. 072	9. 18	----------
	1. 562	17. 9	----------	----------	----------	61. 8	1. 082	11. 42	----------
	1. 858	21. 25	----------	----------	----------	62. 3	1. 096	13. 72	----------
	2. 16	24. 75	----------	----------	----------	62. 8	1. 112	16. 20	----------
	2. 445	28. 0	----------	----------	----------	63. 4	1. 129	18. 62	----------
	2. 74	31. 4	----------	----------	----------	63. 9	1. 144	20. 88	----------
	3. 045	34. 9	----------	----------	----------	64. 0	1. 150	22. 6	----------
	3. 35	38. 4	----------	----------	----------	64. 1	1. 154	26. 0	----------
	3. 64	41. 7	----------	----------	----------	64. 3	1. 159	28. 4	----------
	3. 95	45. 3	----------	----------	----------	64. 5	1. 163	31. 0	----------
	4. 24	48. 5	----------	----------	----------	65. 0	1. 180	33. 7	----------
	4. 84	55. 5	----------	----------	----------	65. 2	1. 188	38. 9	----------
	5. 44	62. 4	----------	----------	----------	65. 5	1. 198	44. 0	----------
	D_p=0.00303 inch, weight=3,544 gm., RT=73° F., BP=738 mm. Hg, air, D_t=4.00 inches, CH=1.288 ft.								
C′–2	0. 1330	1. 525	0. 0102	6. 0	19. 5	57. 8	1. 00	----------	31, 400
	. 2576	2. 95	. 0197	12. 0	39. 0	57. 8	1. 00	----------	16, 750
	. 3875	4. 44	. 0297	17. 8	57. 2	57. 8	1. 00	----------	10, 875
	. 683	7. 84	----------	26. 4	86. 0	58. 9	1. 027	4. 68	----------
	. 983	11. 3	----------	26. 0	84. 6	60. 3	1. 062	7. 00	----------
	1. 283	14. 73	----------	26. 2	85. 3	60. 7	1. 073	9. 21	----------
	1. 585	18. 2	----------	26. 4	86. 0	61. 2	1. 088	11. 5	----------
	1. 880	21. 55	----------	26. 4	86. 0	61. 5	1. 095	13. 72	----------
	2. 19	25. 2	----------	26. 4	86. 0	61. 7	1. 103	16. 2	----------
	2. 48	28. 4	----------	26. 4	86. 0	61. 7	1. 100	18. 18	----------
	2. 78	31. 9	----------	----------	86. 3	61. 7	1. 105	20. 5	----------
	3. 085	35. 4	----------	----------	86. 3	62. 2	1. 118	23. 0	----------
	3. 40	39. 0	----------	----------	86. 0	62. 3	1. 120	25. 4	----------
	3. 685	42. 3	----------	----------	86. 0	62. 6	1. 130	27. 8	----------
	4. 29	49. 1	----------	----------	86. 3	63. 0	1. 142	32. 7	----------
	4. 90	56. 2	----------	----------	86. 6	63. 6	1. 164	38. 1	----------
	5. 51	63. 3	----------	----------	87. 6	64. 2	1. 180	43. 5	----------
	6. 13	70. 3	----------	----------	88. 6	64. 7	1. 200	49. 3	----------
	6. 73	77. 2	----------	----------	88. 6	65. 1	1. 212	54. 5	----------
	7. 33	84. 0	----------	----------	89. 5	65. 9	1. 239	60. 5	----------

TABLE X.—*Fluidization data with mixed round and sharp sands in 2.5-inch and 4-inch tubes*

Run No.	w, lb./hr.	G, lb. ft.$^{-2}$ hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	f
	D_p=0.00940 inch, weight=1,000 gm., RT*=74° F., BP=740 mm. Hg, air, D_t=2.5 inches, CH*=0.681 ft.								
1M-1	0. 0706	2. 04	0. 0374	0. 8	2. 60	43. 7	1. 00		2, 880
	. 1335	3. 84	. 0708	1. 6	5. 20	43. 7	1. 00		1, 632
	. 1952	5. 63	. 103	2. 2	7. 15	43. 7	1. 00		1, 044
	. 258	7. 43	. 136	2. 7	8. 80	43. 7	1. 00		737
	. 385	11. 1	. 204	4. 0	13. 0	43. 7	1. 00		490
	. 511	14. 78	. 271	5. 3	17. 2	43. 7	1. 00		366
	. 673	19. 45	. 357	7. 2	23. 4	43. 7	1. 00		286
	. 969	28. 0	. 514	11. 0	35. 8	43. 7	1. 00		211
	1. 26	36. 3	. 667	14. 0	45. 5	43. 7	1. 00		159
	1. 558	44. 8	. 823	17. 4	56. 6	43. 7	1. 00		133
	1. 85	53. 3		17. 5	57. 0	44. 7	1. 016	21. 4	
	2. 152	62. 0		17. 6	57. 3	46. 0	1. 042	25. 6	
	2. 438	70. 3		17. 7	57. 6	46. 8	1. 062	29. 6	
	2. 73	78. 6		17. 8	57. 8	48. 3	1. 088	33. 9	
	3. 04	87. 6			57. 3	49. 3	1. 110	38. 5	
	3. 34	96. 2			57. 3	50. 3	1. 132	43. 1	
	3. 63	104. 8			57. 3	51. 4	1. 160	48. 0	
	3. 93	113. 4			57. 3	52. 3	1. 186	53. 1	
	4. 22	122			57. 3	53. 7	1. 218	58. 9	
	4. 54	131			57. 3	54. 7	1. 245	64. 6	
	D_p=0.00940 inch, weight=1,000 gm., RT=74° F., BP=740 mm. Hg, helium, D_t=2.5 inches, CH=0.681 ft.								
1M-2	0. 01132	0. 326	0. 0057	1. 0	3. 25	43. 7	1. 00		19, 650
	. 0237	. 683	. 0118	2. 0	6. 50	43. 7	1. 00		8, 940
	. 0619	1. 785	. 0310	5. 2	16. 9	43. 7	1. 00		3, 400
	. 105	3. 02	. 0525	8. 7	28. 3	43. 7	1. 00		1, 995
	. 170	4. 90	. 0852	13. 6	44. 3	43. 7	1. 00		1, 188
	. 134	3. 85	. 0670	11. 6	37. 7	43. 7	1. 00		1, 638
	. 232	6. 68		17. 4	56. 5	44. 5	1. 012	20. 4	
	. 335	9. 65		17. 5	57. 8	46. 9	1. 060	31. 0	
	. 448	12. 93		17. 9	58. 2	49. 3	1. 110	43. 4	
	. 551	15. 90			58. 5	51. 9	1. 170	56. 4	
	. 670	19. 35			58. 5	54. 6	1. 241	72. 7	
	. 783	22. 6			58. 8	55. 9	1. 279	87. 3	
	D_p=0.00940 inch, weight=1,492 gm., RT=74° F., BP=740 mm. Hg, air, D_t=2.5 inches, CH=0.989 ft.								
1M-3	0. 0706	2. 04	0. 0374	1. 0	3. 25	42. 3	1. 00		2, 185
	. 322	9. 26	. 169	5. 1	16. 6	42. 3	1. 00		540
	. 512	14. 82	. 272	8. 2	26. 7	42. 3	1. 00		341
	. 673	19. 45	. 357	11. 2	36. 4	42. 3	1. 00		313
	. 969	28. 0	. 514	16. 6	54. 0	42. 3	1. 00		224
	1. 26	36. 3	. 666	21. 7	70. 7	42. 3	1. 00		175
	1. 558	44. 8	. 822	26. 6	86. 6	42. 3	1. 00		141
	1. 85	53. 3		26. 3	85. 5	43. 9	1. 030	31. 6	
	2. 152	62. 0		26. 7	87. 0	45. 5	1. 058	37. 8	
	2. 438	70. 3			86. 2	46. 7	1. 082	43. 3	
	2. 73	78. 6			86. 8	48. 3	1. 118	50. 1	
	3. 04	87. 6			87. 2	49. 3	1. 137	56. 4	
	3. 34	96. 2			87. 8	51. 0	1. 178	65. 3	
	3. 63	104. 8			88. 1	52. 1	1. 207	73. 0	
	3. 93	113. 4			87. 5	52. 7	1. 223	80. 3	
	4. 22	122			90. 0	53. 7	1. 248	87. 8	

*RT=temperature of gas: CH=column height=L.

TABLE X.—*Fluidization data with mixed round and sharp sands in 2.5-inch and 4-inch tubes*—Con.

Run No.	w, lb./hr.	G, lb. ft.$^{-2}$hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_c/\rho$ lb./hr.^{2}	f
	D_p=0.00940 inch, weight=1,492 gm., RT=74° F., BP=740 mm. Hg, helium, D_t=2.5 inches, CH=0.989 ft.								
1M-4	0.824	2.38	0.0414	10.3	33.6	42.3	1.00	----------	2,330
	.134	3.85	.0669	18.6	60.6	42.3	1.00	----------	1,610
	.232	6.68	----------	26.3	85.5	43.2	1.014	29.5	----------
	.335	9.65	----------	26.9	87.6	46.9	1.089	45.9	----------
	.448	12.93	----------	26.8	87.2	49.4	1.142	64.5	----------
	.551	15.90	----------	----------	87.6	52.7	1.228	85.1	----------
	.670	19.35	----------	----------	88.2	54.7	1.279	108	----------
	D_p=0.00838 inch, weight=1,000 gm., RT=79° F., BP=740 mm. Hg, air, D_t=2.5 inches, CH=0.675 ft.								
2M-1	0.0706	2.04	0.0329	1.0	3.25	43.1	1.00	----------	3,050
	.322	9.26	.149	5.0	16.23	43.1	1.00	----------	740
	.574	16.55	.267	9.1	29.6	43.1	1.00	----------	423
	.673	19.45	.314	11.5	37.4	43.1	1.00	----------	387
	.969	28.0	.452	16.1	52.4	43.1	1.00	----------	262
	1.26	36.3	----------	17.4	56.8	44.8	1.030	21.5	----------
	1.558	44.8	----------	17.5	57.0	45.7	1.050	27.1	----------
	1.85	53.3	----------	17.8	57.8	46.8	1.074	33.0	----------
	2.152	62.0	----------	----------	57.3	48.3	1.100	39.3	----------
	2.438	70.3	----------	----------	57.6	49.4	1.123	45.5	----------
	2.73	78.6	----------	----------	57.3	50.4	1.149	52.0	----------
	3.04	87.6	----------	----------	56.7	51.4	1.172	59.2	----------
	3.34	96.2	----------	----------	57.3	52.1	1.192	66.2	----------
	3.63	104.8	----------	----------	57.3	53.4	1.228	74.0	----------
	3.93	113.4	----------	----------	58.3	54.5	1.253	81.5	----------
	4.22	122	----------	----------	58.3	55.7	1.290	90.5	----------
	D_p=0.00838 inch, weight=1,000 gm., RT=79° F., BP=740 mm. Hg, helium, D_t=2.5 inches, CH=0.675 ft.								
2M-2	0.01132	0.326	0.00496	1.0	3.25	43.1	1.00	----------	16,570
	.0619	1.785	.0271	6.9	24.4	43.1	1.00	----------	4,140
	.146	4.20	.0639	17.8	58.0	43.1	1.00	----------	1,790
	.134	3.85	.0586	17.8	58.0	43.1	1.00	----------	2,120
	.173	4.98	----------	17.9	58.4	44.4	1.024	23.1	----------
	.232	6.68	----------	----------	57.3	46.3	1.060	32.0	----------
	.335	9.65	----------	----------	57.9	48.8	1.112	48.4	----------
	.448	12.93	----------	----------	58.2	50.6	1.155	67.5	----------
	.551	15.9	----------	----------	59.2	53.9	1.239	88.8	----------
	.670	19.35	----------	----------	59.5	55.7	1.288	113	----------
	D_p=0.00838 inch, weight=1,500 gm., RT=79° F., BP=740 mm. Hg, air, D_t=2.5 inches, CH=1.008 ft.								
3M-3	0.0706	2.04	0.0329	1.4	4.55	42.8	1.00	----------	1,890
	.322	9.26	.149	7.2	23.4	42.8	1.00	----------	470
	.574	16.55	.267	12.7	41.1	43.8	1.00	----------	260
	.673	19.45	.314	15.6	50.8	42.8	1.00	----------	232
	.969	28.0	.452	22.8	74.0	42.8	1.00	----------	163
	1.26	36.6	----------	26.0	84.8	43.7	1.019	21.3	----------
	1.558	44.8	----------	26.5	86.3	45.1	1.040	26.9	----------
	1.85	53.3	----------	26.8	87.3	46.5	1.070	33.0	----------
	2.152	62.0	----------	----------	86.8	48.0	1.101	39.3	----------
	2.438	70.3	----------	----------	87.6	49.3	1.130	45.9	----------
	2.73	78.6	----------	----------	88.5	50.8	1.165	52.7	----------
	3.04	87.6	----------	----------	87.8	52.4	1.207	61.0	----------
	3.34	96.2	----------	----------	87.3	53.3	1,230	68.2	----------
	3.63	104.8	----------	----------	89.8	54.5	1.263	76.2	----------

TABLE X.—*Fluidization data with mixed round and sharp sands in 2.5-inch and 4-inch tubes*—Con.

Run No.	w, lb./hr.	G, lb. ft.$^{-2}$hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	f
	D_p=0.00838 inch, weight=1,500 gm., RT=79° F., BP=740 mm. Hg, helium, D_t=2.5 inches, CH=1.008 ft.								
2M–4	0. 01132	0. 326	0. 00496	2. 0	6. 51	42. 8	1. 00	----------	14, 600
	. 0824	2. 38	. 0362	15. 4	50. 0	42. 8	1. 00	----------	2, 100
	. 170	4. 90	----------	26. 6	86. 6	43. 4	1. 011	22. 4	----------
	. 232	6. 68	----------	27. 2	88. 5	45. 9	1. 057	32. 0	----------
	. 335	9. 65	----------	27. 9	90. 6	49. 4	1. 132	49. 5	----------
	. 448	12. 93	----------	----------	88. 8	51. 7	1. 189	69. 5	----------
	. 551	15. 90	----------	----------	87. 6	55. 5	1. 289	92. 4	----------
	. 256	7. 38	----------	----------	86. 3	46. 7	1. 072	35. 8	----------
	. 294	8. 47	----------	----------	86. 8	47. 7	1. 093	41. 9	----------
	. 337	9. 70	----------	----------	87. 8	48. 7	1. 116	49. 0	----------
	. 378	10. 90	----------	----------	87. 6	50. 1	1. 149	56. 5	----------
	D_p=0.01163 inch, weight=1,362 gm., RT=78° F., BP=740 mm. Hg, air, D_t=2.5 inches, CH=0.884 ft.								
3M–1	0. 0706	2. 04	0. 0455	1. 0	3. 25	40. 9	1. 00	----------	2, 540
	. 322	9. 26	. 207	4. 1	13. 3	40. 9	1. 00	----------	505
	. 574	16. 55	. 370	7. 7	24. 9	40. 9	1. 00	----------	297
	. 673	19. 45	. 435	9. 0	29. 2	40. 9	1. 00	----------	252
	. 969	28. 0	. 628	13. 4	43. 6	40. 9	1. 00	----------	181
	1. 26	36. 3	. 813	17. 6	57. 3	40. 9	1. 00	----------	141
	1. 558	44. 8	1. 000	22. 4	72. 7	40. 9	1. 00	----------	116
	1. 850	53. 3	----------	24. 2	78. 6	41. 9	1. 015	32. 0	----------
	2. 152	62. 0	----------	----------	78. 4	42. 8	1. 032	38. 0	----------
	2. 438	70. 3	----------	----------	79. 4	44. 2	1. 060	44. 2	----------
	2. 73	78. 6	----------	----------	80. 4	45. 3	1. 080	50. 2	----------
	3. 04	87. 6	----------	----------	81. 4	46. 9	1. 112	57. 8	----------
	3. 34	96. 2	----------	----------	82. 0	47. 8	1. 130	64. 4	----------
	3. 63	104. 8	----------	----------	82. 3	48. 7	1. 151	71. 6	----------
	3. 93	113. 4	----------	----------	82. 6	49. 4	1. 169	78. 6	----------
	4. 22	122. 0	----------	----------	83. 6	50. 4	1. 192	86. 5	----------
	D_p=0.01163 inch, weight=1,000 gm., RT=78° F., BP=740 mm. Hg, helium, D_t=2.5 inches, CH=0.655 ft.								
3M–2	0. 01132	0. 326	0. 00691	1. 0	3. 25	41. 4	1. 00	----------	19, 680
	. 0824	2. 38	. 0504	6. 3	20. 5	41. 4	1. 00	----------	2, 330
	. 170	4. 90	. 1033	12. 4	40. 3	41. 4	1. 00	----------	1, 080
	. 134	3. 85	. 0816	10. 3	34. 5	41. 4	1. 00	----------	1, 495
	. 232	6. 68	. 141	17. 7	57. 6	41 4	1. 00	----------	830
	. 335	9. 65	----------	18. 2	59. 2	44. 2	1. 050	45. 8	----------
	. 359	10. 38	----------	----------	59. 8	44. 8	1. 062	49. 7	----------
	. 397	11. 47	----------	----------	59. 8	45. 8	1. 078	55. 7	----------
	. 440	12. 7	----------	----------	60. 2	46. 6	1. 100	63. 1	----------
	. 472	13. 64	----------	----------	60. 2	47. 2	1. 110	68. 3	----------
	. 510	14. 72	----------	----------	59. 8	48. 3	1. 132	75. 4	----------
	. 551	15. 9	----------	----------	60. 5	49. 6	1. 162	83. 5	----------
	. 670	19. 35	----------	----------	62. 8	51. 5	1. 213	106. 0	----------
	. 783	22. 6	----------	----------	----------	52. 1	1. 225	125. 0	----------

TABLE X.—*Fluidization data with mixed round and sharp sands in 2.5-inch and 4-inch tubes*—Con.

Run No.	w, lb./hr.	G, lb.ft.$^{-2}$hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_c	$G\mu l_c/\rho$ lb./hr.^{2}	f
	D_p=0.01163 inch, weight=1,000 gm., RT=78° F., BP=740 mm. Hg, air, D_t=2.5 inches, CH=0.655 ft.								
3M-3	0.0706	2.04	0.0455	0.7	2.28	41.4	1.00	----------	2,440
	.322	9.26	.207	2.7	8.8	41.4	1.00	----------	458
	.574	16.55	.369	5.25	17.1	41.4	1.00	----------	280
	.673	19.45	.434	6.9	22.4	41.4	1.00	----------	265
	.969	28.0	.625	9.85	32.0	41.4	1.00	----------	183
	1.26	36.3	.810	12.5	40.7	41.4	1.00	----------	138
	1.558	44.8	1.00	15.5	50.5	41.4	1.00	----------	113
	1.85	53.3	1.19	18.0	58.7	41.4	1.00	----------	92
	2.152	62.0	----------	17.9	58.4	41.8	1.007	35.7	----------
	2.438	70.3	----------	----------	58.7	44.5	1.056	42.8	----------
	2.73	78.6	----------	----------	59.3	45.6	1.076	48.7	----------
	3.04	87.6	----------	----------	60.2	46.4	1.097	55.4	----------
	3.34	96.2	----------	----------	60.5	47.8	1.122	62.2	----------
	3.63	104.8	----------	----------	60.5	49.1	1.153	69.6	----------
	3.93	113.4	----------	----------	60.5	49.8	1.169	76.4	----------
	4.22	122.0	----------	----------	60.5	50.0	1.176	82.6	----------
	4.54	131.0	----------	----------	61.8	51.2	1.202	90.7	----------
	D_p=0.00658 inch, weight=1,000 gm., RT=67° F., BP=730 mm. Hg, air, D_t=2.5 inches, CH=0.665 ft.								
4M-1	0.0706	2.04	0.0260	3.0	9.75	42.2	1.00	----------	6,000
	.1335	3.84	.0491	6.1	19.8	42.2	1.00	----------	3,460
	.258	7.43	.0950	11.9	38.7	42.2	1.00	----------	1,802
	.448	12.92	----------	17.9	58.1	43.5	1.022	7.69	----------
	.511	14.78	----------	17.2	56.0	45.2	1.052	9.05	----------
	.673	19.45	----------	18.0	58.6	46.8	1.083	12.3	----------
	.969	28.0	----------	18.2	59.2	47.3	1.096	17.8	----------
	1.26	36.3	----------	18.2	59.2	48.3	1.116	23.5	----------
	1.558	44.8	----------	----------	59.3	49.1	1.135	29.6	----------
	1.85	53.3	----------	----------	59.9	49.8	1.152	35.7	----------
	2.152	62.0	----------	----------	61.2	51.2	1.185	42.8	----------
	2.438	70.3	----------	----------	61.8	52.1	1.210	49.4	----------
	2.73	78.6	----------	----------	63.2	52.9	1.235	56.5	----------
	3.04	87.6	----------	----------	63.5	54.0	1.259	64.1	----------
	D_p=0.00658 inch, weight=1,972 gm., RT=67° F., BP=730 mm. Hg, air, D_t=2.5 inches, CH=1.290 ft.								
4M-2	0.0706	2.04	0.0260	6.2	20.2	41.0	1.00	----------	6,305
	.1952	5.63	.0720	17.4	56.5	41.0	1.00	----------	2,330
	.385	11.1	.142	34.2	111	41.0	1.00	----------	1,177
	.448	12.92	----------	34.3	111.5	42.2	1.020	7.66	----------
	.511	14.78	----------	34.2	111	43.2	1.037	8.90	----------
	.673	19.45	----------	35.4	115	44.7	1.067	12.0	----------
	.969	28.0	----------	35.7	116	46.0	1.091	17.8	----------
	1.26	36.3	----------	----------	116.5	47.0	1.111	23.4	----------
	1.558	44.8	----------	----------	117.2	48.8	1.151	30.0	----------
	1.85	53.3	----------	----------	119.0	50.1	1.180	36.6	----------
	2.152	62.0	----------	----------	121.0	51.6	1.222	44.0	----------
	2.438	70.3	----------	----------	122.3	53.7	1.274	52.1	----------

TABLE X.—*Fluidization data with mixed round and sharp sands in 2.5-inch and 4-inch tubes*—Con.

Run No.	w, lb./hr.	G, lb. ft.$^{-2}$ hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	f
	D_p=0.00658 inch, weight=2,975 gm., RT=73° F., BP=745 mm. Hg, air, D_t=4.00 inches, CH=0.761 ft.								
5M–1	0. 1330	1. 525	0. 0194	3. 8	12. 0	40. 6	1. 00	----------	10, 980
	. 2516	2. 95	. 0375	7. 5	24. 4	40. 6	1. 00	----------	5, 950
	. 3875	4. 44	. 0565	11. 0	35. 6	40. 6	1. 00	----------	3, 840
	. 515	5. 90	. 0751	14. 6	47. 5	40. 6	1. 00	----------	2. 880
	. 683	7. 84	. 0998	18. 5	60. 3	40. 6	1. 00	----------	2, 080
	1. 283	14. 73	----------	21. 2	69. 0	45. 4	1. 087	9. 08	----------
	1. 88	21. 55	----------	21. 8	70. 6	46. 8	1. 122	13. 67	----------
	2. 48	28. 4	----------	22. 0	71. 6	48. 3	1. 148	18. 45	----------
	3. 085	35. 4	----------	----------	71. 9	49. 3	1. 171	23. 5	----------
	3. 685	42. 3	----------	----------	72. 2	49. 7	1. 181	28. 2	----------
	4. 29	49. 1	----------	----------	72. 5	50. 1	1. 192	33. 2	----------
	4. 90	56. 2	----------	----------	73. 2	50. 9	1. 212	38. 6	----------
	5. 51	63. 3	----------	----------	73. 8	51. 5	1. 228	44. 0	----------
	6. 13	70. 3	----------	----------	73. 8	52. 3	1. 248	49. 7	----------
	6. 21	71. 2	----------	----------	74. 3	51. 7	1. 232	41. 7	----------
	8. 20	94. 0	----------	----------	74. 9	54. 3	1. 302	69. 1	----------
	11. 10	127. 5	----------	----------	78. 2	57. 4	1. 400	100. 8	----------
	14. 08	162	----------	----------	78. 2	59. 4	1. 463	134	----------
	17. 06	196	----------	----------	79. 8	61. 0	1. 528	170	----------
	D_p=0.01346 inch, weight=2,223 gm., RT=75° F., BP=746 mm. Hg, air, D_t=4.00 inches, CH=0.675 ft.								
6M′–1	0. 3875	4. 44	0. 119	0. 9	2. 93	49. 8	1. 00	----------	1, 872
	. 683	7. 84	. 210	1. 7	5. 57	49. 8	1. 00	----------	1, 142
	1. 283	14. 73	. 345	3. 6	11. 7	49. 8	1. 00	----------	678
	2. 48	28. 4	. 762	7. 2	23. 4	49. 8	1. 00	----------	365
	3. 085	35. 4	. 950	8. 9	29. 0	49. 8	1. 00	----------	291
	3. 685	42. 8	1. 135	10. 5	34. 2	49. 8	1. 00	----------	241
	4. 29	49. 1	1. 32	12. 0	39. 1	49. 8	1. 00	----------	204
	4. 90	56. 2	1. 51	13. 7	44. 6	49. 8	1. 00	----------	177
	5. 51	63. 3	----------	15. 5	50. 4	50. 1	1. 005	36. 4	----------
	6. 13	70. 3	----------	16. 1	52. 4	50. 6	1. 017	40. 8	----------
	6. 74	77. 3	----------	----------	53. 3	51. 1	1. 029	45. 3	----------
	7. 36	84. 3	----------	----------	53. 3	51. 9	1. 044	50. 2	----------
	8. 20	94. 0	----------	----------	54. 7	53. 3	1. 079	57. 9	----------
	11. 10	127. 5	----------	----------	57. 3	56. 6	1. 159	84. 3	----------
	14. 08	162	----------	----------	58. 9	59. 0	1. 225	113	----------
	17. 06	196	----------	----------	59. 9	61. 4	1. 300	145	----------

TABLE XI.—*Fluidization data with iron Fischer-Tropsch catalyst in 4-inch tube*

Run No.	w, lb./hr.	G, lb. ft.$^{-2}$hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	f
	D_p=0.01518 inch, weight=4,262 gm., RT*=84° F., BP=740 mm. Hg, air, D_t=4.00 inches, CH*=0.685 ft.								
a–1	0.382	4.39	0.126	0.7	2.28	49.9	1.00	----------	1,648
	.667	7.65	.219	1.3	4.22	49.9	1.00	----------	1,003
	1.252	14.37	.412	2.6	8.45	49.9	1.00	----------	568
	1.837	21.1	.607	4.2	13.65	49.9	1.00	----------	426
	2.42	27.8	.798	5.7	18.5	49.9	1.00	----------	333
	3.02	34.7	.997	7.1	23.1	49.9	1.00	----------	266
	3.65	41.9	1.20	8.4	27.3	49.9	1.00	----------	217
	4.25	48.7	1.40	9.6	31.2	49.9	1.00	----------	183
	4.88	56.0	1.61	11.2	36.4	49.9	1.00	----------	161
	5.51	63.3	1.82	12.7	41.3	49.9	1.00	----------	143
	6.15	70.5	2.02	14.3	46.5	49.9	1.00	----------	130
	6.77	77.7	2.23	15.8	51.4	49.9	1.00	----------	119
	7.37	84.5	2.42	17.2	56.0	49.9	1.00	----------	109
	8.27	94.8	2.71	20.0	65.1	49.9	1.00	----------	101
	11.07	127	3.64	27.8	90.5	49.9	1.00	----------	77.5
	12.4	142	----------	31.4	102	50.2	1.005	79.8	----------
	14.1	162	----------	33.2	108	50.6	1.013	91.5	----------
	15.45	177	----------	32.4	105.3	52.1	1.046	103.4	----------
	17.02	196	----------	33.0	107.3	52.5	1.058	116	----------
	18.5	212	----------	33.5	109	53.5	1.077	128	----------
	20.1	230	----------	33.8	110	54.3	1.098	141	----------
	23.6	271	----------	34.8	113	56.5	1.152	174	----------
	26.5	304	----------	35.5	115	58.5	1.208	205	----------
	27.6	316	----------	36.5	119	61.2	1.295	228	----------
	D_p=0.01215 inch, weight=5,011 gm., RT=79° F., BP=740 mm. Hg, air, D_t=4.00 inches, CH=0.826 ft.								
b–1	0.382	4.39	0.106	1.5	4.89	50.6	1.00	----------	2,650
	.667	7.65	.185	2.4	7.81	50.6	1.00	----------	1,400
	1.252	14.37	.347	5.0	16.2	50.6	1.00	----------	820
	1.837	23.1	.510	7.2	23.4	50.6	1.00	----------	550
	2.42	27.8	.671	9.7	31.5	50.6	1.00	----------	426
	3.02	34.7	.840	12.2	39.7	50.6	1.00	----------	345
	3.65	41.9	1.01	14.5	47.2	50.6	1.00	----------	285
	4.25	48.7	1.18	16.8	54.6	50.6	1.00	----------	241
	4.88	56.0	1.35	19.2	62.6	50.6	1.00	----------	209
	5.51	63.3	1.53	22.0	71.7	50.6	1.00	----------	187
	6.15	70.5	1.70	24.5	79.8	50.6	1.00	----------	168
	6.77	77.7	1.88	27.1	88.3	50.6	1.00	----------	154
	7.37	84.5	2.04	29.4	95.8	50.6	1.00	----------	140
	8.27	94.8	2.29	34.0	111	50.6	1.00	----------	129
	9.65	111	----------	36.4	118	52.3	1.02	63.0	----------
	11.07	127	----------	----------	----------	53.6	1.045	73.5	----------
	12.40	142	----------	38.1	124	54.5	1.066	84.3	----------
	14.10	162	----------	----------	----------	56.1	1.105	99.2	----------
	17.02	196	----------	39.8	129	58.0	1.153	125.5	----------
	20.10	230	----------	----------	----------	60.3	1.22	156	----------
	23.60	271	----------	41.4	134	62.15	1.283	193	----------

*RT=temperature of gas; CH=column height=L.

943247°—51——10

TABLE XI.—*Fluidization data with iron Fischer-Tropsch catalyst in 4-inch tube*—Continued

Run No.	w, lb./hr.	G, lb. ft.$^{-2}$ hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	f
	D_p=0.01215 inch, weight=5,087 gm., RT=78° F., BP=740 mm. Hg, air, D_t=4.00 inches, CH=0.809 ft.								
b–1	0. 256	2. 94	0. 0716	1. 6	5. 20	49. 3	1. 00	----------	5, 930
	. 566	6. 50	. 158	3. 1	10. 05	49. 3	1. 00	----------	2, 345
	. 667	7. 65	. 186	3. 7	12. 0	49. 3	1. 00	----------	2, 015
	1. 252	14. 37	. 350	7. 0	22. 8	49. 3	1. 00	----------	1. 090
	1. 837	21. 1	. 514	10. 5	34. 2	49. 3	1. 00	----------	756
	2. 42	27. 8	. 678	13. 7	44. 6	49. 3	1. 00	----------	568
	3. 65	41. 9	1. 016	20. 6	67. 1	49. 3	1. 00	----------	377
	4. 88	56. 0	1. 36	27. 0	88. 0	49. 3	1. 00	----------	276
	6. 15	70. 5	----------	33. 0	107. 2	49. 6	1. 007	39. 7	----------
	7. 37	84. 5	----------	38. 0	123. 2	50. 1	1. 018	48. 0	----------
	8. 39	96. 1	----------	37. 1	120. 5	51. 3	1. 043	56. 1	----------
	9. 93	114	----------	38. 2	123. 7	52. 5	1. 071	68. 4	----------
	11. 07	127	----------	38. 9	126. 2	53. 4	1. 093	77. 5	----------
	11. 67	134	----------	39. 5	128. 6	54. 1	1. 110	83. 2	----------
	14. 10	162	----------	40. 0	130	55. 9	1. 153	104	----------
	17. 02	196	----------	40. 6	131. 4	57. 4	1. 193	139. 5	----------
	20. 10	230	----------	41. 2	133. 5	59. 4	1. 242	159. 5	----------
	23. 60	271	----------	42. 2	137	60. 6	1. 291	195. 3	----------
	D_p=0.00823 inch, weight=4,650 gm., RT=77° F., BP=745 mm. Hg, air, D_t=4.00 inches, CH=0.771 ft.								
c–1	0. 381	4. 37	0. 0687	5. 7	18. 6	51. 0	1. 00	----------	7, 200
	. 662	7. 60	. 1195	10. 5	34. 1	51. 0	1. 00	----------	4, 350
	1. 244	14. 3	. 225	20. 6	67. 0	51. 0	1. 00	----------	2, 430
	1. 565	17. 97	. 282	25. 0	81. 3	51. 0	1. 00	----------	1, 860
	1. 85	21. 22	. 334	30. 0	97. 6	51. 0	1. 00	----------	1, 610
	2. 14	24. 55	----------	33. 5	109	51. 3	1. 008	14. 9	----------
	2. 43	27. 9	----------	32. 0	104	51. 9	1. 021	17. 18	----------
	2. 73	31. 4	----------	32. 0	104	52. 2	1. 029	19. 43	----------
	3. 09	35. 5	----------	32. 0	104	52. 8	1. 041	22. 3	----------
	3. 61	41. 4	----------	33. 2	108	53. 7	1. 060	26. 4	----------
	4. 20	48. 2	----------	33. 8	110	54. 2	1. 072	31. 1	----------
	4. 80	55. 1	----------	34. 3	112	55. 1	1. 092	36. 3	----------
	5. 38	61. 8	----------	34. 4	112. 5	55. 9	1. 122	41. 7	----------
	5. 96	68. 5	----------	34. 8	114	56. 7	1. 131	46. 6	----------
	6. 17	70. 7	----------	35. 0	114. 5	57. 6	1. 158	49. 3	----------
	7. 99	91. 6	----------	35. 2	115	58. 7	1. 186	65. 5	----------
	10. 68	122. 5	----------	36. 5	119	61. 2	1. 268	93. 5	----------

TABLE XI.—*Fluidization data with iron Fischer-Tropsch catalyst in 4-inch tube*—Continued

Run No.	w, lb./hr.	G, lb. ft.$^{-2}$ hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	f
	D_p=0.00702 inch, weight=5,229 gm., RT=82° F., BP=743 mm. Hg, air, D_t=4.00 inches, CH=0.915 ft.								
d-1	0.132	1.51	0.0199	2.0	6.51	53.6	1.00		20,100
	.255	2.92	.0388	4.0	13.0	53.6	1.00		10,750
	.506	5.80	.0770	7.6	24.1	53.6	1.00		5,160
	.667	7.65	.101	10.0	32.5	53.6	1.00		3,900
	.959	11.0	.146	14.8	48.2	53.6	1.00		2,800
	1.252	14.4	.191	20.0	65.1	53.6	1.00		2,215
	1.55	17.76	.236	24.2	78.8	53.6	1.00		1,760
	1.84	21.1	.280	29.2	95.2	53.6	1.00		1,506
	2.14	24.6	.327	33.6	109	53.6	1.00		1,270
	2.42	27.8		38.7	126	53.8	1.006	16.0	
	3.02	34.7		38.0	123.7	54.2	1.013	20.2	
	3.65	41.9		38.5	125	55.1	1.035	24.8	
	4.25	48.7		39.0	127.7	56.1	1.057	29.5	
	4.88	56.0		39.5	128	56.6	1.070	34.3	
	5.49	62.9		39.6	128.3	57.3	1.089	39.1	
	6.15	70.5		39.8	129.5	58.2	1.110	44.8	
	7.37	84.5		40.2	130.5	59.0	1.130	54.7	
	8.27	94.8		40.8	133	59.8	1.157	57.4	
	9.68	111		41.3	134	61.2	1.192	75.8	
	11.07	127		41.8	136	63.0	1.259	91.3	
	14.15	162		42.3	137.5	64.9	1.325	123	
	17.1	196		44.4	144	65.5	1.395	156	
	D_p=0.00702 inch, weight=5,229 gm., RT=81° F., BP=742 mm. Hg, helium, D_t=4.00 inches, CH=0.885 ft.								
d-2	0.0240	0.275	0.00348	2.5	8.15	52.3	1.00		94,200
	.0610	.700	.00887	6.8	22.1	52.3	1.00		39,400
	.1038	1.19	.0151	12.0	39.0	52.3	1.00		24,000
	.145	1.66	.0210	17.0	55.3	52.3	1.00		17,600
	.232	2.66	.0336	28.5	92.8	52.3	1.00		11,500
	.340	3.90		36.6	119			17.6	
	.450	5.16		38.0	123			23.7	
	.564	6.46		38.8	126			30.4	
	.681	7.81		39.2	127			37.7	
	.797	9.14		39.4	128			45.1	
	1.045	12.0		40.0	130			61.8	
	1.37	15.7		40.6	132			83.5	
	D_p=0.00430 inch, weight=3,986 gm., RT=80° F., BP=734 mm. Hg, air, D_t=4.00 inches, CH=0.724 ft.								
e-1	0.255	2.92	0.0240	8.4	27.4	55.5	1.00		20,570
	.382	4.39	.0362	12.3	40.0	55.5	1.00		13,300
	.506	5.80	.0477	16.3	53.0	55.5	1.00		10,100
	.667	7.65	.0631	23.1	75.1	55.5	1.00		8,230
	.959	11.0		21.8	71.0	56.0	1.010	6.57	
	1.252	14.37		24.0	78.2	56.6	1.025	8.69	
	1.55	17.76		24.5	79.4	57.6	1.048	10.97	
	1.837	21.1		25.0	81.5	58.3	1.064	13.27	
	2.42	27.8		26.6	86.5	58.7	1.078	17.68	
	3.02	34.7		27.8	89.2	59.8	1.106	22.6	
	3.65	41.9		28.0	91.2	60.6	1.130	27.9	
	4.85	56.0		29.0	94.0	61.1	1.142	37.8	
	6.15	70.5		29.8	97.1	62.3	1.180	49.1	
	7.37	84.5		30.6	99.5	63.4	1.216	60.7	
	8.27	94.8		30.5	99.0	64.0	1.237	69.2	
	9.97	114.5		31.8	103.3	65.1	1.273	86.2	
	11.07	127		32.2	104.7	65.9	1.307	98.0	

TABLE XI.—*Fluidization data with iron Fischer-Tropsch catalyst in 4-inch tube*—Continued

Run No.	w, lb./hr.	G, lb.ft.$^{-2}$hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	f
	D_p=0.00430 inch, weight=6,019 gm., RT=80° F., BP=734 mm. Hg, air, D_t=4.00 inches, CH=1.063 ft.								
e–2	0.132	1.51	0.0124	7.8	25.4	54.2	1.00		42,600
	.255	2.42	.0240	15.0	48.8	54.2	1.00		32,000
	.382	4.39	.0362	22.4	72.8	54.2	1.00		14,550
	.506	5.80	.0477	29.7	96.7	54.2	1.00		11,050
	.667	7.65		40.6	132	54.5	1.005	4.47	
	.959	11.0		41.5	135	54.8	1.012	6.49	
	1.252	14.37		41.0	133	55.4	1.027	8.57	
	1.837	21.1		41.0	133	56.7	1.058	12.96	
	2.42	27.8		41.5	135	57.7	1.082	17.5	
	3.02	34.7		42.3	137.5	59.0	1.117	22.5	
	3.65	41.9		43.8	142	59.6	1.132	27.5	
	4.26	48.9		44.5	144	59.9	1.140	32.4	
	4.88	56.0		44.5	144	60.2	1.150	37.4	
	6.15	70.5		45.5	148	61.1	1.178	48.2	
	6.34	72.6		45.8	149	61.9	1.205	50.9	
	8.27	94.8		46.8	152	63.4	1.256	69.2	
	9.47	108.8		47.5	154	64.3	1.287	81.2	
	D_p=0.00278 inch, weight=5,580 gm., RT=80° F., BP=734 mm. Hg, air, D_t=4.00 inches, CH=1.061 ft.								
f–1	0.0712	0.827		12.4	40.4	57.4	1.00		
	.1033	1.20		19.0	61.9	57.4	1.00		
	.1348	1.46		25.6	83.4	57.4	1.00		
	.1685	1.95		31.0	100.6	57.4	1.00		
	.197	2.28		37.0	120	57.4	1.00		
	.228	2.65		42.7	139	57.4	1.00		
	1.252	14.37		32.0	104	59.8	1.059	8.87	
	1.837	21.1		34.5	113	60.7	1.083	13.35	
	2.42	27.8		35	114	61.1	1.094	17.8	
	3.02	34.7		34	111	61.3	1.100	22.3	
	3.65	41.9		32	104	62.1	1.125	27.5	
	4.25	48.7		35.2	115	62.4	1.134	32.3	
	4.88	56.0		37	120	63.8	1.180	38.5	
	5.51	63.3		41.8	136	64.5	1.200	44.3	
	6.15	70.5		38	124	64.5	1.200	49.4	
	7.37	84.5		39.8	130	65.5	1.236	61.1	
	D_p=0.01214 inch, weight=7,234 gm., RT=91° F., BP=736 mm. Hg, air, D_t=4.00 inches, CH=1.210 ft.								
g–1	0.693	7.95	0.190	3.5	11.4	51.7	1.00		1,428
	1.24	14.2	.340	7.0	22.8	51.7	1.00		890
	2.40	27.6	.660	14.0	45.6	51.7	1.00		471
	3.59	41.2	.987	21.0	67.5	51.7	1.00		313
	4.82	55.3	1.32	27.8	90.6	51.7	1.00		234
	6.03	69.1	1.65	35.5	115.5	51.7	1.00		192
	7.22	82.8	1.98	42.0	137	51.7	1.00		157
	8.27	94.7	2.26	51.0	166	51.7	1.00		145
	9.50	109		55.0	179	52.2	1.012	64.0	
	11.10	127		55.6	181	53.4	1.040	76.6	
	12.4	142		56.5	184	54.5	1.064	87.7	
	14.0	160.7		57.5	187	56.2	1.104	102.5	
	16.92	194		58.5	190	58.3	1.160	130.4	
	19.85	228		61.5	200	61.2	1.245	164	

TABLE XI.—*Fluidization data with iron Fischer-Tropsch catalyst in 4-inch tube*—Continued

Run No.	w, lb./hr.	G, lb. ft.$^{-2}$ hr.$^{-1}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	f
	D_p=0.01214 inch, weight=7,234 gm., RT=89° F., BP=736 mm. Hg, helium, D_t=4.00 inches, CH=1.182 ft.								
g-2	0. 0604	0. 692	0. 0156	2. 5	8. 15	50. 4	1. 00	----------	16, 530
	. 144	1. 65	. 0374	6. 3	20. 5	50. 4	1. 00	----------	7, 265
	. 230	2. 64	. 0597	11. 1	36. 1	50. 4	1. 00	----------	5, 010
	. 333	3. 82	. 0865	15. 5	50. 5	50. 4	1. 00	----------	3, 350
	. 549	6, 28	. 142	26. 4	86. 0	50. 4	1. 00	----------	2, 120
	. 786	9. 02	. 204	38. 0	120	50. 4	1. 00	----------	1, 425
	1. 045	12. 0	. 272	50. 8	165. 4	50. 4	1. 00	----------	1, 110
	D_p=0.00480 inch, weight=7,853 gm., RT=91° F., BP=738 mm. Hg, air, D_t=4.00 inches, CH=1.310 ft.								
h-1	0. 0696	0. 798	----------	8. 5	27. 7	51. 5	1. 00	----------	----------
	. 1306	1. 499	----------	16. 0	52. 1	51. 5	1. 00	----------	----------
	. 253	2. 90	----------	30. 8	100. 2	51. 5	1. 00	----------	----------
	. 376	4. 31	----------	45. 5	148.	51. 5	1. 00	----------	----------
	. 499	5. 72	----------	59. 0	192	51. 9	1. 007	3. 45	----------
	1. 239	14. 20	----------	55. 0	179. 1	56. 1	1. 103	9. 39	----------
	1. 821	20. 9	----------	56. 7	184. 5	57. 1	1. 129	14. 13	----------
	2. 40	27. 5	----------	57. 5	187. 2	57. 1	1. 129	18. 6	----------
	2. 98	34. 2	----------	58. 0	188. 8	57. 4	1. 138	23. 3	----------
	3. 56	40. 8	----------	59. 0	192	58. 2	1. 160	28. 4	----------
	4. 14	47. 5	----------	59. 0	192	58. 7	1. 171	33. 4	----------
	4. 72	54. 2	----------	59. 5	193. 8	59. 2	1. 186	38. 5	----------
	5. 31	61. 0	----------	60. 5	197	59. 3	1. 190	43. 5	----------
	5. 89	67. 6	----------	60. 5	197	60. 2	1. 216	49. 3	----------
	6. 38	73. 2	----------	61. 0	198. 3	60. 9	1. 241	54. 5	----------
	7. 85	90. 1	----------	61. 5	200	61. 9	1. 272	68. 8	----------
	9. 13	104. 8	----------	63. 0	205	63. 3	1. 323	83. 2	----------
	10. 57	121. 2	----------	64. 0	208. 5	64. 3	1. 361	99. 0	----------
	D_p=0.00480 inch, weight=5,637 gm., RT=91° F., BP=738 mm. Hg, air, D_t=4.00 inches, CH=0.945 ft.								
h-2	0. 0690	0. 791	----------	5. 7	18. 56	51. 7	1. 00	----------	----------
	. 131	1. 502	----------	10. 6	34. 5	51. 7	1. 00	----------	----------
	. 253	2. 90	----------	21. 2	69. 0	51. 7	1. 00	----------	----------
	. 376	4. 31	----------	31. 8	103. 5	51. 7	1. 00	----------	----------
	. 499	5. 71	----------	41. 6	135. 6	51. 7	1. 00	----------	----------
	. 655	7. 51	----------	42. 0	136. 5	52. 8	1. 025	4. 61	----------
	1. 237	14. 18	----------	39. 0	126. 8	54. 2	1. 055	8. 95	----------
	1. 82	20. 9	----------	40. 5	131. 6	55. 2	1. 069	13. 38	----------
	2. 40	27. 5	----------	41. 2	133. 8	55. 6	1. 088	17. 9	----------
	3. 55	40. 7	----------	41. 5	134. 9	58. 5	1. 162	28. 3	----------
	4. 71	54. 0	----------	42. 0	136. 5	59. 4	1. 188	38. 4	----------
	5. 88	67. 4	----------	42. 5	138. 1	61. 3	1. 236	49. 9	----------
	6. 08	69. 7	----------	42. 5	138. 1	61. 4	1. 250	52. 1	----------
	7. 86	90. 1	----------	44. 0	143	62. 5	1. 286	69. 4	----------
	9. 15	105	----------	45. 0	146. 2	63. 2	1. 310	82. 4	----------
	10. 51	120. 7	----------	45. 5	149. 7	64. 8	1. 371	99. 1	----------

TABLE XII.—*Fluidization data pertaining to mixed materials in 4-inch tube*

(IRON FISCHER-TROPSCH CATALYST—SHARP SAND MIXED IN PROPORTIONS AS SHOWN)

RUNS A TO G, D_p=0.0135 INCH
RUNS A′ TO E′, D_p=0.00633 INCH

Run No.	G, lb. ft.$^{-2}$ hr.$^{-1}$	Δp, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$, lb./hr.^{2}
	Sharp sand, weight=2,241 gm.; iron catalyst, weight=0 gm.				
a	2.21	1.90	49.8	1.00	
	4.34	3.90	49.8	1.00	
	6.45	5.85	49.8	1.00	
	7.54	7.47	49.8	1.00	
	14.3	14.3	49.8	1.00	
	27.4	28.6	49.8	1.00	
	41.8	42.6	49.8	1.00	
	53.8	53.9	49.8	1.00	
	66.7	69.2	50.0	1.017	40.2
	79.6	71.8	51.5	1.028	49.6
	88.8	76.3	52.6	1.052	56.6
	118	79.9	55.4	1.118	79.7
	148	83.8	58.0	1.184	106
	177	87.1	59.5	1.228	131.3
	206	89.9	60.5	1.261	157
	Sharp sand, weight=2,241 gm.; iron catalyst, weight=200 gm.				
b	14.1	14.9	51.4	1.00	
	27.3	29.2	51.4	1.00	
	38.6	40.9	51.5	1.003	23.4
	53.6	55.2	57.8	1.009	33.2
	56.2	64.9	52.0	1.013	34.5
	87.8	79.5	53.2	1.040	55.2
	117	85.1	55.8	1.102	78.3
	147	88.6	58.4	1.168	104
	176	93.5	59.9	1.213	129.8
	205	98.4	62.2	1.289	160
	234	101.7	63.2	1.322	187
	Sharp sand, weight=2,241 gm.; iron catalyst, weight=400 gm.				
c	14.2	14.0	51.3	1.00	
	51.0	53.6	51.6	1.009	31.2
	57.7	62.4	51.6	1.009	35.3
	88.0	79.6	53.2	1.042	55.5
	117	84.2	55.7	1.102	78.3
	147	88.4	57.9	1.158	103
	176	94.2	60.5	1.233	131.8
	206	98.5	62.2	1.290	160.5
	232	108	64.5	1.373	193
	Sharp sand, weight=2,241 gm.; iron catalyst, weight=800 gm.				
d	7.52	7.47	51.3	1.00	
	14.2	15.2	51.3	1.00	
	27.2	31.2	51.3	1.00	
	40.5	46.8	51.8	1.011	24.8
	53.3	60.4	52.0	1.016	32.8
	57.2	72.1	52.0	1.016	34.6
	87.2	91.9	53.0	1.039	54.8
	116	101.7	55.6	1.098	77.2
	147	105.9	57.6	1.149	102
	178	109.2	59.4	1.200	129
	204	116	62.0	1.282	158
	233	121.8	64.4	1.370	193
	Sharp sand, weight=2,241 gm.; iron catalyst, weight=1,600 gm.				
e	20.8	15.3	52.2	1.00	
	33.9	42.9	52.2	1.00	
	48.7	60.4	52.2	1.00	
	63.8	76.0	52.2	1.00	
	87.6	112	52.4	1.003	53.2
	116	123.8	54.3	1.047	73.5
	147	128.6	57.2	1.113	98.8
	174	133.2	59.2	1.169	123.6
	203	138	61.9	1.252	154.6
	231	143	63.1	1.295	181.7

TABLE XII.—*Fluidization data pertaining to mixed materials in 4-inch tube.*—Con.

Run No.	G, lb. ft.$^{-2}$ hr.$^{-1}$	Δp, lb./ft.^{2}	δ, percent	l_e	$G\mu l_e/\rho$, lb. hr.^{2}
	Sharp sand, weight=1,050 gm.; iron catalyst, weight=2,303 gm.				
f	14.2	11.7	56.5	1.00	
	27.4	23.7	56.5	1.00	
	39.7	35.7	56.5	1.00	
	53.6	47.8	56.5	1.00	
	87.7	83.2	56.9	1.009	53.7
	117	102	57.3	1.019	72
	147	107.2	59.9	1.073	95.4
	175	112.4	61.0	1.117	118.7
	205	115	63.0	1.177	146.2
	232	127.8	64.3	1.222	171.7
	307	129.8	69.1	1.362	252
	Sharp sand, weight=1,050 gm.; iron catalyst, weight=3,573 gm.				
g	14.2	13.6	55.8	1.00	
	27.4	28.3	55.8	1.00	
	39.7	42.9	55.8	1.00	
	53.5	56.8	55.8	1.00	
	66.7	73.1	55.8	1.00	
	87.2	102.7	55.8	1.00	
	144	143.6	57.4	1.038	90.8
	174	150.4	59.8	1.099	116.2
	202	155.2	61.7	1.155	141.7
	231	159.2	64.2	1.236	173
	268	167.3	67.2	1.342	219
	Iron catalyst, weight=3,833 gm.; sharp sand, weight=0 gm.				
a′	2.25	7.15	54.1	1.00	
	4.31	14.9	54.1	1.00	
	6.46	20.2	54.1	1.00	
	7.50	24.7	54.1	1.00	
	8.9	46.8	54.1	1.00	
	20.7	69.2	54.1	1.00	
	27.2	92.9	54.1	1.00	
	33.2	106	54.1	1.00	
	37.7	108.2	55.0	1.025	23.4
	45.0	110.5	55.8	1.043	28.4
	53.2	112.4	56.7	1.063	34.3
	66.0	115.4	58.4	1.108	44.3
	68.3	116	58.7	1.118	46.3
	88.3	118.8	60.6	1.171	51.3
	118	123.6	62.5	1.230	88
	147	126.1	63.9	1.279	113.2
	Iron catalyst, weight=3,833 gm.; sharp sand, weight=132 gm.				
b′	2.15	6.18	54.5	1.00	
	4.18	12.4	54.5	1.00	
	6.24	18.5	54.5	1.00	
	7.51	23.1	54.5	1.00	
	14.2	45.5	54.5	1.00	
	27.1	91.0	54.5	1.00	
	40.0	113.5	54.8	1.028	24.9
	45.4	115.8	56.1	1.060	29.1
	45.4	115.2	55.5	1.046	28.8
	53.4	117.1	56.5	1.070	34.6
	65.6	118.2	58.2	1.111	44.1
	87.6	122.8	60.3	1.170	62.3
	119	127	62.8	1.250	89.9
	150	130	65.1	1.332	121
	Iron catalyst, weight=3,833 gm.; sharp sand, weight=430 gm.				
c′	2.12	7.8	53.2	1.00	
	4.45	16.3	53.2	1.00	
	6.38	22.7	53.2	1.00	
	7.54	27.0	53.2	1.00	
	14.2	54	53.2	1.00	
	20.7	81	53.2	1.00	
	27.0	115	53.2	1.00	
	29.9	116	53.6	1.009	18.2
	29.9	111.8	54.1	1.018	18.4
	33.5	120.2	54.4	1.026	20.8
	40.3	124.5	54.9	1.038	25.6
	47.5	126.1	55.8	1.059	30.5
	53.3	126.8	56.3	1.070	34.5
	65.4	126	58.6	1.128	44.7
	88.2	132.8	60.4	1.180	63.1
	116	136.6	62.9	1.262	88.6

TABLE XII.—*Fluidization data pertaining to mixed materials in 4-inch tube.*—Con.

Run No.	G, lb. ft.$^{-2}$ hr.$^{-1}$	Δp, lb./ft.^{2}	δ, percent	l_c	$G\mu l_c/\rho$, lb./hr.^{2}
	Iron catalyst, weight=3,833 gm.; sharp sand, weight=671 gm.				
d'	2.19	7.5	53.9	1.00	----------
	4.32	15.3	53.9	1.00	----------
	6.43	22.7	53.9	1.00	----------
	7.51	27.9	53.9	1.00	----------
	14.1	54.6	53.9	1.00	----------
	20.6	80.6	53.9	1.00	----------
	26.8	108.9	53.9	1.00	----------
	33.2	126.8	54.4	1.011	20.8
	40.1	130	55.0	1.025	25.4
	52.8	134	55.7	1.040	33.9
	65.4	136	58.1	1.099	44.6
	92.6	138.5	60.5	1.166	67.2
	118	144	63.2	1.253	92.0
	146	150	64.9	1.312	120.9
	Iron catalyst, weight=3,833 gm.; sharp sand, weight=989 gm.				
e'	2.19	7.8	54.1	1.00	----------
	4.32	16.6	54.1	1.00	----------
	6.43	24.7	54.1	1.00	----------
	14.0	59.5	54.1	1.00	----------
	26.8	119.3	54.1	1.00	----------
	33.2	138.2	54.2	1.003	20.6
	39.7	140.8	54.9	1.019	25.0
	52.8	144	56.5	1.054	34.4
	65.0	146	58.6	1.107	44.9
	92.3	148	60.6	1.165	67.2
	116	154	62.7	1.231	89.2

TABLE XIII.—*Oil-flow fluidization data of 0.00171-inch iron Fischer-Tropsch catalyst in 1.78-inch tube*

Run No.	G, lb. ft.$^{-2}$ hr.$^{-1}$	δ, percent	l_c	$G\mu\, l_c/\rho$, lb./hr.^{2}
	Catalyst weight=157 gm.			
a	1,138	84.6	4.21	281
	1,408	87.2	5.06	418
	1,765	90.4	6.75	699
	2,123	95.0	13.1	1,632
	2,450	96.7	19.4	2,790
	2,635	97.4	25.3	3,900
	Catalyst weight=450 gm.			
b	598	72.4	2.37	83.2
	926	77.5	2.91	158
	1,317	80.8	3.41	263
	1,675	84.2	4.15	407
	1,810	85.4	4.49	476
	2,182	88.3	5.59	715
	2,450	90.2	6.67	960
	2,635	91.1	7.34	1,132
	2,752	92.2	8.37	1,350
	2,900	92.6	8.89	1,510

TABLE XIII.—*Oil-flow fluidization data of 0.00171-inch iron Fischer-Tropsch catalyst in 1.78-inch tube*—Continued

Run No.	G lb. ft.$^{-2}$ hr.$^{-1}$	δ percent	l_c	$G\mu l_c/\rho$, lb/hr.^{2}
	Catalyst weight=628 gm.			
c	628	75.0	2.53	93.2
	806	78.1	2.91	138
	1,047	81.0	3.34	205
	1,198	82.3	3.57	251
	1,512	84.9	4.18	371
	1,886	87.6	5.11	565
	2,003	88.6	5.57	654
	2,122	89.4	5.98	745
	2,244	89.6	6.16	811

TABLE XIV.—*Fluidization data pertaining to water flow through silica sands in 1.32-inch glass tube*

Run No.	w, lb./hr.	G, lb. ft.$^{-2}$ hr.$^{-1}$	δ, percent	l_c	$G\mu l_c/\rho$, lb./hr.^{2}
	Round sand, D_p=0.0179 inch, weight=200 gm., CH*=7.00 inches				
a	35.7	3,780	55.0	1.078	145
	52.6	5,570	59.5	1.198	238
	61.0	6,460	61.4	1.257	259
	65.3	6,910	62.3	1.285	316
	43.1	4,560	56.7	1.120	182
	Round and sharp sands, D_p=0.00155 inch, weight=105.5 gm., CH=3.95 inches				
b	0.579	61.3	57.4	1.062	2.32
	.929	98.4	66.6	1.354	4.73
	1.925	204	73.0	1.677	12.2
	.715	75.7	58.6	1.097	2.95
	1.32	140	69.4	1.479	7.36
	1.175	124	70.2	1.518	6.70
	Round sand, D_p=0.00415 inch, weight=122 gm., CH=3.91 inches				
c	2.38	252	50.0	1.058	8.93
	3.50	371	55.3	1.182	14.7
	4.36	462	59.1	1.293	20
	9.23	978	69.6	1.740	57
	13.5	1,430	74.6	2.08	99.6
	16	1,697	77.3	2.33	132
	22	2,330	82.2	2.97	232
	12.5	1,325	73.2	1.97	87.3
	10.4	1,102	72.6	1.93	71.2
	4.77	505	61.6	1.388	23.5

*CH=column height=L.

TABLE XV.—*Fluidization data with anthracite in 4-inch tube*

Run No.	w, lb./hr.	G, lb. hr.$^{-1}$ ft.$^{-2}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	δ_e, percent	δ_t, percent
	Anthracite, D_p=0.03819 inch, weight=4,375.5 gm., air, RT*=82° F., BP=740 mm. Hg, CH*=1.605 ft.								
a	2. 37	27. 2	1. 99	3. 2	10. 4	1. 00	----------	44. 6	53. 6
	4. 67	53. 6	3. 92	5. 9	19. 2	1. 00	----------	44. 6	53. 6
	5. 25	60. 2	4. 40	7. 5	24. 4	1. 00	----------	44. 6	53. 6
	6. 99	80. 0	5. 85	9. 1	29. 6	1. 00	----------	44. 6	53. 6
	7. 95	91. 2	6. 66	10. 5	34. 2	1. 00	----------	44. 6	53. 6
	10. 62	122	8. 90	15	48. 8	1. 00	----------	44. 6	53. 6
	13. 63	156. 4	11. 4	19. 5	63. 5	1. 00	----------	44. 6	53. 6
	16. 61	190. 5	13. 9	24	78. 1	1. 00	----------	44. 6	53. 6
	19. 75	226	16. 5	29. 1	94. 6	1. 00	----------	44. 6	53. 6
	23. 0	264	----------	34. 4	112	1. 005	146. 5	44. 6	53. 6
	26. 4	303	----------	38. 4	125	1. 014	170	45. 0	53. 9
	28. 4	326	----------	40	130	1. 032	186	45. 3	54. 3
	29. 7	341	----------	40	130	1. 045	197	46. 3	55. 1
	30. 95	355	----------	40. 2	131	1. 059	208	47. 1	55. 5
	32. 2	369	----------	40. 8	133	1. 083	220	47. 8	56. 1
								48. 9	57. 3
	Anthracite, D_p=0.02795 inch, weight=2,525 gm., air, RT=90° F., BP=743 mm. Hg, CH=0.903 ft.								
b	1. 246	14. 3	0. 756	1. 5	4. 9	1. 00	----------	45. 9	52. 3
	2. 40	27. 5	1. 44	3. 1	10. 1	1. 00	----------	45. 9	52. 3
	3. 58	41. 0	2. 17	4. 5	14. 7	1. 00	----------	45. 9	52. 3
	4. 75	54. 4	2. 88	5. 9	19. 2	1. 00	----------	45. 9	52. 3
	5. 92	67. 8	3. 58	7. 6	24. 7	1. 00	----------	45. 9	52. 3
	7. 09	81. 3	4. 30	9. 1	29. 6	1. 00	----------	45. 9	52. 3
	8. 00	91. 7	4. 84	10. 7	34. 8	1. 00	----------	45. 9	52. 3
	9. 34	107	5. 65	12. 5	40. 6	1. 00	----------	45. 9	52. 3
	10. 68	122	6. 45	14. 7	47. 9	1. 00	----------	45. 9	52. 3
	12. 4	142	7. 50	17. 3	56. 2	1. 00	----------	45. 9	52. 3
	14. 1	161. 5	8. 54	19. 8	64. 4	1. 00	----------	45. 9	52. 3
	16. 5	189	----------	22. 6	73. 5	1. 009	109	46. 3	52. 9
	18. 25	209	----------	23. 8	77. 4	1. 029	123	47. 4	53. 8
	19. 3	221	----------	24	78. 1	1. 050	133	48. 5	54. 7
	20. 75	238	----------	24. 4	79. 4	1. 058	144	48. 9	55. 1
	22. 25	255	----------	24. 8	80. 6	1. 079	157	49. 8	55. 9
	23. 65	271	----------	25. 5	83	1. 090	169	50. 3	56. 4
	25. 3	290	----------	26. 2	85. 2	1. 146	191	52. 7	58. 6
	Anthracite, D_p=0.02321 inch, weight=3,287 gm., air, RT=88° F., BP=739 mm. Hg, CH=1.259 ft.								
c	5. 04	57. 8	2. 56	9. 0	29. 3	1. 00	----------	49. 9	55. 5
	7. 99	91. 5	4. 06	13. 7	44. 6	1. 00	----------	49. 9	55. 5
	10. 73	123	5. 45	19	61. 8	1. 00	----------	49. 9	55. 5
	12. 32	141	6. 24	21. 6	70. 1	1. 00	----------	49. 9	55. 5
	13. 8	158	7. 00	24. 5	79. 7	1. 00	----------	49. 9	55. 5
	17. 0	195	----------	28	91. 1	1. 019	115	50. 8	56. 3
	18. 43	211	----------	28	91. 1	1. 036	126. 7	51. 6	57. 1
	19. 95	229	----------	28. 6	93	1. 067	141. 6	53. 0	58. 3
	21. 5	246	----------	29. 6	96. 3	1. 094	156	54. 2	59. 4
	23. 0	264	----------	30	97. 6	1. 146	175. 5	56. 2	61. 2

*RT=temperature of gas; CH=column height=L.

TABLE XV.—*Fluidization data with anthracite in 4-inch tube*—Continued

Run No.	w, lb./hr.	G, lb. hr.$^{-1}$ ft.$^{-2}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	δ_e, percent	δ_t, percent
	Anthracite, D_p=0.01646 inch, weight=2,015 gm., air, RT=88° F., BP=739 mm. Hg, CH=0.778 ft.								
d	1. 244	14. 3	0. 448	2. 8	9. 1	1. 00	----------	49. 8	55. 9
	2. 40	27. 5	. 865	5. 3	17. 2	1. 00	----------	49. 8	55. 9
	3. 57	40. 9	1. 29	7. 8	25. 3	1. 00	----------	49. 8	55. 9
	4. 74	54. 3	1. 71	10. 3	33. 5	1. 00	----------	49. 8	55. 9
	5. 91	67. 8	2. 13	13. 2	42. 9	1. 00	----------	49. 8	55. 9
	6. 40	73. 3	2. 30	15. 0	48. 8	1. 00	----------	49. 8	55. 9
	8. 02	91. 9	----------	16	52	1. 025	53. 5	51. 0	57. 0
	9. 06	104	----------	16. 5	53. 6	1. 047	62	51. 9	58. 0
	10. 18	116. 5	----------	17	55. 3	1. 063	70. 1	52. 7	58. 6
	11. 3	129. 5	----------	17. 7	57. 2	1. 092	80. 3	53. 9	59. 7
	12. 47	143	----------	18	58. 5	1. 116	90. 5	54. 9	60. 4
	13. 72	157. 5	----------	18. 3	59. 5	1. 147	102. 6	56. 1	61. 6
	14. 9	170. 6	----------	18. 7	60. 8	1. 163	112. 8	56. 8	62. 1
	16. 62	190. 5	----------	19. 2	62. 5	1. 191	129	57. 8	62. 9
	19. 78	227	----------	20	65	1. 265	163	60. 3	65. 1
	23. 0	264	----------	21	68. 3	1. 348	202	62. 6	67. 4
	26. 3	302	----------	22	71. 5	1. 457	250	65. 5	69. 7
	30. 0	344	----------	22. 5	73. 2	1. 603	314	68. 5	72. 5
	Anthracite, D_p=0.01211 inch, weight=2,705 gm., air, RT=84° F., BP=741 mm. Hg, CH=1.002 ft.								
e	0. 193	2. 19	0. 0506	2. 1	6. 8	1. 00	----------	42. 9	53. 9
	. 381	4. 32	. 0988	4. 1	13. 3	1. 00	----------	42. 9	53. 9
	. 567	6. 43	. 149	5. 9	19. 2	1. 00	----------	42. 9	53. 9
	. 666	7. 55	. 174	7. 0	22. 8	1. 00	----------	42. 9	53. 9
	1. 252	14. 2	. 328	12. 3	40	1. 00	----------	42. 9	53. 9
	1. 547	17. 53	. 405	16. 3	53	1. 00	----------	42. 9	53. 9
	1. 835	20. 8	----------	18. 6	60. 5	1. 006	12. 4	43. 2	54. 3
	2. 14	24. 2	----------	19. 5	63. 4	1. 022	14. 6	44. 0	54. 9
	2. 42	27. 4	----------	19. 3	62. 9	1. 028	16. 6	44. 3	55. 2
	2. 71	30. 7	----------	19. 3	62. 9	1. 032	18. 8	44. 7	55. 4
	3. 01	34. 1	----------	19. 9	64. 8	1. 042	21. 1	45. 2	55. 9
	3. 59	40. 7	----------	20	65	1. 068	25. 7	46. 5	56. 9
	4. 18	47. 3	----------	20. 4	66. 4	1. 100	30. 7	48. 1	58. 2
	4. 77	54. 1	----------	20. 7	67. 2	1. 120	35. 9	49. 0	58. 9
	5. 35	60. 6	----------	21. 1	68. 4	1. 137	40. 9	49. 7	59. 5
	5. 94	67. 6	----------	----------	----------	1. 147	45. 9	50. 1	59. 9
	6. 53	73. 9	----------	----------	----------	1. 152	50. 4	50. 4	60. 1
	7. 12	80. 7	----------	22	71. 5	1. 157	55. 2	50. 7	60. 3
	8. 09	91. 7	----------	22. 4	73	1. 188	64. 5	51. 8	61. 3
	9. 30	105. 5	----------	23	74. 8	1. 211	75. 4	52. 7	62. 0
	10. 8	122. 4	----------	23. 5	76. 4	1. 271	91. 9	54. 9	63. 8

TABLE XV.—*Fluidization data with anthracite in 4-inch tube*—Continued

Run No.	w, lb./hr.	Gl, b. hr.$^{-1}$ ft.$^{-2}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	δ_e, percent	δ_t, percent
	Anthracite, D_p=0.00940 inch, weight=3,082 gm., air, RT=85° F., BP=737 mm. Hg, CH=1.129 ft.								
f	0.132	1.51	0.0273	6.4	20.8	1.00	----------	34.4	53.6
	.193	2.21	.0399	9.6	31.2	1.00	----------	34.4	53.6
	.256	2.93	.0529	13.8	44.9	1.00	----------	34.4	53.6
	.317	3.63	.0655	16.1	52.4	1.00	----------	34.4	53.6
	.381	4.37	.0789	19.6	63.8	1.00	----------	34.4	53.6
	.441	5.05	.0912	22.5	73.2	1.00	----------	34.4	53.6
	.669	7.67	----------	17.8	57.9	1.018	4.68	35.6	53.6
	.961	11.0	----------	19.4	63.1	1.042	6.88	37.1	54.4
	1.258	14.42	----------	20	65	1.070	9.24	38.9	55.5
	1.555	17.82	----------	20.5	66.6	1.119	12.0	41.5	56.0
	1.842	21.1	----------	21.5	70	1.160	14.7	43.6	58.5
	2.14	24.5	----------	21.8	70.9	1.178	17.4	44.4	60.0
	2.42	27.7	----------	21.8	70.9	1.197	19.9	45.3	61.0
	2.72	31.2	----------	23.2	75.5	1.203	22.5	45.7	61.3
	3.02	34.6	----------	22.6	73.5	1.220	25.3	46.3	61.5
	3.61	41.3	----------	23.2	75.5	1.247	30.9	47.5	61.9
	4.20	48.1	----------	23.7	77.2	1.263	36.5	48.3	62.8
	4.79	54.9	----------	23.7	77.2	1.277	42.0	48.8	63.2
									63.6
	Anthracite, D_p=0.00844 inch, weight=2,250 gm., air, RT=89° F., BP=743 mm. Hg, CH=0.862 ft.								
g–1	0.132	1.51	0.0254	4.3	14.0	1.00	----------	37.8	55.6
	.255	2.92	.0469	8.2	26.7	1.00	----------	37.8	55.6
	.504	5.78	.0927	16.0	52.0	1.00	----------	37.8	55.6
	.667	7.65	----------	16.0	52.0	1.019	4.69	38.9	56.5
	.774	8.88	----------	14.2	46.2	1.039	5.55	40.1	57.3
	.958	10.96	----------	15	48.7	1.073	7.07	42.2	58.7
	1.254	14.4	----------	15.4	50	1.092	9.45	43.0	59.4
	1.55	17.75	----------	16	52	1.120	12.0	44.5	60.4
	1.84	21.1	----------	16.2	53	1.139	14.5	45.5	61.1
	2.14	24.5	----------	16.7	54.3	1.158	17.1	46.3	61.6
	2.42	27.7	----------	17	55.3	1.177	19.6	47.2	62.2
	3.01	34.1	----------	17	55.3	1.198	24.9	48.1	62.2
	3.60	41.2	----------	17.4	56.5	1.217	30.2	48.9	63.4
	4.77	54.7	----------	17.6	57.2	1.257	41.5	50.9	64.6
	5.95	68.2	----------	18	58.5	1.291	45.6	51.8	65.6
	6.42	73.7	----------	18.4	----------	1.320	58.5	52.7	66.4
	8.04	92.2	----------	18.7	----------	1.369	65.5	54.4	67.2
	9.36	107	----------	18.8	61.1	1.408	78.0	55.7	68.7
	Anthracite, D_p=0.00844 inch, weight=4,332 gm., air, RT=89° F., BP=740 mm. Hg, CH=1.618 ft.								
g–2	0.1325	1.52	0.0244	8.2	26.6	1.00	----------	37.5	54.5
	.256	2.94	.0472	16.0	52.0	1.00	----------	37.5	54.5
	.381	4.37	.0701	24.6	80.0	1.00	----------	37.5	54.5
	.505	5.79	----------	29.2	94.8	1.018	3.51	38.6	55.3
	.674	7.73	----------	30	97.5	1.027	4.73	39.2	55.7
	.967	11.1	----------	29.5	95.8	1.072	7.10	41.8	57.6
	1.266	14.5	----------	30	97.5	1.110	9.58	43.8	59.0
	1.562	17.9	----------	30.5	99.1	1.147	12.3	45.6	60.3
	1.854	21.2	----------	31.3	102	1.162	14.7	46.3	60.9
	2.44	28.0	----------	32	104	1.198	20.0	47.9	62.1
	3.04	34.9	----------	32.2	104.8	1.215	25.3	48.7	62.5
	3.63	41.6	----------	32.5	105.8	1.235	30.7	49.5	63.2
	4.82	55.3	----------	33	107.4	1.255	41.5	50.3	63.6
	6.01	69.0	----------	33.3	108.3	1.308	53.9	52.1	65.2
	6.53	74.9	----------	33.8	110	1.326	59.1	52.7	65.7
	8.16	93.7	----------	34	110.7	1.347	75.2	53.4	66.2
	10.9	125	----------	35.5	115.4	1.398	104	55.3	67.6

TABLE XV.—*Fluidization data with anthracite in 4-inch tube*—Continued

Run No.	w, lb./hr.	G, lb. hr.$^{-1}$ ft.$^{-2}$	Re	Δp, cm. CCl_4	ΔP, lb./ft.^{2}	l_e	$G\mu l_e/\rho$ lb./hr.^{2}	δ_e, percent	δ_l, percent
	Anthracite, D_p=0.00844 inch, weight=4,332 gm., helium, RT=87° F., BP=740 mm. Hg, CH=1.613 ft.								
g-3	0.0240	0.265	0.00405	12.0	39	1.00	----------	36.9	54.3
	.0611	.700	.0107	30.6	99.5	1.00	----------	36.9	54.3
	.146	1.67	----------	29	94.3	1.039	7.94	39.4	56.2
	.166	1.90	----------	29	94.3	1.122	9.76	43.9	59.3
	.261	2.65	----------	31.4	102	1.132	13.7	44.3	59.7
	.334	3.83	----------	32.2	105	1.162	20.3	45.9	60.7
	.549	6.29	----------	33.0	107.5	1.210	34.8	48.0	62.3
	.780	8.95	----------	33.5	109	1.239	50.6	49.2	63.0
	1.025	11.75	----------	34.2	111.5	1.298	69.7	51.5	64.7
	1.335	15.3	----------	33.8	109.8	1.332	93.0	52.6	65.7
	Anthracite, D_p=0.00658 inch, weight=2,880 gm., air, RT=72° F., BP=740 mm. Hg, CH=1.106 ft.								
h-1	0.133	1.53	0.0194	15	48.8	1.00	----------	33.5	55.5
	.197	2.26	.0288	22	71.6	1.00	----------	33.5	55.5
	.260	2.98	----------	17	55.3	1.022	1.83	35.1	56.5
	.514	5.90	----------	17.5	56.9	1.049	3.71	36.6	57.6
	.673	7.72	----------	19.0	61.8	1.143	5.30	42.0	61.5
	1.27	14.57	----------	20.3	66.0	1.188	10.4	44.1	62.5
	1.87	21.45	----------	21.4	69.6	1.272	16.4	47.9	65.0
	2.46	28.2	----------	21.8	70.9	1.308	22.1	49.3	66.0
	3.06	35.1	----------	22.0	71.6	1.343	28.3	50.6	67.0
	3.65	41.9	----------	22.3	72.6	1.358	34.1	51.1	67.2
	4.85	55.6	----------	22.4	72.9	1.368	45.6	51.5	67.4
	6.04	69.2	----------	22.5	73.2	1.360	56.9	51.2	67.3
	Anthracite, D_p=0.00658 inch, weight=2,880 gm., helium, RT=74° F., BP=743 mm. Hg, CH=1.094 ft.								
h-2	0.0134	0.154	0.00186	13	42.3	1.00	----------	33.6	55.4
	.0299	.343	.00415	24.2	78.6	1.00	----------	33.6	55.4
	.0639	.732	----------	18.5	60.2	1.030	3.32	35.5	56.8
	.105	1.20	----------	18.5	60.2	1.060	5.60	37.5	58.0
	.127	1.46	----------	18.8	61.1	1.092	7.01	39.3	59.3
	.170	1.95	----------	19.2	62.4	1.117	9.57	40.5	60.1
	.175	2.00	----------	20.0	65.0	1.176	10.35	43.6	62.1
	.232	2.66	----------	20.5	66.6	1.228	14.4	46.0	63.7
	.335	3.84	----------	21.3	69.3	1.271	21.6	47.9	65.0
	.445	5.11	----------	21.6	70.3	1.292	29.1	48.5	65.5
	.552	6.34	----------	21.8	70.9	1.311	36.7	49.4	66.1
	.670	7.68	----------	22.2	72.2	1.332	45.1	50.2	66.6
	.783	8.98	----------	22.5	73.2	1.350	53.3	50.8	67.0
	.901	10.32	----------	22.5	73.2	1.340	61.1	50.5	66.8