sample shall not materially affect its metallic content. In other words, the maximum error is determined by the ratio of the weight of the largest particle of metal or high-grade mineral to the weight of the entire lot. At this point another condition must be considered. In any lot of ore it is easy to see that the chances of finding a full-sized piece of the highest grade material would be much greater on a lot of ore crushed to 0.25 inch cubes than in a lot crushed in 1-inch cubes, therefore accuracy demands that the ratio between the weight of the largest particle and the entire lot shall increase directly as the fineness.

In this particular, practice and theory are in complete accord, and all of the latest and most improved mills practise alternate crushing and subdivision from the coarsest size down to the finest. It is customary at each successive stage to reduce the diameter of the coarsest particles one-half, thus decreasing the volume to one-eighth, or 12.5 per cent. The usual sample taken at each successive stage is 20 per cent., so that while the size of the particle at each step has been reduced 12.5 per cent., the amount of sample taken is 20 per cent., consequently the ratio between the weight of the largest particle and the weight of the sample rises steadily from the beginning of the series of operations to the end, thereby meeting the conditions theoretically necessary to an accurate determination of value.

An ideal sampling mill, where the situation and nature of the service will permit this form of construction, is shown in Fig. 15. This plant is entirely automatic, and when the ore is received in hopper-bottom cars no manual handling is required at any stage, while the sample is automatically delivered into a locked steel safe. To simplify the drawing, the roll-feeders have been omitted.

Fig. 16 is a vertical longitudinal section of the new Taylor & Brunton mill at Silver City, Utah, completed January, 1909. Like the plant shown in Fig. 15, it is automatic throughout, electric driven, and contains every modern device for facilitating crushing, sampling, and cleaning, the latter operation being performed by compressed air.

A good example of a modern crushing, screening, and sampling plant is shown in Fig. 17 which is a longitudinal section through the new matte and sulphide mill of the Tintic Smelting Co. at Silver City, Utah.

In order to show the methods of operation in vogue in different districts, I present Figs. 18, 19, 20 and 21, which contain the flow-sheets of a number of the newest and largest sampling works, clearly showing every detail of the process, and the machinery employed in the alternate operations of crushing and subdivision, as well as the increase of ratio as the final stages are reached. This style of flow-sheet was originally typewritten on ordinary 8.5 by 13 inch paper, perforated for a loose-leaf binder. In this way flow-sheets of many classes of operations may be preserved in convenient form.

These flow-sheets show considerable differences at all stages, and a great divergency in the methods of subdividing the final sample. Too many manual operations are in use, and there is no doubt that the complete elimination of the personal equation by using a small Taylor & Brunton splitter with 3/8-inch riffles (shown in Fig. 12) gives by far the most accurate subdivision.

To show how closely results between different mills and repeat-sampling in individual mills may be made to check, the following examples, taken at random, should suffice:—

TABLE I.—*Sampling-Results, Taylor & Brunton Sampling Co., Cripple Creek, Colo.*

Lot No.	Sample.	Resample.
	Gold.	Gold.
	Ounces per Ton.	Ounces per Ton.
3192	3.62	3.64
3198	5.04	5.015
3219	2.70	2.67
3235	3.18	3.16
3310	1.17	1.17
3324	6.52	6.51
3340	0.71	0.78
3388	1.70	1.84
3424	9.24	9.20
3471	30.64	30.52

TABLE II.—*Sampling-Results, Taylor & Brunton Sampling Co., Cripple Creek, Colo.*

Lot No.	Mine.	First Sample.		Resample.		Settlement.
		Gold.		Gold.		
		Mill-Assay.	Mine-Assay.	Mill-Assay.	Mine-Assay.	
		Oz. per Ton.	Oz. per Ton.	Oz. per Ton.	Oz. per Ton.	Oz. per Ton.
4514	Sacramento..........	2.22	2.24	2.22	2.23	2.225
4604	Little Clara.........	115.05	115 25	114.90	115.20	115.03
4705	Mary Cashen.........	1.11	1.10	1.07	1.09	1.08
4726	Midget................	1.27	1.30	1.30	1.35	1.325
4853	Independence, Ltd.	1.36	1.35	1.29	1.30	1.295
4914	Bon. King............	0.53	0.55	0.55	0.56	0.555
5062	Little Clara..........	1.77	1.72	1.75	1.74	1.745
5272	Old Abe..............	1.27	1.24	1.27	1.28	1.27
5753	Independence, Ltd.	2.33	2.34	2.34	2.36	2.35
5913	Little Clara..........	12.62	12.58	12.69	12.68	12.695

TABLE III.—*Sampling-Results, Taylor & Brunton Sampling Co., Cripple Creek, Colo.*

Lot No. of Mixture.	Original Purchase.		Mixture.	
	Weight.	Gold-Assay.	Mathematical Average.	Mechanical Sample.
	Pounds.	Ounces per Ton.	Ounces per Ton.	Ounces per Ton.
5394	17,588 9,646 11,348	0.98 1.17 0.875	0.996	1.00
5496	17,405 6,615 17,123	0.98 0.895 0.995	0.972	0.975
5799	422 12,851 175 21,278	8.24 2.225 8.50 1.85	2.099	2.14
5890	19,090 8,761 8,852	1.925 1.97 1.89	1.927	1.93
3465	5,274 17,935	2.10 1.89	1.937	1.97
3678	3,795 17,122 11,357 6,592	1.88 1.49 1.345 1.465	1.481	1.52
3850	3,633 16,803 8,360 11,222 3,731	3.365 4.675 5.82 3.73 36.445	7.252	7.24
4170	18,605 18,621 11,937 8,593	0.83 0.77 1.42 0.98	0.954	0.92
4292	17,848 15,435 17,436	1.165 0.615 1.12	0.982	0.96
4319	4,014 15,611 13,334 11,712	2.835 2.24 3.35 2.58	2.71	2.75